



### Original Research Article

## A study of Peradeniya organophosphorus poisoning scale (POP scale) in predicting the mortality in cases of acute organophosphorus poisoning

Authors

**Dr Sourav Chattopadhyay<sup>1</sup>, Dr Srikanth Shetty<sup>2\*</sup>**

<sup>1</sup>Assistant Professor, Deptt. of General Medicine, IQ City Medical College and Narayana Multispeciality Hospital, Durgapur, West Bengal, India

9635117577(M), Email: [dr\\_sourav\\_chatterjee@yahoo.in](mailto:dr_sourav_chatterjee@yahoo.in), [sourav.chattopadhyay@iqct.in](mailto:sourav.chattopadhyay@iqct.in)

<sup>2</sup>Senior Consultant Physician, General Hospital, Bhadravati, Shimoga District, Karnataka, India

\*Corresponding Author

**Dr Srikanth Shetty**

9448609456(M), Email: [drsrikanthshetty@gmail.com](mailto:drsrikanthshetty@gmail.com)

### Abstract

**Background & Objectives:** India is a tropical country where agriculture forms the backbone of the nation. Majority of the population is engaged in agriculture and the most hazardous materials that the farmers are exposed to are the organophosphorus compounds which are used as pesticides. In addition to the accidental intoxication from use of these compounds as agricultural insecticides, these agents are frequently used for suicidal purposes because of their easy availability.

This study was done to assess the severity of symptoms of organophosphorus compound poisoning both clinically, by Peradeniya organophosphorus poisoning scoring system and by pseudocholine esterase estimations. Peradeniya scoring system could be a simple and effective system to determine the cases which would require ventilator support, early on in the course. This study will help us identify the factors, which help in the need for ventilator support in a patient with consumption of organophosphorus compound.

**Methods:** This randomized cross sectional study was carried out in Sri Adichunchanagiri institute of medical science and research centre, B.G.Nagara, Mandya district on 100 patients admitted in intensive care unit of the hospital.

Pseudocholine esterase estimations were done at presentation. Subsequent pseudocholine esterase estimations was done at 24 hours, 48 hours and 120 hours after time of poisoning.

Diagnosis was made on clinical history, physical examination & investigations, which include pseudocholine esterase levels.

**Results:** 92% of the cases were suicidal and 8% were accidental. The mortality was 4% in this study. Out of the 100 cases 68 were males and 32 were females. The male and female ratio was 2.125: 1. The maximum number of cases was seen in the age group of 18 to 30 years. Maximum number of cases were from agricultural background. In this study 52% of the cases consumed dimethoate. PChE activity in 10 control patients had values in range of 3714 – 11513 u/l, which is within the normal reference values. 79% of cases in the present study had PChE levels of less than 50% of the normal at the time of admission and out of which 94.8% required ventilatory support.

Pseudocholine esterase levels were significantly depressed in patients who required ventilatory support.

Patients who survived showed rising values of mean pseudocholeline esterase enzyme activity on successive days, while patients who expired had low pseudocholeline esterase activity and did not show much increase in subsequent days.

This points out that better prognosis is directly proportional to higher rise in enzyme activity. Increased interval between consumption and hospitalization correlated with need for ventilatory support. Peradeniya scores of  $\geq 6$  correlated with an increased requirement of ventilatory support.

**Interpretation & Conclusion:** Pseudocholeline esterase levels were significantly depressed in patients who required ventilatory support. Patients who survived showed rising values of mean pseudocholeline esterase enzyme activity on successive days, while patients who expired had low pseudocholeline esterase activity and did not show much increase in subsequent days. This points out that better prognosis is directly proportional to higher rise in enzyme activity. Signs of miosis, fasciculations, bradycardia, increased respiratory rate with cyanosis and impaired levels of consciousness all correlated with the need for ventilator support. Increased interval between consumption and hospitalization correlated with need for ventilatory support. Peradeniya scores of  $\geq 6$  correlated with an increased requirement of ventilatory support.

**Keywords:** Organophosphorus compound; Pseudocholeline esterase.

### Peradeniya Organophosphorus Poisoning Scale

The Peradeniya organophosphorus poisoning scale is an effective scoring system to know the severity of OP poisoning and also for identification of those patients who might require ventilator support.

Peradeniya organophosphorus poisoning (POP) scale (N. Senanayake, L. Karalliede, 1993)

	Parameter	Score
<b>1</b>	<b>Miosis</b>	
	Pupil size >2mm	0
	Pupil size $\leq$ 2mm	1
	spin –point	2
<b>2</b>	<b>Fasciculations</b>	
	None	0
	Present but not generalized or continuous	1
	Generalized and continuous with central cyanosis	2
<b>3</b>	<b>Respiration</b>	
	Respiratory rate $\leq$ 20/min	0
	Respiratory rate >20/min	1
	Respiratory rate >20/min with central cyanosis	2
<b>4</b>	<b>Bradycardia</b>	
	Pulse rate >60/min	0
	Pulse rate 41-60/min	1
	Pulse rate $\leq$ 40/min	2
<b>5</b>	<b>Level of consciousness</b>	
	Conscious and rational	0
	Impaired, responds to verbal commands	1
	Impaired, no response to verbal commands (if convulsions present, add 1)	2
		1
	Total	11

A higher POP score indicates a poorer prognosis.

### Materials and Methods

#### Design of the study

The current study is a randomized cross sectional one. The subjects of the study were taken randomly fulfilling the inclusion criteria and pseudocholeline esterase estimations was done at presentation. Subsequent pseudocholeline esterase estimations were done at 24 hours, 48 hours and 120 hours after time of poisoning.

#### Source of data

Study was carried out at Sri Adichunchanagiri institute of medical science and research center B.G. Nagara, Mandya district.

The study was conducted for a proposed period 18 months, of 100 patients admitted to intensive care unit of in Sri Adichunachanagiri Institute of medical sciences and research center, B.G.Nagar and fulfilling the inclusion criteria.

Diagnosis was be made on clinical history, physical examination & investigations, which include pseudocholeline esterase levels.

#### Inclusion Criteria

Those patients with history of organophosphorus poisoning or of unknown poison with characteristic symptoms of organophosphorus compound poisoning both sexes aged above 18 years.

#### Statistical tests

Categorical variables were analysed and chi square test was used. Continuous variables were analysed using student 't' test.

Differences in sociodemographic characteristics like age, sex, type of poison consumed and quantity of poison consumed was analysed. Later patients were compared with their pseudocholine esterase levels and requirement of ventilatory support. The test of significance used between the associations of different characteristics was the Chi square test. For statistical significance, the p value was calculated and a value less than 0.05 was considered significant. SPSS 16 software was used to analyse the data.

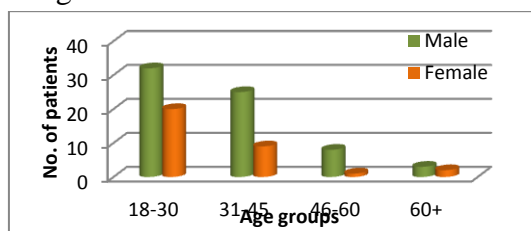
**Ethical issues**

Written informed consent was taken from each patient / guardian after explaining about the study under taken. Clearance from the college ethical committee was sought and taken.

**Results**

The following observations were made after studying 100 cases of organophosphorus poisoning admitted to Sri Adichunchanagiri Institute of medical sciences and research centre, B.G. Nagara, Mandya district, in the intensive care unit.

**Fig.1:** Age and sex distribution

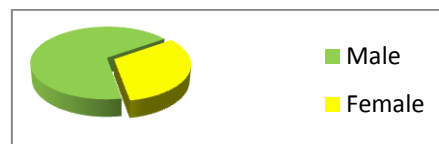


Highest incidence was seen in the age group of 18 – 30 years (52%), followed by 31 – 45 years (34%). This age group corresponds to the maximum period of stressor events. Expectations exceed the reach of many and they find it difficult to adapt to these challenges. (Vyas & Ahuja,1999). In the present study 68% of the patients were males. This correlates with the findings of the previous studies. However, in a study done by M. Vishwanathan et.al,66% of the patients who consumed organophosphorus compounds were females.

**Table -1:** Frequency of age distribution

		Frequency	Percent
Valid	18-30	52	52.0
	31-45	34	34.0
	46-60	9	9.0
	60+	5	5.0
	Total	100	100.0

**Fig.2:** Sex ratio



**Table- 2:** Frequency of sex distribution

		Frequency	Percent
Valid	Male	68	68.0
	Female	32	32.0
	Total	100	100.0

		Frequency	Percent
Valid	Accidental	8	8.0
	Suicidal	92	92.0
	Total	100	100.0

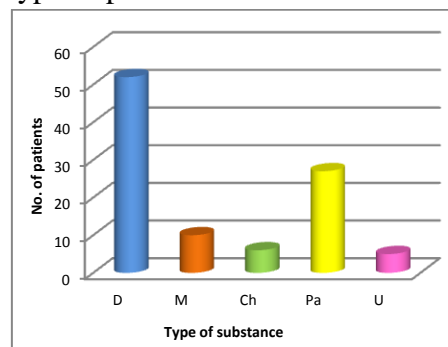
In this study, most of the cases was suicidal,92% & accidental was 8%.In some cases suicidal intention was denied & in some pain abdomen ,headache, burning feet ,vomiting precipitated the accidental consumption of the poison unwittingly. This corresponds to the study by Gupta et.al.,(1968) when out of 60 cases,55 (91%) were due to suicidal intention & 5(8%) were due to accidental consumption.

**Table-3:** Intention of poisoning

Test Statistics

	Intention
Chi-Square	70.560
Df	1
Asymp. Sig.	.000

**Fig.3:** Type of poison consumed



In this study majority of the patients took dimethoate, 52%, the next common poison was parathion, 27% & monocrotophos was seen in 10% of the cases. Chloropyriphos was taken in 6% of the cases & 5% of the cases the compound was unknown.

**Table -5:** Quantity of poison consumed

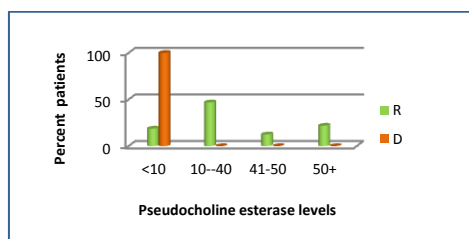
	Frequency	Percent
<20ml	16	16.0
20-40ml	36	36.0
40+ml	48	48.0
Total	100	100.0

Test Statistics

Chi-Square	15.680
Df	2
Asymp. Sig.	.000

The majority of the patients took more than 40 ml of the poison, 48%. 16% of the patients took less than 20 ml of the poison.

**Fig.4:** Pseudocholine esterase levels at the time of admission & death



The decreased levels of pseudocholine esterase levels is highly specific for diagnosis of organophosphorus poisoning and particularly useful in suspected organophosphorus compound patients. The patients with higher pseudocholine activity on day of admission had a better prognosis than with a lower enzyme values. Similar findings were noted on 2<sup>nd</sup> & 3<sup>rd</sup> days. These observations were statistically significant. It can be concluded that initial estimation of

pseudocholine esterase activity can be used to predict the prognosis of the patient.

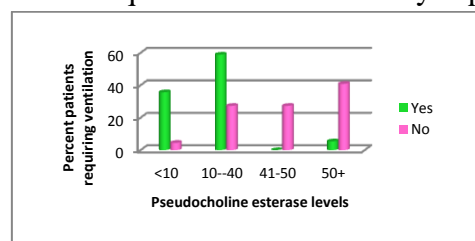
**Symmetric Measures**

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.359	.002
N of Valid Cases		100	

**Table -6:** Peradeniya score & need for ventilation crosstabulation

		VENTILATION		Total		
		No	Yes			
POP SCOR E	0-1	Count	15	14	29	
		% within VENTILATION	34.1%	25.0%	29.0%	
	2-4	Count	8	9	17	
		% within VENTILATION	18.2%	16.1%	17.0%	
	5	Count	1	0	1	
		% within VENTILATION	2.3%	.0%	1.0%	
	6	Count	12	17	29	
		% within VENTILATION	27.3%	30.4%	29.0%	
	7	Count	0	3	3	
		% within VENTILATION	.0%	5.4%	3.0%	
	8	Count	8	13	21	
		% within VENTILATION	18.2%	23.2%	21.0%	
	Total		Count	44	56	100
			% within VENTILATION	100.0%	100.0%	100.0%

**Fig.5:** Pseudocholine esterase levels at the time of admission & requirement of ventilatory support



**Table -7:** Pseudocholine esterase level at admission & need for ventilation cross tabulation.

		VENTILATION		Total	
		No	Yes		
ADMISSION	<10%	Count	2	20	22
		% within VENTILATION	4.5%	35.7%	22.0%
	10-40%	Count	12	33	45
		% within VENTILATION	27.3%	58.9%	45.0%
	41-50%	Count	12	0	12
		% within VENTILATION	27.3%	.0%	12.0%
	50% +	Count	18	3	21
		% within VENTILATION	40.9%	5.4%	21.0%
Total		Count	44	56	100
		% within VENTILATION	100.0%	100.0%	100.0%

**Symmetric Measures**

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.563	.000
No of Valid Cases		100	

**Correlations**

		TIME INTERVAL	ON ADMISSION
TIME INTERVAL	Pearson Correlation	1	-.244(*)
	Sig. (2-tailed)	.	.014
	N	100	100
ON ADMISSION	Pearson Correlation	(*)	

**Peradeniya organophosphorus scale and ventilatory support**

The individual components of the Peradeniya organophosphorus scale namely miosis, fasciculations, respiratory rate, bradycardia, level of consciousness were compared with the need for ventilator support.

Peradeniya score was calculated for all patients. Among those who scored 6 and above, 59% of cases required ventilatory support. Hence Peradeniya scoring system can be used to predict early need for ventilator support if a score of 6 or more than 6 is observed. The mortality was 4 cases in this study, their scores were 8, 9, 10, 10 respectively, all of their score were more than 6. Lesser score was associated with less requirement of ventilatory support. Individual components of Peradeniya score namely miosis, fasciculations, level of consciousness was studied by Goswamy et al.,(1994) and concluded that they predicted the early need for ventilator support.

**Conclusion**

One hundred cases of organophosphorus poisoning in adults aged above 18 years were studied clinically and pseudocholeline esterase levels were estimated. The following observations were made.

1. The most vulnerable group was that between 18 – 30 years, next being 31 - 45 year group.
2. Male to Female ratio was 2. 125 : 1
3. Dimethoate was the commonest poison take compared to the past when diazinon was the commonest poison taken.

4. Majority of patients consumed more than 40ml of poison.
5. All the patients took the poison orally.
6. In most patients the intention of poisoning was suicidal, 92%.
7. Most patients consumed the poison after 6p.m. in the evening.
8. Majority reached the hospital within 4hrs of consumption.
9. Pseudocholeline esterase levels were significantly depressed in patients who required ventilatory support. Patients who survived showed rising values of mean pseudocholeline esterase enzyme activity on successive days, while patients who expired had low pseudocholeline esterase activity and did not show much increase in subsequent days. This points out that better prognosis is directly proportional to higher rise in enzyme activity.
10. Signs of miosis, fasciculations, bradycardia, increased respiratory rate with cyanosis and impaired levels of consciousness all correlated with the need for ventilator support.
11. Increased interval between consumption and hospitalization correlated with need for ventilatory support.
12. Peradeniya scores of  $\geq 6$  correlated with an increased requirement of ventilatory support.
13. Estimation of pseudocholeline esterase level in clinically suspected organophosphorus compound poisoning cases –

- Will assist in diagnosis of unidentified or organophosphorus compound poisoning.
- Will be a very useful parameter along with Peradeniya organophosphorus poisoning (POP) scale in predicting the need for early requirement of ventilator support.

### Summary

The study was conducted on 100 patients with history of organophosphorus compound poisoning admitted in the intensive care unit of Sri Adichunchanagiri institute of medical sciences and research centre, B.G. Nagara, Mandya district. 92% of the cases were suicidal and 8% were accidental. The mortality was 4% in this study. Out of the 100 cases 68 were males and 32 were females. The male and female ratio was 2.125: 1. The maximum number of cases was seen in the age group of 18 to 30 years. Maximum number of cases were from agricultural background.

In this study 52% of the cases consumed dimethoate. PChE activity in 10 control patients had values in range of 3714 – 11513 u/l, which is within the normal reference values. 79% of cases in the present study had PChE levels of less than 50% of the normal at the time of admission and out of which 94.8% required ventilatory support.

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Increased interval between consumption and hospitalization correlated with need for ventilatory support. Peradeniya scores of  $\geq 6$  correlated with an increased requirement of ventilatory support.

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**List of Abbreviations**

- PChE - Pseudocholine esterase.  
O.P.Compound - Organophosphorus compound.  
POP score - Peradeniya organophosphorus score.  
AchE- Acetylcholinesterase.

**Annexure - I**

Peradeniya organophosphorus poisoning (POP) scale.

	Parameter	Score
<b>1</b>	<b>Miosis</b>	
	Pupil size > 2 mm	0
	Pupil size < 2 mm__	1
	Pupils pin – point	2
<b>2</b>	<b>Fasciculations</b>	
	None	0
	Present but not generalized or continuous	1
	Generalized and continuous with central cyanosis	2
<b>3</b>	<b>Respiration</b>	
	Respiratory rste < 20/min __	0
	Respiratory rste > 20/min	1
	Respiratory rste > 20/min with central cyanosis	2
<b>4</b>	<b>Bradycardia</b>	
	Pulse rate > 60/min	0
	Pulse rate 41 - 60/min	1
	Pulse rate < 40/min__	2
<b>5</b>	<b>Level of consciousness</b>	
	Conscious and rational	0
	Impaired, responds to verbal commands	1
	Impaired, no response to verbal commands	2
	(if convulsions present, add 1)	1
	Total	11