

## Serum Cholinesterase Levels in Organophosphorous Poisoning Patients on Ventilatory Support

GV Rao<sup>1,\*</sup>, Jyothsna M<sup>2</sup>

<sup>1</sup>Associate Professor, Assistant Professor,  
Department of Anaesthesiology, VIMS, Bellary, Karnataka

\*Corresponding Author:  
E-mail: jyothsnaabk@yahoo.com

### Abstract

**Introduction:** Organophosphorus compounds are anti acetylcholinesterases which exert their toxicity by interfering with the normal function of zetylcholine, an essential neuro - transmitter throughout the autonomic and central nervous system.

**Methodology:** The study was conducted at the Respiratory Intensive Care Unit of Department of Anaesthesiology. Prior approval for the study and the protocol was obtained from the institution ethical committee. After explaining the possible prognosis in the course of organophosphorus poisoning, consent from a responsible attendant / informant of the patient was obtained before the actual study was initiated.

**Results:** It's evident from the above table that maximum number of patients presented with mild poisoning based on the SCE levels (77%) and about 23% had moderate to severe poisoning levels. Conclusion: There was a significant correlation between SCH levels and duration of consumption of OP.

**Key words:** Organo Phosphorous poisoning, Serum Cholinesterase, Acetylcholinesterases

Access this article online	
Quick Response Code:	Website: www.innovativepublication.com
	DOI: 10.5958/2394-4994.2016.00012.3

### Introduction

IN 1976, the World Health Organization (WHO) using data from 19 countries estimated that approximately 5,000,000 cases of acute pesticide occurring annually and resulting in 9000 or more deaths, 99 % of which were in the third world countries. In 1981, the estimate was 7,50,000 cases annually, whilst in 1983 the figure was 2 million, of which 4000 were fatal<sup>1</sup>.

It is estimated that in India about 5 — 6 persons per lakh of population e due to poisoning. The exact incidence of organophosphorus poisoning in India is uncertain due to lack of data / lack of proper reporting. Being predominantly an agricultural country, pesticides and insecticides are used abundantly for cultivation and access to these poisonous chemical substances by population is easy. Among adults, incidence is more in females of all age ups and generally, those in second and third decades of life are more likely to be affected. The commonest types of insecticidal/pesticide poisoning are organo phosphorus poisoning, chlorinated hydrocarbons, aluminium phosphide, carbamates and pyrethroids<sup>2</sup>. The organophosphorus compounds may be inhaled or ingested accidentally or intentionally, in industries, trade, agricultural fields or homes. The first

account of the synthesis of a highly potent organophosphorus compound tetra ethyl pyrophosphate (TEPP), an anti acetyl cholinesterase, was given by Clermont in 1854. Modern investigations of organophosphorus compounds date from 1932, when Lange and Krueger recorded the synthesis of dimethyl and ethyl phosphorofluoridates<sup>1</sup>.

Organophosphorus compounds are anti acetylcholinesterases which exert their TOXICITY by INTERFERING with the normal function of zetylcholine, an essential neuro - transmitter throughout the autonomic and central nervous system. The manifestations of toxicity are a result of this effect, affecting the patient's physiology. The anticholinesterase effects can be evidenced biochemically by suppression in the serum levels of serum cholinesterase and of red cell cholinesterases. Previous studies associating the severity or prognosis of Organophosphorus poisoning with estimation of serum cholinesterase have been contradictory. Goswamy R. et al.,<sup>3</sup> in their study concluded that apart from clinical indicators, low serum cholinesterase levels were of greatest predictive value for ventilation in Organophosphorus poisoning. However, Aygun D et al.,<sup>4</sup> found that serum cholinesterase level estimations are useful in diagnosis of organophosphorus poisoning in acute phase but show no relation to severity of poisoning.

In view of this, a study was required to know the usefulness of serial estimation of serumcholinesterase in predicting the prognosis of organophosphorus poisoning patients.

## Methodology

36 patients presenting with history of Organophosphorus poisoning and features of respiratory failure (requiring ventilatory support) were included in the present study. The study was conducted at the Respiratory Intensive Care Unit of Department of Anaesthesiology at Vijayanagara Institute of Medical Sciences (VIMS), Bellary. Prior approval for the study and the protocol was obtained from the institution ethical committee. After explaining the possible prognosis in the course of organophosphorus poisoning, consent from a responsible attendant / informant of the patient was obtained before the actual study was initiated.

**Inclusion Criteria** for the study were as follows:

1. Provisional diagnosis of organophosphorus poisoning in a patient irrespective of age / sex, based on history by attenders.
2. Clinical features suggestive of severe grade of organophosphorus poisoning with clinical evidence of respiratory insufficiency.

**Exclusion Criteria** for the study were as follows:

1. Patients with double insecticide / multiple poisoning with other drugs such as opioids, diazepam, barbiturate etc.,
2. Patients with history of respiratory diseases like bronchial asthma, cardiac diseases, neuromuscular diseases like myasthenia gravis or muscular dystrophy or other concomitant illnesses

The patients were assessed based on:

- > Demographic parameters and type / time of poisoning
- > Symptoms and signs of poisoning
- > Severity of intoxication and clinical features of respiratory failure
- > Pharmacological therapy
- > Ventilation: Modes and other settings
- > Monitoring: Clinical and Laboratory (Laboratory: (a) Routine (b) Serum Cholinesterase)

The collected data were analysed with special reference to the 1. Severity of poisoning (as assessed in the emergency ward) 2. The treatment 3. The duration and nature of ventilatory support and 4. The levels of serum cholinesterase estimated on first day and serially on subsequent odd days.

The serum cholinesterase activity was measured by kinetic/ DGKC calorimetric method, of Zydus Pathline Limited. EDTA samples are sent to the laboratory.

The results are expressed in KU / L which is U / L x 1000. The laboratory reference range used in the present study for serum cholinesterase: 5100 to 11700 IU / Ltr.

## Results

Out of 36 cases of OP poisoning in the present study, 28 cases were suicidal (78%) and 8 cases were accidental (22%). It may be noted that all the suicidal poisoning were by ingestion whereas all the accidental poisoning were inhalational.

22 out of 36 patients took Monocrotophos and the rest had poisoning from other OP compounds.

**Table 1: Time Interval between OP Consumption and Admission**

Time (hours)	Frequency
0 – 2	01 (03%)
2 – 4	07 (19%)
4 – 6	09 (25%)
6 – 10	06 (17%)
>10	13 (36%)
Total	36 (100%)

About half of the number of patients presented within 6 hours of poisoning. Nearly 80% were brought after 4 hours of poisoning. This could be related to the fact that majority of patients were from rural areas. Only one patient could be brought within 2 hours.

**Table 2: Cholinesterase levels (SCE) and Severity of OP poisoning**

Range of SCE (IU/L)	Severity	Frequency
<1000	Severe	02 (06%)
1001 – 2000	Moderate	06 (17%)
2001 – 3000	Mild	16 (44%)
3001 – 4000	Mild	08 (22%)
4001 – 5000	Mild	01 (03%)
>5000	Mild	03 (08%)
Total		36 (100%)
	Mean SCE	2843.83+/-258.55

It's evident from the above table that maximum number of patients presented with mild poisoning based on the SCE levels (77%) and about 23% had moderate to severe poisoning levels

**Table 3: Relation between levels of serum cholinesterase at presentation and time of consumption of poison**

SCE levels (IU/L)	0 – 4 hours	4 – 8 hours	8 – 12 hours	>12 hours
<1000	0	0	0	2
1000 – 2000	1	4	0	1
2000 – 3000	5	5	2	4
3000 – 4000	2	2	1	3
>4000	2	0	1	1
Total	10	11	04	11

25/36 of patients (70%) were brought to the hospital within 12 hours of consumption of poison. Based on their SCE values, this group had mild to moderate suppression.

Significantly severe suppression of SCE was found in two patients, both of whom were brought after a gap of 12 hours after poisoning

### Discussion

The present study of serum cholinesterase levels in organo phosphorus poisoning patients on ventilatory support was conducted in 36 patients at the Respiratory Intensive Care Unit of the Department of Anaesthesiology. Majority of them were (80 %) below 40 years of age and were predominantly males. This could be because males have easy accessibility to organo phosphorus compounds. The major route of poisoning was by ingestion, with suicidal intent. Majority of the patients were from rural areas (32 / 36 patients) and agricultural workers and hence, again easy availability could be the reason for OP poison ingestion. Monocrotophos was the commonest type of OP poison used, by more than 60 % of the patients, because of its maximum usage in paddy cultivation in this part of state. Nearly 80 % were brought after 4 hours of poisoning. This could be related to the fact that majority of the patients were from rural areas (and agricultural workers by occupation) and needed to be brought to the VIMS hospital for management by Road.

In our study, taking into consideration the lower limit of reference values of SCE, only 3 out of 36 patients had SCE values of > 5000 IU / L (8 % of patients), indicating that there was suppression in more than 90 % of patients on presentation (With a reference range of 5100 to 11700 IU / L of SCE). More than 60 % of patients showed suppression between 50 % to 70 %. The mean SCE value was  $2843.83 \pm 258.55$ . In 23 patients of OP poisoning Mehta A.B. et al.,<sup>3</sup> observed lowered activity of SCE in more than 70 % of cases at presentation.

Suvit Areekul et. al.,<sup>5</sup> studied 10 patients with OP poisoning and found reduced levels of SCE in all of them with one mortality. A. Dua et al.,<sup>6</sup> also found that SCE was lower than normal in all their study patients with OP poisoning. Thus, reduced levels of SCE on the day of presentation can raise a strong suspicion of OP poisoning. Majority (> 75 %) however, had only mild poisoning based on Serum Cholinesterase levels (SCE)

values, as per Proudfoot classification.<sup>22</sup> Only 23 % had moderate to severe poisoning as per their (SCE) values. Semir Nourira et al.,<sup>7</sup> did not find any statistically significant differences in mean SCE levels in those mechanically ventilated and those not needing ventilatory support. They also found that the total dose of atropine required and Simplified Acute Physiology Score (SAPS) used to grade clinical severity in their study did not correlate with the SCE values. However Thomas Chang Yao Tsao et al.,<sup>8</sup> in their study could associate severe suppression of SCE (> 80 %) with acute / subacute respiratory failure. (<300 mU / mL in a normal range of 3000 to 6000 mU / mL) But Wadia et al.,<sup>9</sup> found no correlation between various clinical signs and levels of RBC and Serum Cholinesterase. Mehta et. 431 also found no correlation between severity of poisoning clinically and SCE levels in their study. Most of the above studies indicate that there is no correlation between the SCE levels and the clinical severity of poisoning such as presence of ventilatory insufficiency. And also SCE does not appear to have any prognostic value as far as OP poisoning is concerned.

### Conclusion

Organophosphorous poisoning was associated with a fall in serum cholinesterase levels on the day of presentation to the hospital after poisoning

### Conflict of Interest: None

### Source of Support: Nil

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