

## Original Research Article

# A prospective evaluation of correlation between cholinesterase level and severity of organophosphorus poisoning

M. Deepak Phanindra<sup>1</sup>, P. V. V. Satyanarayana<sup>1\*</sup>, Anand Acharya<sup>2</sup>

<sup>1</sup>Department of General Medicine, <sup>2</sup>Department of Pharmacology, Konaseema Institute of Medical Science, Amalapuram, Andhra Pradesh, India

**Received:** 21 November 2019

**Revised:** 23 December 2019

**Accepted:** 27 December 2019

### \*Correspondence:

Dr. P. V. V. Satyanarayana,

E-mail: [pvvsatyanarayana@gmail.com](mailto:pvvsatyanarayana@gmail.com)

**Copyright:** © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

## ABSTRACT

**Background:** Organophosphorus compounds are anticholinesterases by inhibiting cholinesterase it protects acetyl choline from hydrolysis. So, acetylcholine accumulates at the synapses, and all the clinical manifestation are due to that. So, this study has been designed to establish the reactive between level of serum and prognosis of op poisoning patients.

**Methods:** Patient with history of organophosphorus poisoning admitted into the emergency department with following exclusion and inclusion criteria were included in this study. All patients were managed as per standard treatment protocol of op poisoning. Various parameters like demography of the patients, sign and symptoms, severity of intoxication, clinical and lab parameter manoring, Serum cholinesterase was measured every alternate day.

**Results:** 22(47.84%) patients have mild symptom out of that 20 patient's serum cholinesterase was more than 2000 IU/L, and 2(4.3%) patients serum cholinesterase was between 1000-2000 IU/L. In eighteen patient's severity as per POP scale was moderate, out of that 2(4.3%) patients have serum cholinesterase was below 1000 IU/L, 8 having serum cholinesterase between 1000 to 2000 IU/L, and remaining eight having serum cholinesterase above 2000 IU/L.

**Conclusions:** Serum cholinesterase was less in patient with high severity score or low serum concentration of cholinesterase was associated with high severity score. Serum cholinesterase was improved as days passes.

**Keywords:** Correlation, Organophosphorus, Serum cholinesterase, Severity

## INTRODUCTION

Acute pesticide poisoning is a global problem, especially in developing country. It has been reported that there could be as many as 25 million agricultural workers in the developing world suffering an episode of poisoning each year.<sup>1,2</sup> Josef GT et al, has reported that 0.3 million people die every year, (WHO).<sup>3</sup> Srivastava et al, from national poisons information centre has reported that most common age group is productive age and mostly suicidal in nature.<sup>4</sup>

Organophosphorus compounds are anticholinesterases by inhibiting cholinesterase it protects acetyl choline from hydrolysis. So acetylcholine accumulate at the synapses, and all the clinical manifestation are due to that.<sup>5,6</sup> Studies have been done to establish the association between serum acetylcholine esterase and prognosis of organophosphorus poisoning.<sup>6,7</sup> But there are controversies in the report of various literatures. Aygun D et al, has reported that serum acetylcholine esterase is low in acute poisoning but it dose not have significant relation with severity.<sup>6,8</sup> Hiremath P et al, has reported that

acetylcholine esterase is a reliable indicator of the severity of OP poisoning.<sup>5</sup>

So, author have designed this study establish the reactive between level of serum and prognosis of op poisoning patients.

Objective of the study was to measure the serum cholinesterase, in patients with op poisoning and to correlate the cholinesterase with the severity of organophosphorus poisoning.

## METHODS

Present study is a prospective observational study conducted in the department of general medicine Konaseema institute of medical science Amalapuram, from March 2018 to October 2019.

Patient with history of organophosphorus poisoning admitted into the emergency department with following exclusion and inclusion criteria were included in this study.

**Table 1: Exclusion and inclusion criteria.**

Exclusion criteria	Inclusion criteria
Unknown poisoning	All age
Multiple poisoning	Both sex
Pre-existing cardiorespiratory and neurodegenerative disorder	Clinical feature and circumstantial evidence of op poisoning.

This study is approved by institutional ethics committee. A written informed consent was obtained from patient/ attendant before enrolment into the study.

Sample size was calculated based on prevalence, of op poisoning, and consider can indene interval was 95% the size was calculated to be 46.

### Exclusion and inclusion criteria

Total 46 patients were included in this study. Each patients were assessed clinically, detail history of the patient were taken, and thorough clinical examination was done, for assessment of severity of poisoning Peradeniya organophosphorus poisoning scale was used.<sup>9</sup>

Blood sample was taken and was analysis for Haemoglobin, total count, DC, ESR, Fasting plasma glucose, blood urea, serum creatinine, serum electrolyte and serum cholinesterase level. All patients were managed as per standard treatment protocol of op poisoning.

Various parameters like demography of the patients, sign and symptoms, severity of intoxication, clinical and lab parameter manoring, Serum cholinesterase was measured every alternate day. The serum chorines terrace activity

was measured by spectrophotometry method, and result was expressed in IU/L, with normal value 4500 IU/L to 12000/IL. For calculation of severity based on serum cholinesterase level proudfoot classification was used10. More than 2001 IU/L - mild, Low IU/L to 1000 IU/L - moderate, and >1000 IU/L - severe.

## RESULTS

During one year eight months of study period 46 patients with established organophosphorus poisoning admitted in the emergency department were enrolled for this study as per inclusion and exclusion criteria.

As per (Table 2), regarding age of the patients, 6 patients were below 20 years of age (13%), out of 46 patients, 28 patients (60.08%) were between 21 to 40 yrs, number of patients between 41 to 60 yrs were 8(17.4%) and above 60 yrs were 4(6.69%)patients. In this study out of 46 patients 30 were male and 16(34.78%) were female. Regarding type of poisoning 32(69.56%) cases were having suicidal intent remaining 14(30.434%) were accidental. Regarding time interval from consumption to admission, only two patients were admitted with 2 hours, ten patients were admitted between 2-4 hours. Time taken for admission was 4-6 hours from 22 patients, and 12 patients were admitted after 6 hours.

**Table 2: Demography of the patients.**

Variables	Number (6/0)	
Age	0-20	6 (13%)
	21-40	28 (60.08%)
	41-60	8 (17.4%)
	60yrs	4 (8.69%)
Sex	M	30 (65.21%)
	F	16 (34.78%)
Type	Suicidal	32 (69.56%)
	Accidental	14 (30.434%)
Time internal For ingestion to adma	<2hr	2 (4.3%)
	2-4hr	10 (21.73%)
	4-6hr	22 (47.82%)
	>6hr	12 (26.08%)

From (Table 3) it is clear that 22(47.84%) patients have mild symptom out of that 20 patients serum cholinesterase was more than 2000 IU/L, and 2(4.3%) patients serum cholinesterase was between 1000-2000 IU/L. In eighteen patients severity as per POP scale was moderate, out of that 2(4.3%) patients have serum cholinesterase was below 1000 IU/L, 8 having serum cholinesterase between 1000 to 2000 IU/L, and remaining eight having serum cholinesterase above 2000 IU/L. Out of 46 patients 6 patients having severe score that is more than 7 and there serum cholinesterase level was also below 1000 IU/L.

As per (Table 4) regarding relation between severity of OP poisoning based on serum cholinesterase using

modified proud foot classification, 8 patients have severe poisoning as cholinesterase level was below 1000 IU/L, 10 patients have moderate severity as serum cholinesterase level was between 1001 to 2000 IU/L. In 16 patients serum cholinesterase was between 2001 IU/L

to 3000 IU/L and severity was mild. In 4 patients serum level was between 3001 to 4000 IU/L and severity was mild. Serum cholinesterase concentration was more than 4000 IU/L in remaining 8 patients, in them also severity was mild.

**Table 3: Relation between serum cholinesterase level and severity (based on POP scale).**

Pop scale	Serum cholinesterase level			Total
	<1000 IU/L	1000 to 2000	>2000	
Mild <4	0	2 (4.3%)	20 (43.24%)	22 (43.47%)
Moderate (4-7)	2 (4.3%)	8 (17.4%)	8 (17.4%)	18 (39.13%)
Severe >7	6 (13.4%)	0	0	6 (13.4%)
Total	8 (17.4%)	10	28	46 (100%)

**Table 4: Relation between severity of OP poisoning and serum cholinesterase as per modified Proudfoot classification.**

Conc. of serum cholinesterase	Severity	No of patients (%)
< 1000	Severe	8 (17.4%)
1001-2000	Moderate severity	10 (21.73%)
2001-3000	Mild	16 (34.78%)
3001-4000	Mild	4 (8.69%)
>4001	Mild	8 (17.4%)
Total		46 (100%)

Regarding relation between the changes in the concentration of serum cholinesterase with respect to

days since admission, on the day of admission the serum cholinesterase concentration was less than 1000 in 8 patients, 1001 IU/L to 2000 IU/L in 10(21.75%) patients, between 2001 to 4000 IU/L in 20 patients (43.74%). Only 8(17.4%) patients have cholinesterase level above 4000. It is clear from the table that as the day passes there is increase in the concentration of cholinesterase.

## DISCUSSION

Present study a prospective evaluation of correlation between cholinesterase level and severity of organophosphorus poisoning has been conducted on 46 patients with OP poisoning in one year eight months duration.

**Table 5: Change in the concentration of serum cholinesterase number of patients (%).**

Serum cholinesterase	Day 0	Day 2	Day 4	Day 6
0-1000	8(17.4%)	0	0	0
1001-2000	10(21.73%)	4(8.69%)	2(4.39%)	2(4.34%)
2001-4000	20(43.74%)	26(56.52%)	26(56.52%)	24(56.52%)
>4000	8(17.4%)	16(34.78%)	18(39.13%)	20(43.74%)

In present study it has been observed that the most common age group with poisoning was 21-40 yrs followed by 41 to 60 years, which is the most productive age of the patients. This observation is supported by the work of Srivastava A et al, and Banerjee I et al, there is male predominance in present study which corroborate with the finding of Ahmed SM et al, and Siva Kumar et al. But it is not supported by the work of Banerjee I et al. Regional sociocultural variation may be the cause of difference.<sup>11,13</sup> In majority of cases suicidal intent was the cause of intoxication which is supported by the work of most of the author.<sup>4,11-13</sup> In present study in most of the

(75%) were brought to the emergency department with in 6hours, only 2 patients were brought within 2 hours, this is supported by the work of Sungur et al.<sup>14</sup>

Regarding relation between severity of poisoning and serum cholinesterase based on POP scale, it has been observed that low level of serum cholinesterase is associated with high severity score, and score was low and severity was mild if serum cholinesterase was >2000 IU/L this finding supports that higher the concentration of cholinesterase milder the symptom. This finding is supported by the work of Choudary SC et al, Hiremath P et al. It has been further observed that 17.4% of the

patients have very severe presentation as there serum cholinesterase level was less than 1000 IU/L.<sup>5,15</sup> But this observation is not supported by the work of Aygun et al, and Nouria.<sup>6,16</sup> Author have estimated serum cholinesterase level serially for 6 days; author have observed that on third day of admission serum concentration was increased. It is clear from the table that as the day passes there is increase in the concentration of cholinesterase. This finding is supported by the study of Manu MS et al.<sup>17</sup>

## CONCLUSION

To conclude most of the patient were in productive age group and there was male predominance. Most of the poisoning cases were suicidal in nature and there was delay in admission of the patient. Serum cholinesterase was less in patient with high severity score or low serum concentration of cholinesterase was associated with high severity score. Serum cholinesterase was improved as days passes.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: The study was approved by the Institutional Ethics Committee*

## REFERENCES

- Jeyaratnam J. Acute pesticide poisoning: a major global health problem. *World Health Stat Q.* 1990;43(3):139-44.
- Gunnell D, Eddleston M, Phillips MR, Konradsen F. The global distribution of fatal pesticide self-poisoning: Systematic review. *BMC Public Health.* 2007;7:357.
- Thundiyil JG, Stober J, Besbelli N, Pronczuk J. Acute pesticide poisoning: a proposed classification tool. *Bull World Health Org.* 2008;86:205-9.
- Srivastava A, Peshin SS, Kaleekal T, Gupta SK. An epidemiological study of poisoning cases reported to the national poisons information centre, All India Institute of Medical Sciences, New Delhi. *Human Experiment Toxicol.* 2005;24(6):279-85.
- Hiremath P, Rangappa P, Jacob I, Rao K. Pseudocholinesterase as a predictor of mortality and morbidity in organophosphorus poisoning. *Indian J Crit Care Med: Peer-Reviewed, Official Publication Ind Soc Crit Care Med.* 2016;20(10):601.
- Aygun D, Dognnay Z, Altintop L, Guven H, Onar M, Deniz T, et al. Serum acetylcholinesterase and prognosis of acute organophosphate poisoning. *J Toxicol Clin Toxicol.* 2002;40:903-10.
- Areekul S, Srichairat S, Kirdudom P. Serum and red cell cholinesterase activity in people exposed to organophosphate insecticides. *Southeast Asian J Trop Med Public Health.* 1981;12:94-8.
- Nouria S, Abroug F, Elatrous S, Boujdaria R, Bouchoucha S. Prognostic value of serum cholinesterase in organophosphate poisoning. *Chest.* 1994;106(6):1811-4.
- Senanayake N, de Silva HJ, Karalliedde L. A scale to assess severity in organophosphorus intoxication: POP scale. *Hum Exp Toxicol.* 1993;12(4):297-9.
- Rehiman S, Lohani SP, Bhattarai MC. Correlation of serum cholinesterase level, clinical score at presentation and severity of organophosphorous poisoning. *J Nepal Med Assoc.* 2008;47(170):47-52.
- Banerjee I, Tripathi SK, Roy AS. Clinico-epidemiological characteristics of patients presenting with organophosphorus poisoning. *North Am J Med Sci.* 2012;4(3):147.
- Ahmed SM, Das B, Nadeem A, Samal RK. Survival pattern in patients with acute organophosphate poisoning on mechanical ventilation: A retrospective intensive care unit-based study in a tertiary care teaching hospital. *Ind J Anaesth.* 2014;58(1):11.
- Shivakumar S, Rajan SK, Madhu CR, Doss P, Pasupathy S, Dhandapani E. Profile of acute poisoning in Chennai: A two year experience in Stanley Medical College and Hospital (1999-2000). *J Assoc Physicians India.* 2002;50:206.
- Sungur M, Güven M. Intensive care management of organophosphate insecticide poisoning. *Crit Care.* 2001;5(4):211.
- Chaudhary SC, Singh K, Sawlani KK, Jain N, Vaish AK, Atam V, et al. Prognostic significance of estimation of pseudocholinesterase activity and role of pralidoxime therapy in organophosphorous poisoning. *Toxicol intern.* 2013;20(3):214.
- Nouria S, Abroug F, Elatrous S, Boujdaria R, Bouchoucha S. Prognostic value of serum cholinesterase in organophosphate poisoning. *Chest.* 1994;106(6):1811-4.
- Manu MS, Prashant V, Akila P, Suma MN, Basavanagowdappa H. A retrospective analysis of serial measurement of serum cholinesterase in acute poisoning with organophosphate compounds. *Toxicol Intern.* 2012;19(3):255.

**Cite this article as:** Phanindra MD, Satyanarayana PVV, Acharya A. A Prospective evaluation of correlation between cholinesterase level and severity of organophosphorus poisoning. *Int J Adv Med* 2020;7:276-9.