

Study of Correlation of Serum Cholinesterase Level with Peradeniya Organophosphorus Poisoning Scale in Organophosphorus Poisoning

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Abstract

Background- Organophosphorus compound poisoning is a common problem in Nepal. In rural areas, cholinesterase levels are not readily available and other clinical severity scores would be useful. Peradeniya Organophosphorus Poisoning (POP) scale is a clinical severity score that has shown promise as a prognostication tool.

Method- This was a single center, prospective study conducted in Nepal medical college between August 2012 to August 2014. A total of 62 cases of organophosphorus poisoning was included on the basis of history of organophosphate compound ingestion. Spearman correlation method was used to find the correlation between serum cholinesterase severity and POP scale severity.

Result- Majority of the patients were between the ages of 15 to 45 and female. The most consistent clinical finding was miosis followed by altered sensorium. The most common organophosphate compound ingested was methyl parathion. No significant correlation was seen between serum cholinesterase severity and POP scale severity.

Conclusion- POP scale severity does not correlate with cholinesterase level severity. Multi-center trial with larger sample size is needed due to inconsistent results amongst similar studies.

Keywords- Organophosphorus poisoning, Peradeniya Organophosphorus Poisoning (POP) scale, Cholinesterase level

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INTRODUCTION

Poisoning is a common problem in Nepal.¹ Research¹ shows that agricultural agents form a major portion such cases of poisoning in Nepal. Agricultural agents accounted for 55% out of which insecticides formed 64.5%. Several studies^{2, 3} have shown that

organophosphate insecticide poisoning is a common problem amongst both adults and children.

The diagnosis of organophosphorus poisoning requires history and biochemical investigation like serum cholinesterase level.⁴ Serum cholinesterase level is frequently used

to grade the severity of organophosphorus poisoning.⁵ Severity of organophosphorus poisoning helps predict increased atropine requirement, increased duration of hospital stay, need for mechanical ventilation, and death.^{6,7} This is important since not all health care centers are equipped to manage critical cases requiring mechanical ventilation. Timely referral to appropriate centers is needed in some cases. In rural resource constrained areas, cholinesterase level monitoring is not readily available, hence alternate methods of prognosis determination is needed. The Peradeniya Organophosphorous Poisoning (POP) Scale is a clinical severity scoring system introduced in 1993.⁸ Research showed that the severity according to the POP scale and that of the serum cholinesterase correlate.⁶ POP scale severity has also been shown to predict mechanical ventilation and death.⁷

Serum cholinesterase level is obtained at the initial presentation. It can be used to classify as mild, moderate and severe poisoning. Mild poisoning 20-50% of normal or >1,401-3,500 IU/L, moderate poisoning 10-20% of normal or 701-1,400 IU/L, severe poisoning <10% of normal or <700 IU/L.⁹ The POP scale is obtained at the initial presentation before any medical intervention. It represents the muscarinic, nicotinic and central effects of the acute cholinergic manifestations of organophosphorus 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.⁸

The objective of this paper was to find the role of the clinical POP score as a prognostic indicator by correlating with serum cholinesterase severity.

Table 1: Peradeniya Organophosphorus Poisoning (POP) Scale

	Clinical criteria	Score
Pupil Size at ambient lighting	>2mm	0
	<2mm	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
Fasciculations	None	0
	Present, generalized or continuous	1
	Both, generalized and continuous	2
Level of consciousness	Conscious and rationale	0
	Impaired response to verbal commands	1
	No response to verbal commands	2
Seizures	Absent	0
	Present	1

METHODOLOGY

This was a single center, prospective study conducted in Nepal medical college between August 2012 to August 2014. Patients included here were those having consumed organophosphate poison diagnosed by history upon presentation. All cases were able to identify the brand name of the poison consumed. Cases excluded were those <14 years of age, patients of Chronic obstructive pulmonary disease, patients with prior history of seizure disorder, patients with documented previous bradycardia, those taking beta-blockers, rate limiting calcium channel blockers, history of head trauma at presentation, patients who were already atropinized before referral, patients having ingested different classes of poison.

Blood sample was collected aseptically from a peripheral vein on presentation. Cholinesterase level was measured from the serum using the Vitros 250 dry chemistry analyzer from Johnson and Johnson®. It employed ellman's reagent and used calorimetry to quantify serum pseudocholinesterase. Pupil diameter was measured in diffuse lighting of the emergency using a camel scale. Verbal consent was taken from the patient or the primary caregiver.

Data were collected to include age, sex, components of the POP scale, time of presentation after poison ingestion, severity categorized according to serum acetyl cholinesterase level, the total dose of atropine for atropinization, intubation and mechanical ventilation status, death or recovery. Spearman rank correlation using SPSS software was used to measure the association between the POP scale severity and the cholinesterase level severity.

Sixty-two cases of organophosphorus poisoning was included during the study period by convenience sampling. Sample size was estimated from prior published data² of 152 patients of organophosphate poisoning cases admitted in a 6-year period from 2005-11. Ten patients were excluded from the Spearman rank correlation analysis due to serum cholinesterase level measurement not being done. Ethical clearance was obtained from the institutional review committee of Karnali Academy of Health Sciences with a reference number 42-069/070.

RESULT

The majority of the patients were young between the age group of 14-45 years. The majority of the patients were female; however, males formed a majority amongst the

>45years age group. [Table 2] Most of the patients presented early to the emergency within two hours of organophosphate consumption. However, the only patient requiring intubation and had subsequent mortality in this study presented early to the emergency. [Table 3] The most common organophosphate compound consumed amongst the patients was methyl parathion. One of the patients who consumed dimethate was intubated due to low Glasgow coma scale score and had subsequent mortality. [Table 4]

Thirty-five patients presented with miosis upon presentation. It was the most common clinical finding. Altered sensorium in the form of drowsiness and loss of consciousness was seen amongst 15 patients. Generalized fasciculation was seen in 5 patients. Wheeze with respiratory distress was seen in only 2 patients. Seizure was observed in only 1. (Figure 1) There were total 10 patients who presented with drowsiness, loss of consciousness or seizure amongst patients with severe poisoning according to cholinesterase level. (Table 5) However, mortality seen was in the patient with mild severity according to the cholinesterase level. [Table 5]

The mean dose of atropine required for atropinization amongst patients with moderate POP score was 14.49 mg. Patients with mild POP score required comparatively less atropine. The mean dose of atropine required for atropinization showed corresponding increase with POP score severity. [Figure 2] There was no significant correlation between the POP score severity and the cholinesterase severity. Analysis excluded 10 out of the total of 62 patients due to unavailability of their cholinesterase level. [Figure 3] Spearman's Rank Correlation

Coefficient (R_s) was -0.261 with p value of 0.5 (50% statistical significance level) and degree of freedom 0. This can be interpreted as having a very weak negative correlation of no

statistical significance. Analysis excluded 10 out of the total of 62 patients due to unavailability of their cholinesterase level.

Table 2: Age and sex distribution amongst the cases of organophosphate poisoning patients

Age	Male	Female
>45 years of age	3	1
14-45 years of age	13	45

Table 3: Time to arrival in the emergency after consuming organophosphate and their corresponding intubation status

Time to arrival in the emergency	Number of patients	Intubated with mechanical ventilation
Within 2 hours of consumption of organophosphate	52	1 patient
2-6 hours of consumption of organophosphate	6	0
More than 6 hours of consumption of organophosphate	4	0

Table 4: Type of organophosphate compounds consumed and corresponding mortality

Organophosphate compound	Number of patients	Intubation and mortality
Metacid 50 (methyl parathion)	52	0
Chlorpyrifos	4	0
Nuvan (Dichlorvos)	3	0
Rogor (Dimethate)	2	1 patient
Triazophos	1	0

Table 5: Neurological manifestations, Cholinesterase severity and death comparison amongst patients of organophosphate poisoning

Seizure / Loss of consciousness	Poisoning severity according to the cholinesterase level	Intubation and death
10	Severe	0
0	Moderate	0
4	Mild	1
2	Unavailable	0

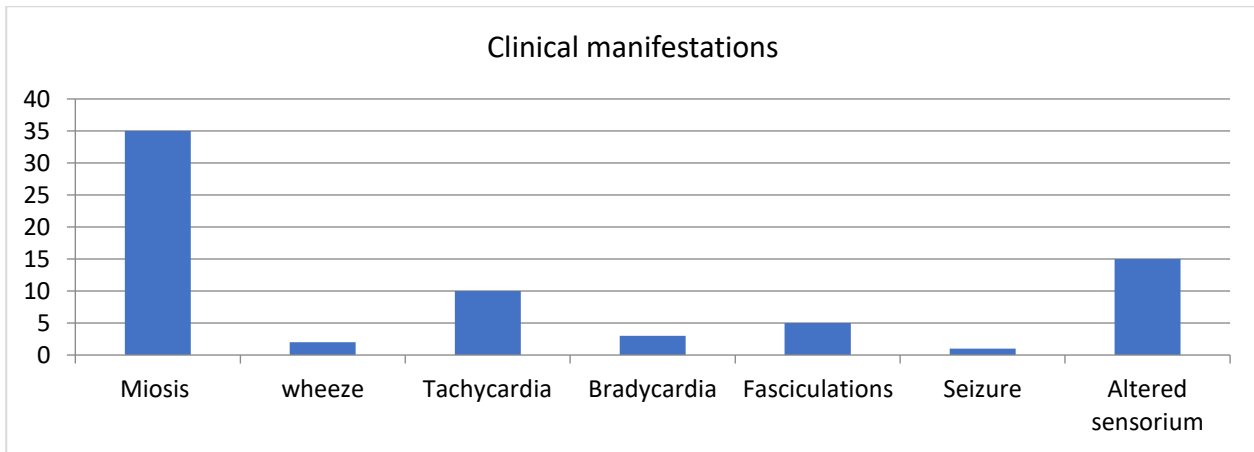


Figure 1: Clinical manifestations amongst the cases of organophosphorus poisoning

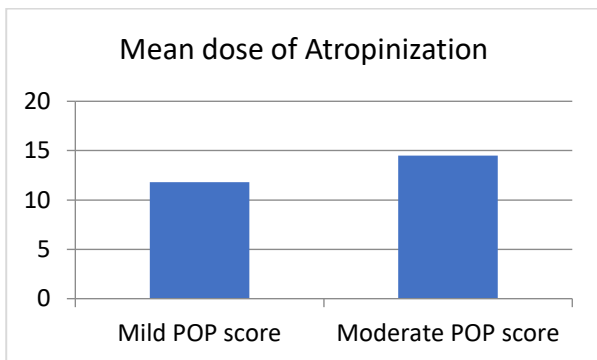


Figure 2: Mean dose of atropine required for atropinization in patients of organophosphate poisoning

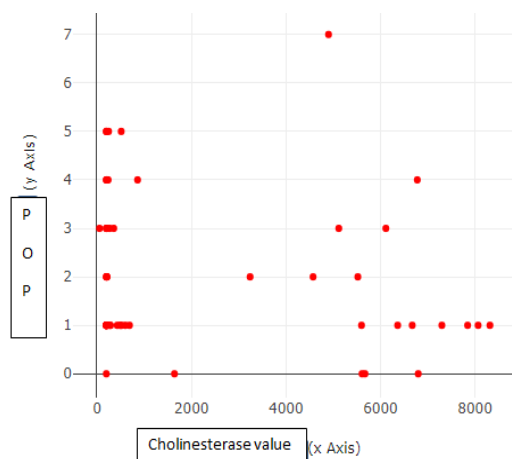


Figure 3: Spearman's Rank Correlation Coefficient between POP score and cholinesterase level

DISCUSSION

Despite a plethora of studies on organophosphorus poisoning, the author could find only one published study⁶ that had compared the POP scale and serum cholinesterase severity. It showed a correlation

between the two severity scores. Another study¹⁰, also showed a correlation between the two-severity scoring. This study, however, did not show a significant correlation between POP scale severity and the serum cholinesterase severity which could be due to

the following reasons: Pupillary diameter measurement requires an ideal setting of diffuse lighting and patience. This especially in a non-cooperative patient could affect such minute measurements. In this study, miosis was the most consistent feature. Similar finding has been reported in another study.¹¹ Parameters such as heart rate and respiratory rate are dependent on a variety of other factors such as anxiety following ingestion and the rush to the emergency.

The use of subjective clinical parameters may also be why the world health organization in its pesticide intoxication guideline¹² did not mention the POP scale. It instead mentioned the Glasgow coma scale on presentation as the best predictor of the outcome. This study showed a predominance of female patients among the cases of organophosphorus poisoning which was similar to other studies.^{13,14} Females showed an overall predominance in all types of poisoning cases.^{15,16} Domestic female abuse is fairly common in Nepal and has been reported to be an important precipitator of suicidal attempts amongst women in some studies.^{17,18} This study also showed a predominance of young patients similar to other studies.^{13, 14} There was only one death (1.6%) in this study. This low mortality is inconsistent with other studies.^{10, 19} This finding, however, is not unique as per result of other studies^{20, 21} similarly using magnesium sulphate upon admission. Such studies had shown a significant mortality reduction with the use of magnesium sulphate on admission. Another explanation may be that the majority of compounds used by patients in this study was different from studies showing higher

mortality. Different organophosphate compounds have variable effect on mortality as per research.²² Also contributing to it may be the patient profile of this study, which showed only a small percentage of the older population. None of the patients had comorbidities like COPD, cardiac diseases which would contribute to mortality. Other studies^{6,19} did not exclude such patients. Those studies did not discuss the comorbidities in their mortality population. The study⁷ that discussed its mortality showed comorbidities like COPD, ischemic heart disease, chronic kidney disease.

The majority of the patients presented early within two hours of consumption of the organophosphate poison. However, the mortality recorded was of the patient presenting early on to the emergency. This finding was also consistent with another study.¹³ The most common organophosphate compound seen in this study was methyl parathion sold as metacid. This finding was similar to other studies.^{2, 23}

Limitations: Pseudocholinesterase level was used instead of RBC cholinesterase which closely approximates the cholinesterase levels in the neurosynapses. This was due to the current unavailability of RBC cholinesterase level detection technology in Nepal. The small sample size of the study may affect the result.

CONCLUSION

POP scale severity did not correlate with cholinesterase level severity. Multi-center trial with larger sample size is needed due to inconsistent results amongst similar studies.

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