

Correlation of Severity of Organophosphorus Poisoning as Assessed by Peradeniya Organophosphorus Poisoning Scale with Serum Amylase and CPK Level

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ABSTRACT

Introduction: Organophosphorus compounds are commonly used for suicide in developing country like India due to their easy availability. This study was undertaken to estimate serum amylase level and CPK level at time of admission and correlating it with the severity of organophosphorus compound poisoning as assessed by Peradeniya scoring, ventilator requirement and mortality

Material and methods: This was an observational study done at G.M.C Medical College and associated Hamidia hospital Bhopal. Over a period of one year 100 patients fulfilling inclusion criteria, were included and patients were categorized according to Peradeniya organophosphorus poisoning (POP) scale. Level of serum CPK, and serum amylase were measured at admission

Results: In this study the correlation between severity of poisoning as assessed by pop scale and serum CPK and serum amylase level was significant ($p < 0.0001$). Serum CPK levels and serum amylase levels correlated well with need for ventilator support ($p < 0.0001$) and mortality. Logistic regression analysis showed serum amylase (Coefficient=0.44) is a better predictor of ventilator requirement as compared to serum CPK (Coefficient=0.17) and also serum amylase (Coefficient=0.19) is better predictor of mortality than serum CPK level. (Coefficient=0.0006)

Conclusion: Serum amylase and serum CPK level correlate well with severity of poisoning and serum amylase is better predictor of ventilator support requirement and mortality.

Keywords: Organophosphorus Poison, Serum Amylase, CPK Level

INTRODUCTION

World Health Organization (WHO) estimates that around 0.3 million people die every year globally due to various poisonings¹ and pesticide poisonings causes more than 2,20,000 deaths in developing countries like India² because of cheap and easy availability of highly hazardous pesticides. In many Indian reports, the rates of poisoning as suicidal method range from 20.6% (10.3% organophosphorus) to 56.3% (43.8% organophosphorus).^{3,4} Organophosphorus (OP) compounds causes over stimulation at cholinergic synapses by inhibiting acetyl cholinesterase and butyryl cholinesterase enzymes⁵ Measuring serum cholinesterase level in blood is a gold standard for diagnosis of organophosphorus poisoning as its level decreases in OPC poisoning.⁶ However, because of wide inter-individual variability, significant depression of the enzyme cholinesterase activity may occur but still fall within the "normal" range.⁷ Serum enzymes EChE or BChE measurement is not available regularly in all laboratories and is costly so new cheaper and easily quantifiable biochemical markers are needed in relation to OP poisoning like creatine phosphokinase (CPK), serum amylase.

Several animal model studies proposed that serum level of CPK is often found to be elevated in OP poisoning, and it may be used as a biomarker.⁸

In organophosphorus poisoning raised serum amylase (hyperamylasemia) level is secondary to pancreatic injury because of parasympathetic overstimulation and hypersecretion. There have been studies showing that elevated serum amylase on admission day was related to the development of respiratory failure need for ventilatory support and increased mortality.⁹

Peradeniya OP poisoning scale is a simple and effective system to determine the severity of organophosphorus poisoning Pop scale is a scoring system introduced by N Senanayake, HJ de Silva and L Keralliceede in 1993. Common clinical manifestations of op poisoning are selected as parameters each is assessed on a three-point scale varying from 0 to 2. The score is obtained at initial presentation before doing any medical intervention and it represents the muscarinic, nicotinic and central effects of acute cholinergic manifestations of op poisoning. The overall score of 0 to 3 considered as mild poisoning, 4 to 7 as moderate poisoning and 8 to 11 as severe poisoning.¹⁰

Therefore, this study was conducted to assess the severity of acute OP poisoning as assessed by peradeniya OP poisoning scale and its correlation with serum CPK and serum amylase level.

MATERIALS AND METHODS

Study design and Study period: An prospective observational study on 100 patients of organophosphorus poisoning, selected on the basis of inclusion and exclusion criteria, admitted in medicine department of Hamidia Hospital Bhopal was done from period of January 2015 to December 2015.

Inclusion criteria: Patient having history of organophosphorus poisoning within previous 24 hours with clinical features and physical evidence of poisoning consumed were included in the study.

Exclusion criteria: Patients with concomitant illness or conditions, patients who consumed other poisons along with organophosphorus compound, patients with chronic lung disease and patients treated outside for the poisoning, patients

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who have consumed poison along with alcohol were excluded from the study.

The Ethical committee approval was obtained to carry out the study of OP poisoning patients admitted in medicine department in Hamidia Hospital Bhopal.

A preformed and pre-tested proforma was used to collect information from patients detailed history, clinical examination and relevant biochemical investigations were done. Patients were evaluated at time of admission and were followed up during treatment. Peradeniya OP poisoning scale (Table-1) was applied to all study subjects at time of admission and they were graded as mild, moderate, severe. 3 ml of plain blood was collected from all study subjects before administration of atropine at time of admission and serum CPK and serum amylase were estimated.

Patient were followed till their final clinical outcome and whether they required ventilator support or not was noted. Based on the assessment as described in table-1, a score was given to the patients. A score of 0 to 3 is considered as mild poisoning, 4 to 7 as moderate poisoning and 8 to 11 as severe poisoning.

STATISTICAL ANALYSIS

Data after collection was tabulated in Microsoft excel and later SPSS software and OPEN EPI version 2.3.1 was used for analysis

Pupil Size	>2 mm	0
	<2 mm	1
Respiratory rate	Pin point	2
	<20/min	0
	>20/min	1
Heart rate	>20/min with central cyanosis	2
	>60/min	0
	41-60/min	1
Fasciculation	<40/min	2
	None	0
Level of Consciousness	Present, generalized or continuous	1
	Both generalized and continuous	2
	Conscious and rationale	0
Seizures	Impaired response to verbal commands	1
	Absent	0
Seizures	No response to verbal commands	2
	Present	1

Table-1: Peradeniya Organophosphorus Poisoning Scale

Severity According To Pop Score	No. of patients	Percent
Mild	68	68.0
Moderate	27	27.0
Severe	5	5.0
Total	100	100.0

Table-2: Showing severity of poisoning according to pop scale

	Total pop score (total pop score)						P value
	Mild		Moderate		Severe		
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	
Serum CPK	182.7	73.1	472.5	165.4	1110.4	120.8	<0.0001
Serum AMYLASE	56	15	101	18	188	17	<0.0001

One way Analysis of Variance with Bonferroni adjustment was applied for multiple comparisons

Table-3: POP scale and correlation with mean serum cholinesterase, CPK at the time of admission

of data. Fisher’s exact test, One way Analysis of Variance with Bonferroni adjustment, Pearsons Chi square test and univariate logistic regression analysis was used to analyse qualitative data. By using the above mentioned tests, level of significance was calculated. A 'p' value less than 0.05 is statistically significant.

RESULTS

100 patients of organophosphorus poisoning who were admitted in medicine department in Gandhi Medical College BHOPAL and associated Hamidia Hospital Bhopal from January 2015 to December 2015 were studied in this prospective observational study.

Out of the total 100 cases, females were 52 and 48 were males. Majority of patients were from urban area and their age ranged from 14 year to 61 year out of which majority of patient were young and 45 out of 100 patients were in the age group of 21-30 years. 95% patient ingested op compounds with suicidal intent symptoms Salivation and vomiting were the most common symptoms and Bradycardia was the most common sign followed by constricted pupil and tachypnoea

According to the severity of poisoning as per the POP Scale, 68 patients had mild poisoning, 27 had moderate poisoning and 5 had severe poisoning (Table-2). S.CPK and S.amylase level were recorded in mild, moderate and severe group of poisoning and it was seen that with increase in the severity of poisoning, mean value of S.CPK and S. amylase increases (Table 3). Mean value of serum CPK levels in mild, moderate and severe grade of poisoning was 182.7±76, 472±165.4, 1110.4±120.8. Severity of poisoning and serum CPK showed a high degree of positive correlation (r = 0.95) and the correlation was also statistically significant (p = 0.001). Mean Amylase value in mild, moderate and severe poisoning was 56 ± 15, 101 ± 18, 188 ±17. The correlation between serum amylase and severity of poisoning was also positive with a value of (r = 0.93),and statistically significant (p <0.0001).

No patient i.e. 0% patient with normal serum CPK levels required ventilator support whereas 16.7% of the patients with elevated serum CPK levels required ventilator support. P value of .018 was significant for this association. No patients with normal serum Amylase levels required ventilator support whereas 44% of the patients with elevated serum Amylase levels required ventilator support. P value of <.0001 was highly significant for this association (Table-4).

Univariate Logistic regression analysis showed serum amylase (Coefficient=0.44) was a better predictor of ventilator requirement as compared to serum CPK (Coefficient=0.17).

In present study out of 100 patients there were 5 mortalities all patients died because of respiratory failure out of them 3 patients had severe grade of poisoning (score 11) and 2 had moderate grade of poisoning (score 6 and 7) according to pop scale there serum CPK levels were 1196, 1154,1228, 672,796

		Ventilator required				P value
		No		Yes		
		Count	Row N %	Count	Row N %	
Serum CPK	<174 mg/dl	28	100.0%	0	0.0%	0.018
	>174 mg/dl	60	83.3%	12	16.7%	
Serum Amylase	<80 mg/dl	73	100.0%	0	0.0%	<0.0001
	>80 mg/dl	15	55.6%	12	44.4%	

Fisher's exact test was applied as cell have <5 frequencies

Table-4: Shows association between serum CPK level, serum Amylase levels and need for ventilator support

and serum amylase level 193,208,196,154 and 174 respectively. The association between raised serum CPK level ($p < 0.0001$), raised serum amylase level ($p < 0.0001$) and mortality was significant with univariate regression analysis showing serum amylase then serum CPK level.

Logistic regression analysis showed that serum amylase and serum CPK levels were significantly associated with mortality and serum amylase (Coefficient=0.19). It is better predictor of mortality than serum CPK level (Coefficient=0.0006).

DISCUSSION

In this study out of 100 patients majority of patients 45% were in age group 21-30 years. This age group distribution is comparable to that found in studies done by Basavaraj R¹¹, Shah Harsh D et al¹², Reihman et al¹³, Kavya S.T et al.¹⁴ In this study female were 52% similar findings were reported in previous studies done by Nermeen A. M. Hassan et al¹⁵, Abhay Nath Chaturvedi et al.¹⁶ The severity of OP poisoning in this study as per POP scale ranged from mild to severe, most of the cases 68% belonged to mild grade of poisoning with a POP score (0-3), 27% of the patients belonged to moderate grade (4-7) and only 5% of patients had severe grade (8-11) of poisoning according to paredeniya organophosphorus poisoning scale. Serum CPK and serum Amylase levels were measured in each group of poisoning. The CPK levels in mild poisoning were 198 (± 76), whereas in moderate severity it was 486 (± 152) and in severe poison it was 1124.78 (± 357.1) association between serum CPK levels and severity of organophosphorus poisoning according to POP score was statistically significant (P value < 0.0001). Similar results were observed in the studies done by K.Bhattacharya et al¹⁷ and Nermeen et al¹⁵, D. Markandeyulu et al¹⁸ This may be due to muscle fiber necrosis and needs to be confirmed by muscle biopsy. Yves Vanneste and Dominique Lisson had shown that rhabdomyonecrosis occurs after organophosphate poisoning and was accompanied by a concurrent increase in serum total creatine phosphokinase activity and urinary creatine excretion rate.¹⁹

Mean serum amylase value in mild, moderate and severe poisoning was 56 \pm 15, 101 \pm 18, 188 \pm 17. The correlation between severity of poisoning and serum amylase was also statistically significant ($p < 0.0001$). Similar observations between POP scale and serum CPK and serum amylase were reported by the studies of K.Bhattacharya et al¹⁷, Nermeen A.M Hasan et al.¹⁵ Hyperamylasemia in OP poisoning is caused by pancreatitis by excessive cholinergic stimulation of pancreas and also by intestinal ischemia, enteritis, and hypersalivation caused by the direct action of the organophosphate²⁰

In this study no patient with normal serum CPK levels required ventilator support whereas 12 patients with elevated serum

CPK levels required ventilator support. P value was significant for this association ($p < 0.018$). No patients with normal serum amylase level required ventilator support whereas 44 patients with elevated serum Amylase levels required ventilator support. P value was significant for this association ($p < 0.0001$) (Table-3). Studies done by N Matsumiya et al⁹ Sumathi et al²¹ and Kozaci²² et al reported that the elevation of amylase levels was high in respiratory failure and could be used as a predictive value for intubation and requirement of mechanical ventilation.

Univariate Logistic regression analysis showed that serum amylase level is better than serum CPK level in predicting need for ventilator support.

In present study out of 100 patients there were 5 mortalities all patients died because of respiratory failure out of them 3 patients had severe grade of poisoning (score 11) and 2 had moderate grade of poisoning (score 6 and 7).

The association between severe grade of poisoning ($p < 0.0001$), raised serum CPK level ($p < 0.0001$), raised serum amylase level ($p < 0.0001$) and mortality was significant with univariate regression analysis showing severe grade of poisoning is better predictor of mortality followed by serum amylase then serum CPK level.

High Serum amylase, high serum CPK and moderate and severe grade of poisoning according to POP scale associated well with need for ventilator support with severe grade of poisoning having strongest association followed by serum amylase, moderate grade of poisoning and serum CPK in that order.

CONCLUSION

Serum CPK levels, serum amylase levels correlated well with the severity of poisoning as graded by POP scale. Increased Serum amylase, increased serum CPK had significant association with need for ventilator support with serum amylase level grade having stronger association followed by serum CPK.

Increased Serum amylase and serum CPK level had significant association with mortality with serum amylase having stronger association than serum CPK level.

In case of high POP score, high levels of serum amylase and serum CPK levels on admission, transferring the OP poisoning patient to a Intensive Care Unit and monitoring as he may require ventilator support. Thus it can be concluded that patient with moderate or severe grade of poisoning according to POP scale with raised serum CPK level and raised serum amylase level should be monitored in ICU setup as they may require ventilator support.

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