

Original Research Article

Correlation of serum amylase level with the severity of acute organophosphorus compounds poisoning

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ABSTRACT

Background: Organophosphorus (OP) poisoning is a common mode of suicidal poisoning in our country and is associated with significant mortality and morbidity. Serum amylase has shown a promising role in the assessment of the severity of OP poisoning. We conducted this study to see the association of serum amylase level with acute OP poisoning severity.

Methods: This cross-sectional study was conducted among 150 patients admitted with acute OP poisoning to the inpatient department of medicine of a tertiary hospital in Bangladesh from July 2016 to June 2018. Peradeniya organophosphorus poisoning scale was used to detect clinical severity. Serum amylase was measured on the day of admission.

Results: The patients' mean age was 23.68±6.80 years, and 65.3% were male. As assessed by the POP scale, 56.7%, 34.7%, and 8.7% of patients had mild, moderate, and severe grades of OP poisoning, respectively. The median serum amylase level was 103.50 (IQR 73.75-156.0) IU/l; 44.7% of the subjects had normal, and 53.3% had an elevated serum amylase. A progressive increase in serum amylase level was observed with the increasing severity of OP poisoning; 77.0 IU/l (IQR 58.0-97.0) in mild grade, 154.0 IU/l (IQR 125.25-162.5) in moderate grade, and 298.0 IU/l (IQR 289.5-305.0) in severe grade and the differences in the median amylase across the three groups were statistically significant ($p<0.001$). A significant positive correlation between serum amylase level and POP scale score ($r=0.970$; $p<0.001$) was also observed.

Conclusions: Serum amylase level may be used as a readily available marker of the severity of acute OP poisoning in resource-poor settings.

Keywords: Organophosphorus poisoning, Serum amylase, Peradeniya organophosphorus poisoning scale

INTRODUCTION

Organophosphorus (OP) compounds are a wide variety of chemicals derived from phosphoric, phosphonic, and

phosphinic acids, primarily used as pesticides. It is one of the commonest poisonings and has reached epidemic proportions in most parts of the world, especially in developing countries like Bangladesh.¹ The worldwide

estimate of pesticide poisoning is around 3 million each year, with around 2 million hospitalized from a suicide attempt as it is readily available in every home and cheap, with a 3-25% mortality rate.²⁻⁴ It acts through inhibiting the acetylcholinesterase enzyme (AChE) at muscarinic and nicotinic receptors, resulting in the accumulation of acetylcholine and over activation of acetylcholine receptors, thereby producing an array of symptoms and complications, sometimes causing mortality.⁵ Peradeniya organophosphorus poisoning scale is a simple and effective system comprising common clinical features to determine OP poisoning severity.⁶ The plasma cholinesterase level has been used as a gold-standard to assess the severity of poisoning and determine the clinical course. However, because of its wide inter-individual variability, lack of availability and high cost leads to the necessity of search for new cheap and readily available biomarkers.⁷

Several studies reported elevated serum amylase levels in patients with OP compound poisoning and found hyperamylasemia to be closely related to clinical severity and the presence of shock and respiratory failure in such patients.⁷⁻¹¹ However, this association still has not been widely recognized, and there is no local data available regarding the frequency of high amylase levels and the severity of OP poisoning. We conducted this study to assess the correlation between acute OP poisoning severities as assessed by Peradeniya organophosphorus poisoning scale with serum amylase level in our setting.

METHODS

In this cross-sectional study conducted in the inpatient department of medicine, MAG Osmani medical college hospital, Sylhet, Bangladesh, from July 2016 to June 2018, 150 patients of acute OP poisoning were evaluated. Subjects presented after 48 hours of OP ingestion, having a history of liver disease, pancreatitis, parotid gland disease, renal disease, alcohol addiction, and simultaneous multiple other substance ingestion, were excluded. The patient was identified by history obtained from the patients or their attendants, the characteristic smell of OP, toxidrome of OP poisoning, and the container of poison (if they brought). Clinical severity of OP poisoning was assessed by the Peradeniya organophosphorus poisoning scale (POP Scale) on the day of examination; a score of 0-3 was categorized as mild poisoning, score 4-7 as moderate poisoning, and score 8-11 was categorized as severe poisoning.⁶

Procedure

A venous blood sample (2 ml) was drawn from all participants by disposable syringe aseptically. Blood samples were allowed to coagulate at room temperature for 10-15 minutes, and then serum was separated by centrifugation for 15 minutes at 2500 rpm. Serum amylase levels were measured by Vitros-350 autoanalyzer via enzymatic and colorimetric assay.

Serum amylase levels between 30 and 110 U/l were considered normal.

Informed written consent was taken from each of the patients before taking any interviews after describing the study's purpose and methods, the confidentiality of the interviews, risks, and benefits of participating in the study. All information was collected confidentially with complete respect to the patient with and without any force or pressure.

Statistical analysis

Statistical analysis was done using statistical packages for social sciences (SPSS) for Windows, version 23.0 software. The categorical variables were presented as percentages; measurable variables with normal distribution were presented as mean±standard deviation (SD), and those not following normal distribution were presented as the median and interquartile range (IQR). Kruskal-Wallis H test and Chi-square test were performed to compare the variables across the groups as applicable. Correlations of serum amylase and Peradeniya organophosphorus poisoning scale score was done through Spearman's correlation tests, $p \leq 0.05$ was considered to be statistically significant.

RESULTS

The participants' age ranged from 14 to 45 years with a mean age of 23.68 ± 6.80 years; the majority (45.3%) of the participants were in the age group 21-30 years, followed by 14-20 years (37.3%). Almost two-thirds (65.3%) were male; male to female ratio was 1.9:1. By occupation, farmers were the most common (24.0%) among the study subjects, followed by housewives (22.7%), students (15.3%), businessmen (14.0%), day labors (12.0%), service holders (4.0%); some were currently unemployed (12%). Most of the participants were from the lower economic class (47.4%), whereas 35.3% were from the middle class and 17.3% from the upper class. Among the study subjects, 77.3% were from rural, and 22.7% were from urban areas (Table 1).

According to the POP Scale, 56.7%, 34.7%, and 8.7% of the patients had mild, moderate, and severe grades of OP poisoning. The serum amylase level ranged from 40-310 IU/l with a median serum amylase level of 103.50 IU/l (IQR 73.75-156.0). The frequency of the subjects having elevated and normal serum amylase level were 44.7% and 55.3%, respectively (Table 1).

Serum amylase level (IU/l) was 77.00 (IQR 58.00-97.00) in mild grade, 154.00 (IQR 125.25-162.50) in moderate grade, and 298.0 (IQR 289.50-305.00) in the severe grade of OP poisoning; the difference in serum amylase level between mild, moderate, and severe grade was statistically significant ($p < 0.001$) (Table 2). Hyperamylasemia was more frequent in the subjects with severe disease compared to the mild and moderate

disease ($p<0.001$) (Table 3). A significant positive correlation was observed between serum amylase level and Peradeniya organophosphorus poisoning scale score ($r_s=0.970$; $p<0.001$) (Figure 1).

Table 1: Baseline characteristics of the study participants.

Variables	Subgroups	Frequency (%)
Age (years)	14-20	56 (37.3)
	21-30	68 (45.3)
	31-40	20 (13.4)
	41-45	6 (4.0)
	Mean \pm SD	23.68 \pm 6.80
Gender	Male	98 (65.3)
	Female	52 (34.7)
Residence	Rural	116 (77.3)
	Urban	34 (22.7)
Occupation	Student	23 (15.3)
	Housewife	34 (22.7)
	Farmer	36 (24)
	Service	6 (4)
	Business	21 (14)
	Day labor	18 (12)
	Unemployed	12 (8)
Socio-economic class	Lower	71 (47.4)
	Middle	53 (35.3)
	Higher	26 (17.3)
Severity grading (As per POP score)	Mild grade	85 (56.7)
	Moderate grade	52 (34.7)
	Severe grade	13 (8.7)
Serum amylase (IU/l)	Normal	67 (44.7)
	Raised	83 (53.3)
	Median (IQR)	103.50 (73.75-156.0)

Table 2: Serum amylase level in different grade severity of poisoning measured by Peradeniya organophosphorus poisoning scale (n=150).

Grade of severity	Serum amylase (IU/l)		P value
	Median	IQR	
Mild (n=85)	77.0	58.0-97.0	<0.001
Moderate (n=52)	154.0	125.25-162.5	
Severe (n=13)	298.0	289.5-305.0	

P value by Kruskal-Wallis H test

DISCUSSION

Acute OP poisoning is the most common suicidal modality of poisoning in an agriculture dependent country like Bangladesh due to its easy availability. It causes acetylcholine excess in nerve endings and hyperstimulation of the pancreas resulting in raised serum

amylase. The serum amylase level can be a predictor of the clinical severity of acute OP poisoning.

Table 3: Comparison of serum amylase level and severity of OPC poisoning (n=150).

Grade of severity	Serum amylase level		χ^2	P value
	Elevated Frequency (%)	Normal Frequency (%)		
Mild (n=85)	2 (2.4)	83 (97.6)	142.1	<0.001
Moderate (n=52)	52 (100.0)	0 (0.0)	98.6	
Severe (n=13)	13 (100.0)	0 (0.0)	17.6	

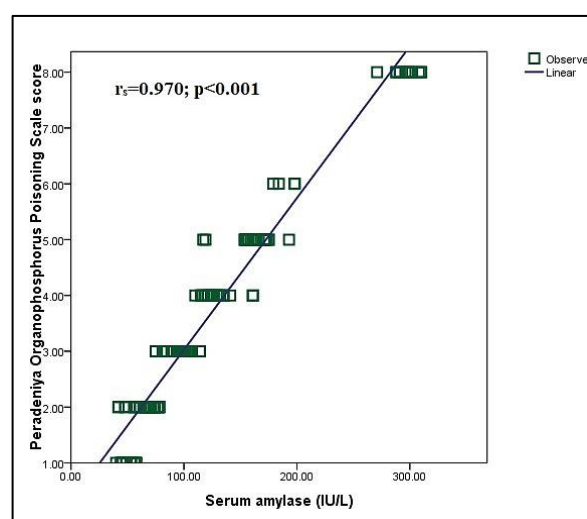


Figure 1: Scattered diagram showing the correlation between serum amylase and Peradeniya organophosphorus poisoning scale score (n=150).

In current study, the mean age of the patients was 23.68 \pm 6.8 years. This result correlated with Kozac et al study, where they reported the mean age of the patients with OPC poisoning was 23.6 \pm 12.4 years.¹² In this study, most participants (45.3%) belonged to the age group 21-30 years, followed by 37.3% of patients in the age group of 14-20 years. This result correlated with Salame and Wani's study, where they found that the majority of the patients (46%) belonged to the age group 21-30 years.¹³ Other researchers also reported similar findings.¹⁴⁻¹⁶ This age group is the most critical period when one is likely to face various problems that may lead to psychological stress, so a person may take drastic steps to end his life by consuming available poisons. The common risk factors associated with this group include school stress, college failure, love affairs, and conflict with parents.¹⁵ In this study, the male to female ratio was 1.9:1. Males outnumbered females were reported in several other studies also.¹⁷⁻¹⁹ However, female predominance was

reported in other studies conducted by Kozac et al and Dubey et al.^{12,20}

Badiger and Vishok reported that farmers were the most common victims of OPC poisoning, affecting 31.2% of the total number of victims, followed by students and homemakers.¹⁷ Our observation was quite similar. Farmers are more prone to OP poisoning due to the easy availability and accessibility of pesticides among them. As most of the farmer community resides in the rural area, the current study showed, most OP poisoning patients came from rural localities.

In current study, 56.7% of the patients belonged to mild grade, 34.7% of the patients belonged to moderate grade, and 8.7% belonged to the severe grade of OP poisoning. The findings were in accordance with the findings noted in other studies, but Patil and Vasepalli reported more mild cases (70%).²¹⁻²³

The present study showed that 44.7% of the patients had elevated serum amylase levels, and 55.3% had normal serum amylase levels. The median serum amylase level of 103.50 IU/l (IQR 73.75-156.0). Our results were comparable with the study done by Singh et al.²⁴ This hyperamylasemia in OP poisoning cases maybe because acute OP poisoning causes acute pancreatitis by OP-induced excessive cholinergic stimulation of the pancreas and ductular hypertension.^{25,26}

A rising trend of serum amylase levels was observed from the mild to the severe grade of OP poisoning. Dubey et al and Panda et al also had similar observations.^{20,21} Whereas Ganesan and Moorthy did not find any significant difference in serum amylase level in different grades of severity of OPC poisoning.¹⁹ They used different grading systems of the severity of OP poisoning in their study, explaining this discordance.

Limitations

Limitations of current study were; the sample size in this study was small, and this study had no control arm. The chemical nature of OP compounds could not be determined due to the unavailability of the facility.

CONCLUSION

Hyperamylasemia is significantly less frequent in mild and more frequent in moderate and severe grades of acute OP poisoning. A significant strong positive correlation was revealed between the serum amylase levels positively correlated with the Peradeniya organophosphorus poisoning scale score. At admission, serum amylase level may be used as a marker of severity in the clinical management of acute OP poisoning. A further large-scale study involving multicenter is needed to find out more evidence from this perspective.

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Conflict of interest: None declared

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

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