ORIGINAL RESEARCH

Correlation of serum amylase with outcome in acute organophosphorous poisoning at a tertiary hospital

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ABSTRACT

Background:Organophosphate (OP) poisoning is an important cause of poisoning all over the world. Prompt recognition and aggressive management of acute intoxication are essential to minimize the morbidity and mortality from these potentially lethal compounds. Present study was aimed to study correlation of serum amylase with outcome in acute organophosphorous poisoning at a tertiary hospital.

Material and Methods: Present study was hospital based, prospective, observational study, conducted in patients of OP poisoning, >18 years age, confirmed by history, circumstantial evidence of poisoning, specific clinical examination, and basic laboratory reports.

Results: During study period, 108 patients satisfying study criteria were included. Majority of patients were from 31-45 years age group (39.81 %) followed by 19-30 years age group (34.26 %). Mean Age was 36.26 ± 14.62 years. Majority were males (59.26 %) as compared to females (40.74 %). Mean Serum acetylcholinesterase level 2434 ± 1677 IU/L. Elevated levels of serum amylase were noted as increase in severity grading (As per POP score) & difference was statistically significant(Elevated levels of Serum amylase were observed among patients with increased severity grading (As per POP score) & difference was statistically significant). Serum amylase was significantly raised in patients requiring ICU admission as compared to patients not required ICU admission & difference was statistically significant (p<0.001). Serum amylase was significantly raised in non-survived patients as compared to survived patients & difference was statistically significant (p<0.001)

Conclusion: Serum amylase estimation can be used as a prognostic indicator in assessing severity of OP poisoning.

Keywords: serum amylase, organophosphorus poisoning, outcome, survival

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INTRODUCTION

Organophosphorus (OP) compounds are used as pesticides, herbicides, and chemical warfare agents in the form of nerve gases. Its widespread use and easy availability has increased the likelihood of poisoning with these compounds in developing countries like India.[1] Organophosphate (OP) poisoning is an important cause of poisoning all over the

world. OPs inhibit the enzyme acetylcholinesterase resulting in excessive acetylcholine accumulation, which affects muscarinic and nicotinic receptors at synapses within the peripheral and central nervous systems [2]

OP poisoning is associated with derangement of various biochemicals, among which hyperamylasemia is well documented.[3] The pathophysiology of elevation of amylase in OP compounds is due to the subclinical pancreatic damage caused by the OP compounds secondary to the parasympathetic overstimulation and hypersecretion of enzymes by the compounds.[4]

Prompt recognition and aggressive management of acute intoxication are essential to minimize the morbidity and mortality from these potentially lethal compounds. In India, we need cheap and easily measurable biomarkers. Few studies were conducted regarding serum amylase for a diagnostic tool. Present study was aimed to study correlation of serum amylase with outcome in acute organophosphorous poisoning at a tertiary hospital.

MATERIAL AND METHODS

Present study was hospital based, prospective, observational study, conducted in department of general medicine, at XXX medical college & hospital, XXX, India. Study duration was of 2 years (January 2020 to December 2021). Study approval was obtained from institutional ethical committee.

Inclusion criteria

- Patients of OP poisoning, >18 years age, confirmed by history, circumstantial evidence of poisoning, specific clinical examination, and basic laboratory reports, Willing to participate in present study

Exclusion criteria

- Patients with history of intake of OP compound mixed with any other poison or alcohol,
- Patients with indication of exposure to an entirely different poison other than OP poison,
- Chronic alcoholism,
- Disorders of salivary gland.
- Patients with a history suggestive of gall stone disease
- Patients with known history of lipid disorders.

Study was explained to patients/relatives in local language & written informed consent was taken for participation & study. About 3 ml of venous blood were collected on two occasions from each subject first within 24 hours of consumption of poison and the samples were centrifuged at 3000 rpm for 15 minutes. The supernatant serum was separated and froze. Serum Amylase was estimated with the help of kit manufactured by Diasys Diagnostic Systems GmbH Alte S Strasse g 65558 Holyheim Germany by using CNP-G3 method Autoanalyser AUTOPAK. Biochemical evaluation which includes Serum Amylase Blood glucose, urea, creatinine, and Liver function tests.

After the biochemical analysis, patient were followed-up for clinical outcome like complete recovery, acute respiratory distress syndrome, circulatory failure, CNS complications, renal failure, death due to any of the above-mentioned complications and any other complications.

Data was collected and compiled using Microsoft Excel, analysed using SPSS version 23.0. Frequency, percentage, means and standard deviations (SD) was calculated for the continuous variables, while ratios and proportions were calculated for the categorical variables. Difference of proportions between qualitative variables were tested using chi-square test or Fisher exact test as applicable. P value less than 0.05 was considered as statistically significant.

RESULTS

During study period, 108 patients satisfying study criteria were included. Majority of patients were from 31-45 years age group (39.81 %) followed by 19-30 years age group (34.26 %). Mean Age was 36.26 ± 14.62 years. Majority were males (59.26 %) as compared to females (40.74 %).

Table 1: Basic characteristics

Characteristic	No. of patients/ Mean ± SD	Percentage (%)
Age group (in years)		
19-30	37	34.26%
31-45	43	39.81%
46-60	21	19.44%
>60	7	6.48%
Mean Age (years)	36.26 ± 14.62	
Gender		
Males	64	59.26%
Females	44	40.74%

In present study, mean Serum acetylcholinesterase level was 2434 ± 1677 IU/L. Elevated levels of serum amylase were noted as the severity increases increase in severity grading (As per POP score) &the difference was statistically significant (<0.001).

Table 2: Comparison of serum amylase level and severity of OPC poisoning

Severity grading (As per POP score)	Serum amylase level		Total (%)	P value
	Elevated Frequency (%)	Normal Frequency (%)		
Mild grade	6 (5.56 %)	51 (47.22 %)	57 (52.78 %)	<0.001
Moderate grade	24 (22.22 %)	9 (8.33 %)	33 (30.56 %)	
Severe grade	18 (16.67 %)	0	18 (16.67 %)	
Total	**48 (44.44 %)**	**60 (55.56 %)**		

Serum amylase was significantly raised in patients requiring ICU admission as compared to patients not required ICU admission & difference was statistically significant (p<0.001)

Table 3: Correlation of serum amylase and ICU admission.

Amylase	ICU admission		P value
	With ICU admission (%)	Without ICU admission (%)	
No. of cases (n=108)	29 (26.85 %)	79 (73.15 %)	
Mean serum amylase level(U/L)	216.76 ± 54.42	903.22 ± 584.45	<0.001

In present study, serum amylase was significantly raised in non-survived patients as compared to survived patients & difference was statistically significant (p<0.001)

Table 4: Correlation of serum amylase and survival.

Amylase	Survived (%)	Non survived(%)	P value
No. of cases (n=108)	95 (87.96 %)	13 (12.04 %)	
Mean serum amylase level (U/L)	122.83 ± 64.62	1152.29 ± 821.62	<0.001

DISCUSSION

Organophosphorus poisoning often presents as a medical emergency requiring monitoring and management in intensive care unit. Management of poisoning depends on clinical severity and is assessed by clinical signs and symptoms as well as laboratory evaluation.

The mortality rate of self-poisoning in developing countries is 10–20%, mainly caused by respiratory insufficiency secondary to central depression of respiration, muscle weakness, and/or direct lung effects by bronchospasm and bronchorrhea.[5,6] Several syndromes are associated with OP poisonings, like acute cholinergic crises, intermediate syndrome (IMS) and OP-induced delayed neuropathy. Because of high mortality risk, both the acute cholinergic crises and the intermediate syndrome are best managed in an intensive care unit, unless the poisoning has been very mild.[7]

Dungdung A et al.,[8] studied 100 patients, and observed that serum amylase and serum lipase were negatively correlated with plasma cholinesterase levels and it was statistically significant. It was seen that serum amylase had the highest diagnostic accuracy for assessing severity of poisoning, 10 deaths were there in which 6 had <10% of plasma cholinesterase activity, 8 out of these 10 patients had elevated amylase level. OP poisoning is associated with elevated amylase level. Serum amylase could therefore be considered as a better predictor of severity than lipase.

In study by Aniket P et al.,[9] among 100 cases mean serum amylase level in discharged patients was 335.40 ± 192.45, and in the patients who expired it was found to be 843.37 ± 22.60. Serum amylase level showed significant correlation with clinical outcomes in organophosphorus poisoning. (t-value 7.07, p-value 0.0001, statistically significant).

Paul G et al.[10], noted that 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 ($r=0.970$; $p<0.001$) were also observed. The similar pattern were reflected in our study too.

In study by Rohit N S,[11] in OP poisoning patients, the amylase levels were significantly elevated at the time of admission (178.21 U/L) and have shown a gradual remission with proper treatment. The mean amylase level in severely poisoned patients was 294.8 U/L. The bad prognostic factorsvery well correlated with serum amylase levels such as Pinpoint pupil with serum amylase level of 297 U/L, Fasciculations-309 U/L, Severe secretions-321 U/L, CNS depession-334 U/L, Respiratory failure-359 U/L and Convulsions-398 U/L. The overall mean value of serum amylase was significantly higher in non-survivors Vs survivors (482.46 U/L Vs 148.34 U/L, $p<0.0001$).

In the study by P Elango et al.,[12] the Amylase levels were significantly elevated at the time of admission (185.2 U/L) and have shown a gradual remission with proper treatment. The mean Amylase level in severely poisoned patients was 297.7 U/L which was significantly ($P < 0.01$) higher than the healthy control group. On comparing the Amylase

levels in first 24 hours against control, the variations were considered to be significant ($P < 0.01$).

Raveendra KR[13] studied 110 acute OP-poisoning cases, patients who were intubated had elevated mean serum amylase levels (>90 U/l) in comparison to patients who were not intubated. Sixty-three patients had normal amylase levels on day 1 (≤90 U/l) (normal value of serum amylase as per the laboratory was 28–90 U/l) and 47 patients had raised amylase levels on day 1 (>90 U/l). Among 47 patients with raised amylase level, 18 patients died and there were no deaths in the normal amylase level group with $P = 0.00^*$ which is statistically significant. Raised serum amylase correlated well in predicting ventilator requirement and mortality in patients with OP poisoning.

Studies have also shown that serum amylase above the normal range on the day of admission was related to the development of respiratory failure and the elevation of amylase level and predictive of subsequent respiratory failure.[14,15] Moreover, the elevated level of enzyme (hyperamylasaemia) is closely related to clinical severity and the presence of shock.[16,17]

Limitations of present study were small sample size, compound wise assessment of severity was not done and pancreatitis was not assessed in some of the severe patients. Larger population with probability sampling technique and multicenter studies will provide a more definite conclusion.

CONCLUSION

Serum amylase estimation can be used as a prognostic indicator in assessing severity of OP poisoning. This will help in identifying those with greater morbidity and aid in decision making regarding admission to ICU, referral or intensive observation in resource constrained settings like rural or remote areas and developing countries with limited resources and to improve outcome.

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