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# Clinical significance of Serum Amylase in Acute Organo phosphorus Poisoning

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***Abstract :***
***Introduction:*** *OP compounds constitute heterogeneous category of chemicals used as pesticides. In this study we intend to know the clinical significance of serum amylase levels in OP poisoning cases at the time of admission in assessing the severity.*
***Materials and Methods:*** *A prospective observational study was conducted in a total of 36 clinically proven cases of OP poisoning. Serum amylase, lipase and Cholinesterase were measured at the time of admission. Patients were followed up for final outcome.*
***Results:*** *Serum cholinesterase is decreased in all the groups. Serum amylase is significantly elevated in group III when compared to group I and II. Serum lipase is not statistically significance. Correlation of serum cholinesterase levels with serum amylase and lipase showed significant negative correlation with serum amylase.*
***Conclusion:*** *Hyperamylasemia is common in OP poisoning. Serum amylase estimation can be used as a prognostic indicator along with the serum cholinesterase activity in assessing severity of OP poisoning. However estimation of lipase in cases with hyperamylasemia helps to differentiate cases with acute pancreatitis. Further studies with estimation of isoenzymes of amylase and correlation with clinical severity in larger population is necessary.*
***Key Words:*** *Amylase, Cholinesterase, lipase, Organophosphate poisoning*

## I. Introduction

OP compounds constitute heterogeneous category of chemicals specifically designed to control pests, weeds or plants diseases. The potential effects of OP compounds are likely, to be higher in developing countries like India due to easy availability and low risk awareness causing high morbidity and mortality. Recent 2007 statistics shows around 76000 poisoning cases are being admitted annually in India, currently this figure must be much higher. (1)

The principal pharmacological action, of OP compounds is inhibition of Acetylcholine esterase (AchE) enzyme at nerve endings and neuromuscular junction, causing overstimulation of acetylcholine receptors.(2) OP compounds binds to the serine residue at the active site of the enzyme subsequently phosphorylating the enzyme. This phosphorylated enzyme is inactive but stable and degrades over days to weeks (3). Signs and symptoms of poisoning are mainly due to muscarinic, nicotinic and central nervous system receptor over stimulation. These manifestations generally occur only after more than 50% of serum cholinesterase activity is inhibited. In mild poisoning cholinesterase level reduces to 20-50%, in moderate poisoning 10-20% and in severe poisoning levels reduces to less than 10% .(4)

In literature there are many scoring systems based on clinical signs and symptoms to evaluate the intoxication such as APACHE (Acute Physiology and Chronic Health Evaluation) and SAPS (Simplified Acute Physiology Score) to evaluate the clinical severity and to predict the outcome. These clinical scoring systems encompass various clinical data which facilitates clinician to plan treatment strategy. It is known that in cases of suicidal poisoning, ingestion of poison is more which can damage the tissues and organs. Hence along with the clinical assessment, laboratory evaluation also becomes very important to confirm the poisoning and to the organ damage. Inhibition of cholinesterase activity is most specific test for the diagnosis of OP poisoning (5). The decrease in the cholinesterase activity in patients with identical signs and symptoms vary widely because of physiological variations that occur within and between individuals, influence of disease status, genetic variations and medications. (6)

Among other biochemical abnormalities, hyperamylasemia is frequent in severe organophosphate poisoning. Many studies have demonstrated a significant correlation of increased serum amylase levels at the time of admission, with the development of respiratory failure. 'Probable mechanism is due to excessive cholinergic stimulation of salivary glands causing increased salivation leading to bronchial obstruction in severe OP poisoning. (7,8). A study by Lee WC and coworkers, also observed a significant correlation of serum amylase with severity and shock (9).

There is much research is being conducted about the use of various biochemical markers in assessing the severity of poisoning but there are few studies where use of serum amylase as a predictor of outcome and severity in OP poisoning has been studied. Till now plasma cholinesterase is the most commonly used biochemical parameter in assessing severity of poisoning hence in this study we intend to know the clinical significance of serum amylase levels in OP poisoning cases at the time of admission in assessing the severity.

## II. Materials and Methods

A prospective observational study was conducted from June- August 2013 in subjects diagnosed of acute OP poisoning attending emergency unit of R.L Jalappa Hospital and research center, Tamaka, Kolar. Subjects of either gender of all age groups were included for the study.

A total of 36 OP poisoning cases during the study period were included. Clinically proven cases of OP poisoning are included. The presumptive diagnosis was made based on history, circumstantial evidence of consumption, characteristic clinical findings and basic laboratory investigations. We excluded the patients brought to the hospital with remote history of poisoning, history of consumption of OP poison mixed with any other poison, patients with chronic alcoholism, history of diseases of salivary glands, history of Chronic renal failure or any associated renal disorders and patients with Diabetes and Hypertension.

At the time of admission, after obtaining informed consent about 2 ml of blood was collected in plain tube under aseptic precautions. After the blood is clotted, serum was separated by centrifugation and used for the analysis of following parameters.

Estimation of serum amylase by chromogenic method using dyed amylopectin in vitros 250 drychemistry analyser (10).

Estimation of serum Lipase by kinetic method using 1-oleoy1-2-3- diacetyl glycerol as substrate (10).

Estimation of serum cholinesterase by kinetic method based on hydrolysis of butyrylthiocholine by cholinesterase by vitros 250 drychemistry analyser (10).

## III. Results

Table 1 depicts the distribution of cases among the groups. Maximum no. of cases belonged to group III who had serum cholinesterase levels < 10%. Sex distribution among different groups showed male preponderance.

Table 2 shows mean values of biochemical parameters and their comparison between the groups. Mean values of serum cholinesterase is decreased in all the groups. Serum amylase at the time of admission is significantly elevated in group III when compared to group I and II. Even though of mean values serum lipase is elevated in group III, it is not statistically significance.

Percentage of mortality in relation to biochemical abnormality among different groups is depicted in table 3. Maximum number (2/19, 10.5%) has been observed in group III and maximum number of patients in group III had elevated amylase and lipase levels at the time of admission.

In table 4 correlation of serum cholinesterase levels with serum amylase and lipase showed significant negative correlation with serum amylase.

**Table 1.** Distribution of Cases

| **Serum cholinesterase activity (% of Normal) & groups** | **Number of patients** | **Percentage of cases** | **Male** | **Female** |
|---|---|---|---|---|
| Normal | 00 | 00 (00%) | 00 | 00 |
| 20-50% (Group I) | 07 | 7/36 (19.4%) | 3/7 (42.8%) | 4/7 (57.1%) |
| 10-20% (Group II) | 10 | 10/36 (27.7%) | 8/10 (80%) | 2/10 (20%) |
| <10% (Group III) | 19 | 19/36 (52.7%) | 13/19 (68.4%) | 6/19 (31.5%) |

**TABLE 2.** Comparison of Biochemical Parameters between Groups By Mann Whitney 'U' Test

| **Parameter Groups** | **Serum cholinesterase (IU/L)** | **Amylase (IU/L)** | **Lipase (IU/L)** |
|---|---|---|---|
| **Group I Mean ± SD N=07** | 1629±527.8 | 63.57±32.9 | 79.14±59.22 |
| **Group II Mean ± SD N=10** | 951.3±165.33 | 141.9±103.12 | 76.1±60.8 |
| **Group III Mean ± SD N=19** | 282.89±101.87 | 152.15±72.4 | 168.89±215.59 |
| **Group I Vs II** | <0.001** | 0.051* | 0.659 |
| **Group II Vs III** | <0.001** | 0.521 | 0.506 |
| **Group I Vs III** | <0.001** | <0.05 * | 0.772 |

*Significant ** Highly Significant

**Table 3.** Percentage of Mortality in relation to various Biochemical parameters

| Serum cholinesterase activity (% of Normal) & groups | Number of patients | Mortality Number (Percentage) | Serum Amylase U/L | Serum Lipase |
|---|---|---|---|---|
| **Normal** | 00 | 00 (00%) | 00 | 00 |
| **20-50% (Group I)** | 07 | 00 (00%) | 1/7 (14.2%) | 1/7 (14.2%) |
| **10-20% (Group II)** | 10 | 00 (00%) | 3/10 (30%) | 2/10 (20%) |
| **<10% (GroupIII)** | 19 | 02 (10.5) | 8/19 (50%) | 4/19 21% |

**Table 4.** Correlation of Pseudocholinesterase with Amylase and Lipase

| Parameter | 'r' value | 'p' value |
|---|---|---|
| **Amylase** | -0.419 | <0.05* |
| **Lipase** | -0.271 | 0.109 |

*Significant

## IV. Discussion

Acute OP Poisoning often presents with medical emergency which accounts for high mortality. In this regard constant monitoring and laboratory evaluation becomes critical in the management of acute OP poisoning. Hence a prognostic marker assists treating physician to categorize the severity and strategize the treatment plan.

In this study more number of cases was reported in group III. This could be due to consumption of excessive dose poison during suicidal attempt which was the most common cause for OP poisoning in this study. Incidence of OP poisoning showed male preponderance. A study by Thuga G et al., evaluated incidence, clinical characteristics and management of OP poisoning and they reported male to female ratio 2.1:1. (11) In another study by Amanvermez and coworkers reported female preponderance. Gender preponderance in OP poisoning depends mainly on the geographical area, their occupation and socioeconomic status.(5)

OP compounds are irreversible inhibitors of cholinesterase enzyme both true and plasma cholinesterase. Severity of symptoms parallels the degree of severity. In the present study as depicted in table 2, serum cholinesterase levels were decreased in all the groups & significantly decreased in group II and III patients. Most of the patients in group II had vomiting, hypersalivation, abdominal pain, disorientation and bronchorrhea. Group III patients were unconscious, had hypersalivation and respiratory depression. In our study, two patients died of respiratory failure that belonged to group III had lowest serum cholinesterase (200 and 253 IU/L). Two patients had intermittent syndrome, which belonged to group I and III. There was no mortality observed in group II. Above findings in the present study suggests that serum cholinesterase levels reflects the clinical severity of OP poisoning. Similar results were observed in a study by Radhika et al., correlated cholinesterase activity with severity of poisoning. Serial estimation of both RBC and plasma cholinesterase levels parallels with the severity of poisoning. However this correlation was observed only during early stages of poisoning. Subsequent estimation of enzyme levels did not show any correlation with severity of poisoning. (12)

Another retrospective study by Manu MS et al., studied the utility of serial measurements of AchE levels in acute OP poisoning. Among patients who had very low cholinesterase activity had very poor prognosis and high mortality rates. (13) However a study by Semir Nouria et al., did not observe any correlation of AchE levels with severity of OP poisoning. (14)

In present study majority of the cases who had increased serum amylase was belonged group II and III, whereas serum lipase levels were not significantly increased in any of the groups. This observation is similar to other studies done by Amenvermez R (5), Singh S (15) and Lee WC (9). Study done by Amenvermez R et al., on various laboratory abnormalities in suicidal patients with OP poisoning observed increased serum amylase in grade II and grade III patients. They concluded that acute pancreatitis is not rare in OP poisoning and OP poison causes excessive cholinergic stimulation of pancreas causing hyperamylasemia. (5)

Another retrospective study by Lee WC et al., observed hyperamylasemia in 36% of cases. Serum Lipase was elevated in 9/28 cases. They concluded that hyperamylasemia is closely related to clinical severity and estimation of lipase is indicated in cases with hyperamylasemia to exclude acute pancreatitis. (9) In our study, serum amylase is correlated with severity of poisoning, since highest mortality was seen in group III patients who had increased amylase levels and also amylase levels correlated inversely with serum cholinesterase levels and which was statistically significant. Similar results observed in a retrospective study by Matsumiya N, where serum amylase levels increased in non-survivor patients who succumbed to death due to respiratory failure. Hyperamylasemia is due to excessive cholinergic stimulation of salivary glands contributing for the salivary type of amylase to increase. (7)

## V. Conclusion

Hyperamylasemia is common in OP poisoning. amylase estimation can be used as a prognostic indicator along with the serum cholinesterase activity in assessing severity of OP poisoning. However estimation of lipase in cases with hyperamylasemia helps to differentiate cases with acute pancreatitis. Further studies with estimation of isoenzymes of amylase and correlation with clinical severity in larger population is necessary to know the type of hyperamylasemia and its clinical significance in acute OP poisoning.

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