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Original Research Article

Study of serum amylase levels in organophosphate poisoning

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Abstract

Background: Organophosphorus is poisoning producing clinical alterations in the serum amylase and lipase activity. Earlier plasma cholinesterase level was used to assess the severity of poisoning. Presently serum amylase is being recommended as a better indicator of severity.

Aims and Objectives: The present study was undertaken to estimate serum amylase levels in acute organophosphate poisoning and to correlate serum amylase levels with outcome of patient.

Methods: This cross sectional study was conducted in Shri Vasantrao Naik Government Medical College and Hospital, Yavatmal. A total of 120 patients with organophosphorus poisoning admitted to the hospital during the study period of 1st January 2017 to 30th November 2017 were included in the study. Biochemical evaluation which includes serum amylase, blood glucose, urea, creatinine, and liver function tests were analyzed.

Results: 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 factors, very well correlated with serum amylase levels were Pinpoint pupil- 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, $p<0.0001$).

Conclusion: Serum amylase levels may be considered as a marker of Organophosphorous intoxication, since it enables the early recognition of severity and to identify those at risk of developing the complications of Organophosphorous poisoning.

Keywords: Organophosphorus poisoning, Serum amylase, Plasma cholinesterase, Serum creatinine, Blood glucose.

1. Introduction

During past four decades more than 50,000 organophosphorous compounds have been synthesized and tested for insecticidal activity, but the number actually used for this purpose today probably does not exceed three dozen [1]. 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 [2]. The importance of pesticides in India can be understood from fact that agriculture is major component of Indian economy. Incidence of poisoning by pesticides and consequent admission to the hospital has been increasing in recent decades [3].

The OP compounds act by inhibiting acetylcholine esterase enzyme at nerve endings and neuromuscular junction, causing overstimulation of acetylcholine receptors. Signs and symptoms of poisoning are mainly due to muscarinic, nicotinic and central nervous system (CNS) receptor over-stimulation [4]. OP compound poisoning is

associated with various biochemical abnormalities, among which hyperamylasemia is well documented and may be due to excessive cholinergic stimulation of pancreas. Acute pancreatitis is frequent in OP poisoning and increased serum amylase is less specific and sensitive. Several studies [5-9] reported elevated serum amylase levels in patients with organophosphorous compound poisoning (OP) and found hyperamylasaemia to be closely related to clinical severity and the presence of shock. However the toxic effects of OPs are associated with significant morbidity and mortality and are a major global clinical problem. Mortality ranges from 4-30% in Indian studies. Occupational, suicidal (or) homicidal exposure to OPs produces a characteristic but treatable syndrome in humans thus; early recognition and timely intervention of toxicity from these compounds are of great importance, to emergency physicians and patients [10]. Neurologic, cardiac, and respiratory complications are the main causes of morbidity and mortality in these patients. The involvement of other systems can also occur but it is very uncommon [11].

The present study was carried out with an objective 1. To estimate serum amylase levels in acute organophosphate poisoning and 2. To correlate serum amylase levels with outcome of patient.

2. Material and Methods

The study designed was a cross sectional study, including total 120 OP poisoning patients and those getting admitted in casuality, intensive care unit of medicine and medicine ward of Shri.V.N.GMC Yavatmal, during the period of 1st January 2017 to 30th November 2017. Qualifying patients were undergoing detailed history, clinical examination, biochemical examinations and radiological examination. Ethical Committee Approval was obtained to carry out the study in the hospital. A previously designed proforma was used to collect the demographic and clinical details of the patients.

2.1 Inclusion criteria

Patients with a history of organophosphorous poisoning with clinical features and physical evidence of poisoning were the study subjects.

2.2 Exclusion criteria

- Patients with indication of exposure to a entirely different poison other than OP poison.
- Patients who have consumed poison along with alcohol
- Patients who are chronic alcoholics
- Patients with history suggestive of gall stone disease
- History of intake of drugs – e.g.: Azathioprine, Mercaptopurine, Thiazides, Frusemide, Pentamidine

2.3 Sample collection

From the all selected patients, about 3 ml of venous blood were collected on two occasions, first within 24 hours of consumption of poison (Sample I) and next after 24 hours of the first sample (Sample II). 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, serum cholinesterase, blood glucose, urea, creatinine, and liver function tests were analyzed. Clinical outcome seen was pupil size, pulse, blood pressure, respiratory rate, secretions.

2.4 Statistical Analysis

All the collected data were statistically analyzed using appropriate statistical tests. A p value less than 0.01 were considered significant.

3. Observations and Results

In this study total 120 patients fulfilled inclusion and exclusion criteria and were included in the study. Table 1 shows the hematological parameters changes in patients with organophosphorous poisoning. Out of 120 patients with OP poisoning 22% had normal serum amylase levels and 78% had increased serum amylase levels in first 24 hours. Clinical features and serum amylase levels changes in organophosphorous poisoning was as per Table 2. The difference between all clinical features and changes in serum amylase levels was statistically significant, ($P < 0.01$). There was no significant relationship of serum amylase levels with the age, sex, mode of consumption, agents, ($P > 0.01$). There was significant decrease in serum amylase levels with treatment compared from day I to day II.

Table 1: Hematological parameters changes in organophosphorous poisoning

Parameters	Cases	Controls	P value
Blood Sugar	98.2±19.4	103.2±11.6	>0.01, NS
Urea	29.7±8.6	32.2±7.2	
Serum Creatinine	0.94±0.5	0.81±0.3	

Table 2: Relationship of serum amylase levels with clinical severity

Clinical features		Serum amylase levels (Mean + SD)	
		Day I	Day II
Pinpoint pupil	Present	297.4±126.1	65.8±33.2
	Absent	80.2±32.5	31.2±21.2
	P value	0.0001, S	0.0008, S
Depressed mental status	Yes	334±154.5	67.34±3.1
	No	103±1.24	33.6±32
	P value	0.0002, S	0.0023, S
Secretions	Mild	87.2±58.1	34.5±23.2
	Moderate	112.8±88.6	34.4±24.4
	Severe	321.2±154.2	63.2±32.3
	NS	86.3±71.7	67.4±66.5
	P value	0.00167, S	0.0213, S
Fasciculation	Present	309.8±146.9	69.6±33.5
	Absent	87.5±47.9	29.8±23.8
	P value	0.0001, S	0.0001, S
Heart Rate	Bradycardia	209.7±146.2	57.1±30.9
	Tachycardia	-	-
	Normal	93.2±82.9	33.13±31.4
	P value	0.0001, S	0.0001, S
Convulsions	Present	398	39
	Absent	147.3±125.2	42.3±31.9
	P value	0.0001, S	0.0001, S
Respiratory Failure	Yes	359.4±149.9	69.5±37.2
	No	91.4±50.7	32.00±25.6
	P value	0.0001, S	0.0001, S

Outcome and amylase level was as per Table 3. Out of 120 patients, 13(10.83%) died and 107 (89.16%) were alive. The amylase level was 482.46±59.1 in dead patients versus 148.34±78.06 in patients who were alive which was statistically significant, ($P < 0.01$). There was no significant relationship between age, blood urea, serum creatinine and outcome, ($P > 0.01$). Out of 13 patients who died had pin point pupils, depressed mental status, severe secretions, fasciculation, bradycardia and respiratory failure. All the patients presented with convulsions died.

Table 3: Relationship of serum amylase levels with outcome

Outcome	Serum Amylase levels (Mean + SD)	
	Day I	Day II
Alive	148.34±78.06	67.70±36.98
Died	482.46±59.1	166.96±11.32
P value	0.0001, S	0.0001, S

4. 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. In mild cases, the management of poisoning done by removing the patient from the area of exposure and a low dose of atropine may suffice. However, in severe cases, mechanical ventilation, high doses of antidotes and resuscitation become necessary. In developing counties like India where there is paucity of health care facilities, precise disease classification and accurate outcome prediction can optimize usage of facilities by reducing unnecessary low risk monitored-only patients and futile care of terminally sick patients. In this regard a prognostic marker allows the clinician to estimate individual patient risk and permit proper allocation of available means at a time of economic constraint and resource limitation. Estimation of acetyl cholinesterase poorly correlates with the severity of the OP poisoning. Several studies [12,13] showed that elevated serum amylase levels (hyperamylasemia) are associated with clinical severity and poor outcome. Considering this fact the present study was undertaken to estimate serum amylase levels in acute organophosphate poisoning and correlated with outcome of patient.

In current study majority of the patients (46%) belonged to age group 21-30yrs. This was consistent with other studies [14-16]. The common risk factors associated with this group include stress of school, failure in college, love affairs and conflict with parents. Males outnumbered females. Among the total cases, 103 (85.83%) were males and 17 (14.16%) were females. This data was similar to that

of the previous studies [14,15,17]. A positive correlation existed between the glycemic changes and the severity of poisoning which was also indicated by Uchil S et al [18]. Other biochemical parameters (Serum creatinine and urea) results have not shown much variation from the normal levels in our study. The study also found an association between the severity of poisoning and clinical manifestations. The most marked muscarinic signs in our study population were miosis (58%), excessive secretions (62%), and respiratory distress (29%). The most prominent of the nicotinic effect was muscular end plate block, resulting in muscle weakness and fasciculation's (38%). The CNS symptoms, like depressed mental status was found in 31.5% patients where as reported to be 76% by Murat S et al [3]. OP insecticides increase the intraductal pressure and exocrine pancreatic flow. The increase in pressure leads to extravasation of pancreatic fluid. This increased pancreatic exocrine flow could be due to direct cholinergic hyper stimulation of pancreatic acinar and ductal cells.

In present study, 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. However this hyperamylasemia in cases of OP poisoning, may be due to the fact that acute pancreatitis is caused by excessive cholinergic stimulation of pancreas by OP compounds [19,20]. Our study results were in accordance with the study done by Bhardwaj et al where they found that serum amylase is elevated in 47% of patients with organophosphorus poisoning [21]. In a prospective study by Singh S [22] amylase was elevated in 48.95% in patient with fenthion poisoning and serum amylase showed persistent elevation during serial estimation.

Respiratory failure is the most common dreaded complication in organophosphorus poisoning leading to mechanical ventilation and death. In a study conducted in Japan by Sumiya et al [23], an increase in plasma amylase levels above the normal range have been found in 50% of the patients who developed respiratory failure. Lin CL et al., found that mean amylase levels were elevated in patients with respiratory support and serum amylase levels predicted ventilator support in OP poisoning [24]. Among the 120 patients in our study, death was reported in 13 (10.83%) patients and 107 (89.16%) patients survived after mechanical ventilation. The overall mortality in our study was 10.83% and this was compared with other studies [15,25].

5. Conclusion

From the observation of present study, it may be concluded that the serum amylase levels considered as a marker of organophosphorous intoxication, since it enables the early recognition of severity and also helps to identify those at risk of developing the complications of Organophosphorous poisoning. In current study, age and sex of the patients have no significant relationship with the amylase levels but significant correlation found between elevated amylase levels and the outcome. From the observation, we made, it could be suggested that OP pesticide poisoning is a serious condition that needs rapid diagnosis and treatment. However further analysis of a larger group would give an insight into the finer relationship between serum amylase level and clinical severity and outcome in OP poisoning.

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