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Original Research Article

Serum Amylase Levels as a Prognostic Marker for Clinical Severity and Outcome in Organophosphorus Poisoning: A Comprehensive Study

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Abstract:

Background and Aim: This comprehensive study investigates the potential of serum amylase levels as a prognostic marker for assessing the clinical severity and outcomes of organophosphorus poisoning cases. Organophosphorus compounds are widely used as pesticides and are responsible for a significant number of poisonings in developing countries.

Materials and Methods: The study, conducted on 240 patients, explores the correlation between serum amylase levels and various clinical features such as pupil size, mental status, secretion levels, heart rate, and respiratory failure.

Result and conclusion: The results indicate that elevated serum amylase levels are associated with the severity of poisoning and poor clinical outcomes. This research emphasizes the importance of early detection and treatment of organophosphorus poisoning and highlights serum amylase levels as a valuable tool for prognostication.

Keywords: Organophosphorus Poisoning, Serum Amylase Levels, Clinical Severity, Outcome, Prognostic Marker.

Introduction

Over the past four decades, more than 50,000 organophosphorous chemicals have been created and tested for their ability to kill insects, but the number currently in use probably doesn't surpass thirty-two. [1] Organophosphorus 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 fact that agriculture is a significant part of the Indian economy explains the significance of pesticides in that country. In recent decades, the frequency of pesticide poisoning and subsequent hospital admission has increased. [3]

In most parts of the world, acute poisoning from organophosphosphorous pesticides (OP) has epidemic proportions, especially in developing agrarian nations where the toxicity of the available poisons and lack of adequate medical facilities guarantee a high fatality rate. [4] With a fatality rate of less than 1%, occupational exposure poisoning accounted for about one-fifth of the incidents. [5] The majority of the subjects are young males, and more than 90% of the non-occupational incidents were suicidal with a fatality rate of more than 10%; 8–10% of the incidents involved accidental exposures, and less than 1% involved other types of poisoning, such as homicidal use. According to various nations and institutions, the reported overall mortality rate after OP insecticide poisoning ranges from 4 to 30%. Organophosphorous substances are primarily used as pesticides, and exposure to them is very common in developing nations. The toxic effects of OPs are a significant global clinical issue because they are linked to significant morbidity and mortality. [6]

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. Case reports on acute

pancreatitis following acute organophosphorus compound ingestion has been reported now and then, but regular studies with reference to Pancreatitis is not available in a serial manner. Hence an attempt was made to study pancreatic involvement through biochemical means. [7] The main causes of morbidity and mortality in these patients are complications related to the nervous system, the heart, and the lungs. Although it can happen, involvement of other systems is extremely rare. [8] 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.

Material & Methods

This study was conducted in the Department of Medicine, Narayan medical college and hospital Jamuhar, Sasaram. After obtaining Institutional ethical committee approval and taking informed consent on the basis of inclusion criteria.

Inclusion Criteria

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

Exclusion Criteria

- All patients who do not give informed consent.
- Patients who are chronic alcoholics.
- Patients with history suggestive of gall stone disease.
- Patient with renal insufficiency.
- Patient with intra-abdominal diseases like GI perforation, peritonitis etc.

Study Tools

The patients were subjected to detailed history taking, general survey, systemic examination and relevant investigations. From the all selected patients, venous blood were collected on two occasions, first within 24 hours of consumption of poison (Sample I). Serum amylase was estimated Biochemical evaluation which includes serum amylase, serum cholinesterase, blood glucose, urea, creatinine, and liver function tests were analyzed. Clinical outcome seen were pupil size, pulse, blood pressure, respiratory rate, secretions.

Statistical Analysis

All the collected data were statistically analyzed using appropriate statistical tests. A p - value less than 0.05 was considered significant.

Result

In this study total 240 patients fulfilled inclusion and exclusion criteria and were included in the study.

Table 1: Hematological parameters changes in organophosphorous poisoning

Parameters	Cases	Controls	P value
Blood Sugar	97.5±18.4	101.2±10.7	0.002
Urea	30.7±7.3	32.1±5.2	
Serum Creatinine	0.90±0.7	0.79±0.2	

This table shows the hematological parameters changes in patients with organophosphorous poisoning. In the first 24 hours, 78% of the 240 patients with OP poisoning had elevated serum amylase levels, compared to 22% of patients with normal serum amylase levels.

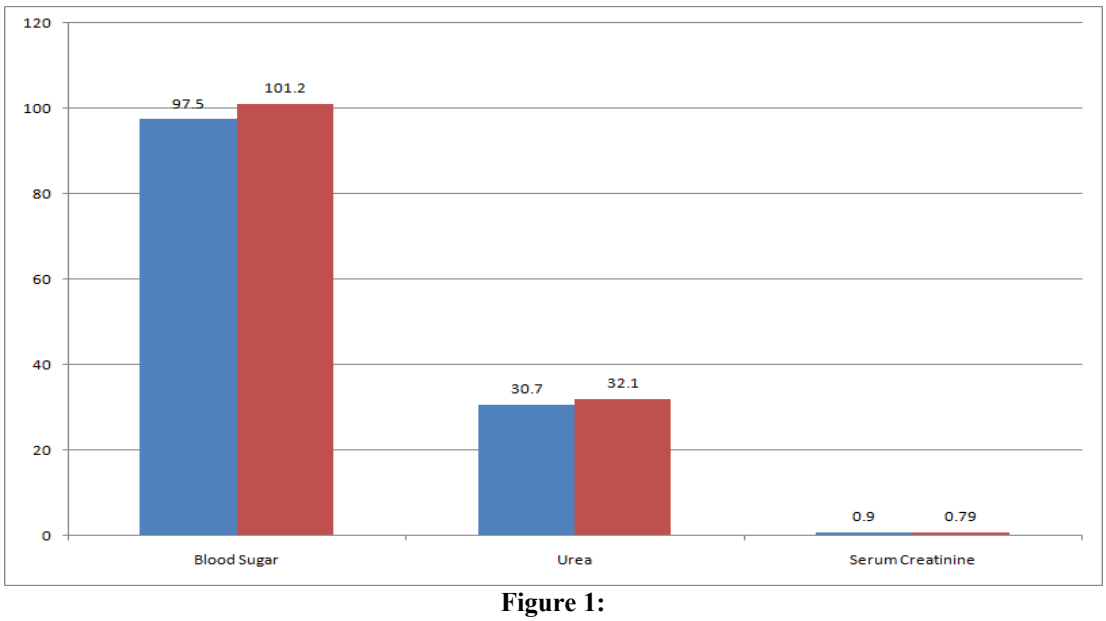

Figure 1:

Table 2: Relationship of serum amylase levels with clinical severity

Clinical Features		Serum amylase levels (Mean + SD)	
		DAY I	DAY II
Pinpoint Pupil	Present	279.3±119.1	64.8±29.2
	Absent	79.2±32.5	30.2±21.2
	P value	0.0003	0.0006
Depressed mental status	Yes	334±154.5	67.34±3.1
	No	103±1.24	33.6±32
	P value	0.0002	0.0023
Secretion	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	0.0213
Fasciculation	Present	309.8±146.9	69.6±33.5
	Absent	87.5±47.9	29.8±23.8
	P value	0.0001	0.0001
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	0.0001
Convulsion	Present	398	39
	Absent	147.3±125.2	42.3±31.9
	P value	0.0001	0.0001
Respiratory Failure	Yes	359.4±149.9	69.5±37.2
	No	91.4±50.7	32.00±25.6
	P value	0.0001	0.0001

Clinical characteristics and changes in serum amylase levels in organophosphorous poisoning were as shown in Table 2. There was a statistically significant difference between all clinical characteristics and changes in serum amylase levels, ($P < 0.01$). Serum amylase levels did not significantly correlate with age, sex, mode of consumption, or agents, ($P > 0.01$). There was significant decrease in serum amylase levels with treatment compared from day I to day II.

Table 3: Relationship of serum amylase levels with outcome

Outcome	Serum Amylase level	
	Day I	Day II
Alive	143.26±79.06	63.70±34.89
Died	475.32±49.1	157.92±9.32

Out of 240 patients, 26(10.83%) died and 214 (89.16%) were alive. The amylase level was 475.32±49.1 in dead patients versus 143.26±79.06 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 26 patients who died had pin point pupils, depressed mental status, severe secretions, fasciculation, bradycardia and respiratory failure. All the patients presented with convulsions died.

Discussion

The symptoms of organophosphorus poisoning frequently resemble a medical emergency that calls for monitoring and treatment in an intensive care unit. The treatment of poisoning is based on the clinical severity, which is determined by both laboratory testing and clinical signs and symptoms. In minor cases, removing the patient from the exposure site and administering a small dose of atropine may be sufficient for poisoning management. However, in severe cases, resuscitation, high doses of antidotes and mechanical ventilation are required. By minimizing unnecessary low risk monitored-only patients and ineffective care for terminally ill patients, precise disease classification and accurate outcome prediction can maximize the use of facilities in developing nations like India where there are few health care facilities. In this regard, a prognostic marker enables the clinician to determine the risk associated with each patient individually and to allocate resources effectively during times of resource and financial constraint. The severity of OP poisoning is only weakly correlated with estimates of acetyl cholinesterase. In current study majority of the patients (52%) belonged to age group 21-30yrs. This was consistent with other studies. [9, 10, 11] Common risk factors for this

group include the strain of school, college failure, extramarital affairs, and problems with the parents. Males predominate over females. 103 (85.83%) of the total cases were male, and 17 (14.16%) were female. This data was similar to that of the previous studies. [9,10,12] A positive correlation existed between the glycemic changes and the severity of poisoning which was also indicated by Uchil S et al. [13]

In our study population, miosis (58%), excessive secretions (62%), and respiratory distress (29%) were the most pronounced muscarinic symptoms.

Muscular end plate block, which causes muscle weakness and fasciculation's, was the most noticeable nicotinic effect (38%). When compared to the 76% reported by Murat S et al. [3], the CNS symptoms, such as a depressed mental state, were found in 31.5% of patients. OP insecticides increase the intraductal pressure and exocrine pancreatic flow. The increase in pressure leads to extravasation of pancreatic fluid. The direct cholinergic hyper stimulation of pancreatic acinar and ductal cells may be the cause of this increased pancreatic exocrine flow.

The amylase levels in the current study were markedly elevated at the time of admission (175.36 U/L) and have demonstrated a gradual remission with appropriate treatment. Patients who had been poisoned severely had an average amylase level of 288 U/L. However, acute pancreatitis is brought on by excessive cholinergic stimulation of the pancreas by OP compounds, which may be the cause of this hyperamylasemia in cases of OP poisoning. [14,15] Our study results were in accordance with the study done by Bhardwaj et al where they found that serum amylase is elevated in 49% of patients with organophosphorus poisoning. [16]

The most frequent and dangerous complication of organophosphorus poisoning that results in mechanical ventilation and death is respiratory failure. In a Japanese study by Sumiya et al [17]. It was discovered that 50% of the patients who developed respiratory failure had elevated plasma amylase levels above the normal range. According to Lin CL et al [18], mean amylase levels were higher in patients requiring respiratory support, and serum amylase levels were a good indicator of whether OP poisoning would require ventilator support. Out of the 240 patients in our study, 26 (10.83%) died, while 214 (89.16%) continued to live after receiving mechanical ventilation.

Conclusion

According to the results of the current study, serum amylase levels are a reliable indicator of organophosphorous intoxication because they allow for early detection of the condition's severity and the identification of people who are most likely to experience its complications. Age and sex of the patients are not significantly correlated with amylase levels in the current study, but elevated amylase levels are significantly correlated with the results. Our findings could imply that OP pesticide poisoning is a serious condition that requires quick diagnosis and treatment. A deeper understanding of the relationship between serum amylase level and clinical severity and outcome in OP poisoning would come from further analysis of a larger sample.

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