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Original Research Article

A Study on Serum Amylase Levels in Acute Organophosphorus Poisoning

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Abstract

Background: To estimate serum Amylase levels in acute organophosphorus compound poisoning and find out its relationship with clinical severity and outcome. Patients presenting with Organophosphorous poisoning were the study subjects from SVS Hospital, Mahabubnagar from September 2019 to August 2021. In India, Organophosphorus compounds cause more suicidal deaths among the earning and nonearning members of the society. Of the 40 patients in our study 15 patients (37.5%) had normal serum amylase level; 25patients (62.5%) had elevated serum amylase level which is very significant.

Keywords: Serum Amylase; Acute Organophosphorus Poisoning

Background

Acute poisoning by Organopho-sphosphorous Pesticides (OP) has reached epidemic proportions in most parts of the world, particularly in developing agrarian countries, where the toxicity of available poisons and paucity of appropriate medical facilities ensure a high fatality rate.

Their ease of access and socio–cultural factors play important role in choice of OP as a self-poison and the incidence is higher in young economically active group with a common fatality ratio of 20% [1,2]. According to WHO, worldwide estimates of pesticide poisoning number 3 million each year, with 2 million hospitalized from suicide attempts and 2,20,000 deaths, the majority of which are actually intentional.

Poisoning due to occupational exposure, accounted for about one fifth of the incidents, with a fatality ratio of less than 1%. More than 90% of the non-occupational incidents were suicidal, with a fatality rate more than 10% and the majority of the subjects are young males [3].

Accidental exposures accounted for 8-10% of the incidents and homicidal use (less than 1%) were other forms of poisoning. The reported overall mortality following OP insecticide poisoning varies from 4-30% in different countries and institutions [4]. In India, OP compounds cause more self-poisoning deaths in southern and central India. In Northern India, aluminum phosphide causes most deaths with a fatality ratio over 90%. Other Pesticides used for self –poisoning include carbamates, Organ chlorines and

pyrethroids [5]. Organophosphorous compounds are principally used as pesticides, and their exposure is highly prevalent in developing countries. Toxic effects of OPs are associated with significant morbidity and mortality and are a major global clinical problem.

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 organ phosphorus 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.

Aim of the Study

1. To estimate serum Amylase levels in acute organophosphorus compound poisoning.
2. To find out its relationship with clinical severity and outcome

Material and Methods

Of a total of 145 patients with organophosphorus compound poisoning admitted to the hospital during the study period, 40 were included in the study.

Controls

10 healthy (age matched) individuals were kept as control.

Inclusion Criteria

40 patients with a history of exposure to OP poison were the study subjects.

Exclusion Criteria

- Patients with indication of exposure to an entirely different poison other than OP poison.
- Patients with double poisoning.
- History of intake of drugs likely to produce pancreatitis
- History of renal or hepatic disease
- Patients with history of renal or hepatic disease
- History suggestive of parotid gland disease
- Patients with history of lipid disorders
- History suggestive of parotid gland disease
- Patients with known history of lipid disorders
- Patients with history suggestive of gall stone disease
- Patients who are chronic alcoholics
- Patients who have consumed poison along with alcohol
    - Azathioprine
    - 6-Mercaptopurine
    - Thiazides
    - Frusemide
    - Pentamidine

Sample collection

40 Patients satisfying the inclusion criteria were selected for the study. About 3 ml of venous blood were collected in two occasions from each subject first within 24 hours of consumption of poison (Sample I) and next after 24 hours of first sample (Sample II). The samples were centrifuged at 3000 rpm for 4 minutes. The supernatant serum was separated and freezed. Serum Amylase was estimated with the help of Beckman coulter AU480 Autoanalyzer.

Test principle

Method based on recommendations of the international federation of clinical chemistry (IFCC). The α amylase colour test employs 4,6 ethylidene (G7)-p-nitrophenyl (G1)-α-Dmaltohepatoside (ethylidene G7 PNP) as substrate. This substrate reacts with α amylase and the fragments with α glucosidase to give 100% release of P-nitrophenol (PNP). The increase of absorbance @ 410 nm is directly proportional to the amylase activity in the sample.

Results

Table 1: Age Distribution

Age (Year)	Cases		Control		p-value
	Frequency	Present	Frequency	Control	
16 – 30	21	52.5	4	40.0	<0.05
31 – 40	14	35.0	4	40.0	
41 and above	5	12.5	2	20.0	
Total	40	100.0	10	100.0	

Table 2: Features of Poisoning

Reasons	Frequency	Percent
Familial	26	65.0
Financial	10	25.0
Job Stress	2	5.0
Others	0	5.0
Total	40	100.0

Table 3: Mode of Consumption

Mode of consumption	Frequency	Percent
Alone	10	25.0
Milk	3	7.5
Water	27	67.5
Total	40	100.0

Table 4: Increased Amylase levels in first 24 hours

Amylase levels in	Normal		Increased	
	No	%	No	%
Cases	15	37.5	25	62.5
Controls	10	100	-	-
'p'	0.0015 Significant			

Table 5: Clinical features and Amylase levels

Clinical features	Amylase levels		p value
Pinpoint pupil			
Present	204.1 ± 136.1	52.4 ± 33.2	
Absent	67 ± 38.5	25.4 ± 25.1	
p - value	* 0.0001	*0.0009	Significant
Depressed mental Status			
Yes	261 ± 151.8	63 ± 31	
No	97.4 ± 75.6	31.7 ± 29	
p-value	*0.0003	*0.0023	Significant
Secretions			
Mild	83 ± 59.2	30.3 ± 25.7	
Moderate	108.9 ± 90.6	30.3 ± 26.8	
Severe	242.2 ± 157.2	59.7 ± 32.3	
NS	84.5 ± 72.8	67.5 ± 67.2	
p-value	*0.0168	*0.0219	Significant
Fasciculation			
Present	272.3 ± 149.9	67.5 ± 33.4	
Absent	86.6 ± 50.8	29 ± 24.7	
p-value	*0.0001	*0.0001	Significant
Heart Rate			
Bradycardia	207.1± 142.8	51.1 ± 31.8	
Tachycardia	-	-	
Normal	93.3 ± 83.4	33 ± 31.7	
p-value	*0.0001	*0.0321	Significant
Convulsions			
Present	156 ± 0.00	38 ± 0.00	
Absent	142.1 ± 126.9	40.3 ± 32.9	
p-value	*0.0001	*0.0001	Significant
Respiratory Failure			
Yes	297.7 ± 151.8	69.8 ± 36.4	
No	90.6 ± 50.8	30.4 ± 24.6	
p-value	*0.0001	*0.0016	Significant

*p< 0.001 is statistically highly significant

Table 6: Outcome and Amylase levels

Clinical features	Amylase levels	
Heart Rate	**I**	**II**
Alive	134.6 ± 122	39.9 ± 33.4
Dead	213 ± 142	44 ± 25.3
p - value	* 0.1762	*0.443

Table 7: Clinical parameters and outcome

Clinical features	Outcome				'p' value
	Alive		Death		
	Yes	No	Yes	No	
Pinpoint pupil					
Present (22)	18	81.8	4	18.2	0.8
Absent (18)	18	100	-	-	Not significant
Depressed mental status					
Yes (11)	7	63.6	4	36.4	0.0036 significant
No (29)	29	100	-	-	
Secretions					
Mild (3)	3	100	-	-	
Moderate (24)	24	100	-	-	0.0001
Severe (11)	7	63.9	4	36.4	Significant
NS (2)	2	100	-	-	
Fasciculation					
Present (12)	8	66.7	4	33.3	0.0054
Absent (28)	28	100	-	-	Significant
Heart Rate					
Bradycardia (17)	13	76.5	4	23.5	
Tachycardia (-)	-	-	-	-	0.026
Normal (23)	23	100	-	-	Significant
Convulsions					
Present (1)	-	-	1	100	0.1
Absent (39)	36	92.3	3	7.7	Not significant
Respiratory Failure					
Yes (10)	6	60	4	40	0.0023 Significant
No (30)	30	100	-	-	

Discussion

Organophosphates and Carbamates are frequently used pesticides which can produce life-threatening intoxication. Well over 50,000 organophosphorous compounds have been synthesized since the first one by Clermont in 1857. All these compounds act by irreversible inactivation of acetylcholinesterase (ACh). The clinical symptoms range from the classic cholinergic syndrome to flaccid paralysis and intractable seizures. About 99% of fatal poisoning occurs in developing countries, particularly among farm workers. Despite an increased incidence of organophosphorous insecticide poisoning, the exact micro molecular changes that take place remain elusive. Till date, atropine and oxime continue to occupy the prime position in the specific management of OP poisoning.

With the ease of availability, it is not surprising that the use of OP compounds in suicide attempts has mushroomed from a disturbing early trend to being one of the commonest modes of suicidal poisoning which accounted for 100% in our study. This rate was consistent with the findings of Mahadi Balali Mood *et al* [6] (94.3%) whereas it was reported to be 67% by AM Saadeh *et al* [7]. There was no accidental exposure in our study. This alarming incidence of suicidal attempts may be probably because of the uncontrolled sale and use of these agents all over the country.

The vast majority of poisonings followed oral ingestion of liquid form and almost for all the patients gastric lavage was immediately done. The incidence was higher (40%) in the age group of 21-30 followed by (35%) in the age group of 31-40.

These are consistent with the findings of Muhammet Guven *et al* [8] and AM Saadeh *et al*, where the mean ages were 24.1 and 23.95 respectively.

The most common reason for consumption in our study was found to be the familial stress (65%) followed by financial stress (25%). Methyl parathion accounted for about 52.5% of intoxication. The commonest mode of intake was found to be poison along with water (67.5%).

The accumulation of ACh in nerve terminals, results in continued stimulation with sub-sequent paralysis of receptors and accounts for the clinical signs of muscarinic, nicotinic and CNS effects.

Both the present study, and the study by Mahdi Balali-Mood *et al*, found association between the severity of poisoning and clinical manifestations. The most marked muscarinic signs in our study population were miosis (55%), excessive secretions (60%), and respiratory distress (25%). The most prominent of the nicotinic effect is muscular end plate block, resulting in muscle weakness and fasciculations (30%). The CNS symptoms, like depressed mental status was found in (27.5%) patients. Similar findings have also been reported by Murat Sungur *et al* [9].

The biochemical (Blood sugar, Serum creatinine & urea) results have not shown much variation from the normal levels in our study which was also indicated by Mahdi Balali-Mood *et al*.

The most troublesome complication of OP poisoning was respiratory depression which could be due to reasons such as: aspiration of gastric contents, excessive secretions, pneumonia and septicemia complicating adult respiratory distress syndrome. Of the 40 patients, respiratory depression was observed in 10 (25%) cases [10].

Early recognition of respiratory failure, prompt endotracheal intubations and mechanical ventilation are lifesaving in severe OP poisoning.

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 hyperstimulation of pancreatic acinar and ductal cells [11].

In the study, 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 ($P < 0.01$).

From our observation, it can be suggested that estimation of Amylase levels would be extremely useful to assess the clinical severity.

Age and gender of the patients have no significant relationship with the amylase levels. The mean Amylase level in first 24 hours was 154 U/L which is significantly higher than the control groups.

In our study, there was no significant correlation 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.

Conclusion

1. The mean Amylase level in first 24 hours of OP poisoning was 154 U/L

which is significantly higher than the control groups.

2. The bad bedside prognostic factors which correlated very well with serum Amylase levels in the order of increasing severity include
   a. Convulsions (Amylase – 156 U/L)
   b. Severe secretions (242 U/L)
   c. CNS depression (261 U/L)
   d. Fasciculations (272U/L)
   e. Respiratory failure (297.7U/L)
3. Serum amylase levels may be 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.
4. This study shown that there was a significant correlation between markedly elevated Amylase level and respiratory failure and therefore poor outcome.
5. A significant rise in Serum Amylase level also portends various complications that include convulsions, CNS depression, fasciculations and respiratory failure.
6. The study was limited to a small population due to financial and laboratory constraints, analysis of a larger group would definitely give an insight into the further finer relationship between serum amylase level and clinical severity and outcome in OP poisoning.

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