

**ORIGINAL RESEARCH**

# Correlation between serum amylase, serum creatine phosphokinase (CPK), random blood sugars (RBS), serum cholinesterase with outcome: Acute organophosphorus compound poisoning

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### ABSTRACT

According to the World Health Organization (WHO), 1 million serious unintentional poisonings occur every year and an additional 2 million people are hospitalized for suicide attempts with pesticides. In countries such as India, OPs are easily available and cheap, hence a source of both intentional and unintentional poisonings. Since it is a time bound study, all the patients diagnosed with organophosphorus poisoning attending OPD and inpatient department during study period were included in the study. A total of 188 study participants were included. Out of 69 mild OP poisoning cases, all of them survived, mortality was zero. Among 82 moderate cases, only 4 patients died. Among 37 severe OP poisoning cases, 14 patients died. The co-relation between severity of poisoning and mortality was statistically significant. And among out of 18 dead mean CPK was 756. Thus, the correlation between mean CPK and mortality was statistically significant.

**Key words:** CPK, RBS, Serum Cholinesterase

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### Introduction

Self inflicted violence accounts for almost half of the 1.6 million violent deaths that occur every year worldwide. About 63% of global deaths from self harm occur in the Asia Pacific region. According to National Crime Records Bureau India, every 5 minutes a person commits suicide, forming about 1,00,000 deaths per year<sup>1</sup>. Suicide rate was highest in the state of Kerala<sup>2</sup>. Majority of the victims belonged to the age group 14- 34 Years<sup>3</sup> and Organophosphorus Compounds (OPC) were the most common agent used for suicide purpose<sup>4</sup>.

OP poisoning causes what is known as the “suicide impulse” which leads to high level of suicides in some sectors of the agricultural industry. Organophosphates

are used as medications, insecticides, and nerve agents as a weapon.<sup>5,6</sup> Most patients exposed to organophosphates come into contact with insecticides. The first organophosphate insecticide was created in the mid-1800s but was not widely used until after World War II.<sup>7,8,9</sup>

According to the World Health Organization (WHO), 1 million serious unintentional poisonings occur every year and an additional 2 million people are hospitalized for suicide attempts with pesticides.<sup>10,11</sup>

In countries such as India, OPs are easily available and cheap, hence a source of both intentional and unintentional poisonings.

Massive OP intoxication from suicidal and accidental events, such as the Jamaican ginger palsy incident in

1930, led to the discovery of the mechanism of action of OPs.

Organophosphates act by irreversibly inhibiting the enzyme acetyl cholinesterase, resulting in accumulation of acetylcholine at synapses and neuromuscular junctions leading to cholinergic over activity:

- 1. Muscarinic symptoms:** SLUDGE: Salivation, lacrimation, urinary incontinence, diarrhoea, GI disturbances, emesis, other symptoms like bradycardia, hypotension, meiosis etc.
- 2. Nictonic symptoms:** fasciculations muscle weakness, hypotension or hypertension, tachy or brady arrhythmias.  
-salivation, lacrimation, urinary incontinence, diarrhoea, GI disturbances, emesis, other symptoms like bradycardia, hypotension, meiosis etc

Organophosphate (OP) poisoning continues to be a frequent reason for admission to hospitals and Intensive Care Units in developing countries.<sup>12</sup>

The most commonly observed complications are acidosis, respiratory paralysis, acute renal failure, seizures, arrhythmias, aspiration, coma and even death. The causes of death in OP poisoning may be either one or a combination of the above.

Early diagnosis plays a vital role in preventing these complications including mortality.

Investigations such as serum erythrocyte cholinesterase (EchE) and plasma cholinesterase (PchE) estimation, are not cost effective and are performed in very few laboratories in our country.

There are other emerging options for new cheaper biochemical markers in relation to OP poisoning such as CPK levels, serum amylase and random blood sugar. Various studies worldwide and in India have shown the importance of these biochemical markers as a most cost effective.

Hence serum creatine phosphokinase (CPK), serum amylase, and random blood sugar (RBS) can be used an alternative to cholinesterase level to assess the severity and as a prognostic marker in acute op compound poisoning.

## Methodology

### Source of data

All the patients with acute OP poisoning admitted in the department of General Medicine,

**Study design:** Cross-sectional study

**Study population:** patients attending the department of General Medicine Outpatient department and Inpatient Department

### Sample size calculation

Since it is a time bound study, all the patients diagnosed with organophosphorus poisoning attending OPD and inpatient department during study period were included in the study.

A total of 188 study participants were included.

### Inclusion Criteria

1. Patients of age group >18 years and both sex with a history of exposure to OP compound will be the study subjects.
2. Patients who are brought to hospital within 24 hours of poison ingestion.

### Exclusion Criteria

1. Patients with history of OP poisoning mixed with any other poison or alcohol.
2. History suggestive of Myopathy, Epilepsy, Psychiatric illness, Auto immune disease, Malignancy, Trauma, Sepsis, Renal disease, Myocardial infarction and myocarditis, recent IM injections.
3. History of drug intake possibly causing myopathy like Statins, fibrates, dexamethasone, frusemide, and amphotericin B.
4. Patients with history of chronic alcoholism, lipid disorders, gall stones, parotid gland disease, acute or chronic pancreatitis, pancreatic disorders, abdominal trauma, Endoscopic retrograde Cholangiopancreatography (ERCP).
5. Patients with hepatic or renal disorders.
6. History of intake of drugs likely to produce pancreatitis- azathioprine, 6-mercaptopurine, thiazides, furosemide, pentamidine, valproate and sulphonamides.
7. Patients with age <18 years.
8. Patients with history of type 2 diabetes mellitus

## Results

**Table 1: Outcomes among severity of OP cases**

Severe	Survived		Died		Total		P value
	No. of cases	Percentage	No. of cases	Percentage	No. of cases	Percentage	
Mild	69	36.70	0	0	69	36.70	<0.0001
Moderate	78	41.49	4	2.13	82	43.62	
Severe	23	12.23	14	7.45	37	19.68	
Total	170	90.43	18	9.57	188	100.00	

Out of 69 mild OP poisoning cases, all of them survived, mortality was zero.

Among 82 moderate cases, only 4 patients died.

Among 37 severe OP poisoning cases, 14 patients died.

The co-relation between severity of poisoning and mortality was statistically significant.

**Table 2: Correlation between CPK and Outcomes of patients**

	Survived		Death	
	Mean	SD	Mean	SD
CPK	405.21	227.15	756.11	201.71
P value	<0.001			

Out of 170 survived patients mean CPK was 40.21  
And among out of 18 dead mean CPK was 756

Thus, the correlation between mean CPK and mortality was statistically significant

**Table 3: Correlation between Serum amylase and Outcomes of patients.**

	Survived		Death	
	Mean	SD	Mean	SD
Serum amalyase	140.72	45.76	203.72	42.23
P value	<0.001			

Out of 170 survived patients mean serum amylase was 140  
And among out of 18 dead mean serum amylase was 203.72

Thus, the correlation between mean serum amylase and mortality was statistically significant

**Table 4: Correlation between RBS, and Outcomes of patients.**

	Survived		Death	
	Mean	SD	Mean	SD
RBS	97.50	12.16	102.33	10.55
P value	0.25			

Out of 170 survived patients mean RBS was 97.5  
And among out of 18 dead, mean RBS was 102.33

Thus, the correlation between mean RBS and mortality was statistically insignificant

**Table 5: Correlation between Serum Cholinesterase and Outcomes of patients.**

	Survived		Death	
	Mean	SD	Mean	SD
Serum cholinesterase	2107.78	1174.01	868.33	646.13
P value	<0.001			

Out of 170 survived patients mean serum cholinesterase was 2107.78.  
And among out of 18 dead, mean serum cholinesterase was 868.33.

Thus, the correlation between serum cholinesterase and mortality was statistically significant

(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 ( $r = 0.970$ ;  $p < 0.001$ ) was also observed.

## Discussion

The initial raise in total serum CPK level correlated well with severity of OP compound poison and prognosis, suggesting its use as a prognostic indicator of OP compound poison. So, cheaper, easily quantifiable and more available biochemical markers in relation to OP poisoning like serum CPK can be used in assessing the prognosis of patients with OP poisoning.

Gunosindhu Paul *et al.*,<sup>13</sup> in their study observed 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

Raveendra KR *et al.*, observed that the mean serum amylase levels at admission, 48 h, and the outcome were 54.81, 54.44, and 53.35 among the non-intubated group, respectively, and 152.23, 152.67, and 141.13 among the intubated group, respectively, with a significant  $P$  value (0.000\*). This shows that 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 ( $\leq 90$  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.<sup>14</sup>

Raveendra K. R *et al.*,<sup>15</sup> The patients in this study were categorized into hypoglycemics (10%), euglycemics (75%) and hyperglycemic (15%). 16% of euglycemics, 30% of hypoglycemics and 60% of hyperglycemics had severe grade of poisoning. The ventilator requirements in hypoglycaemics, euglycemics and hyperglycemics were 40%, 48% and 80% respectively. The outcome in terms of mortality was 8% in euglycemics group and 20% in hyperglycemics group. Hence hyperglycemia was found to be a poor prognostic marker in acute organophosphate poisoning. BS at admission in acute organophosphate poisoning patients is a simple, inexpensive tool that may help to predict the clinical outcome. Early identification of the poor prognostic indicators may help in timely intervention, to reduce morbidity and mortality, especially in a resource limited country like India.

Sheshan. V *Set al.*,<sup>16</sup> in their study mentioned that, out of 90 patients, 18 patients had RBS levels above 200 and 72 patients had RBS levels less than 200. Out of 18 patients, 7 had mild POP scale, 8 had moderate POP scale and 3 had severe POP scale. There were 7 mortality (2-mild, 2-moderate and 3 severe POP scale) in above 200 RBS group. Only 2 mortality case noted in less than 200 RBS group which had moderate and severe POP scale each. Out of 18(100%) patients having RBS scores of above 200, there were 7(38.9%) mortality noted (2- mild, 2-moderate and 3 severe POP scale). Out of 72(100%) patients having RBS scores less than 200, there were 2(2.8%) mortality noted (1-moderate and 1 severe POP scale). Chi-square test was applied to check the association between POP scale and mortality. Chi-square test showed significant association between POP scale and mortality in group having above 200 RBS levels.

Glycaemic status and POP Scale at the time of presentation in OP poisoning may play a role in predicting the need for ICU, Ventilator and Mortality in peripheral health centres in developing countries.

### Conclusion

Our study shows important prognostic factors such as Creatine Phosphokinase, RBS and Serum amylase that help reducing the complications and mortality in OP poisoning.

Though ventilators are boon to patients with respiratory failure, early identification and intensive management are vital in reducing the mortality.

Therefore, serum amylase, CPK and RBS levels are among the important prognostic factors in OP poisoning.

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