“STUDY OF SERUM AMYLASE AND SERUM CHOLINESTERASE IN ORGANOPHOSPHORUS POISONING”

By

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Dissertation submitted to BLDE University, Vijayapur

In partial fulfilment of the requirements for the degree of

MD

in

General Medicine

UNDER THE GUIDANCE

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2015

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ABBREVIATIONS

OP	:	Organophosphorus
AV	:	Atrioventricular
PchE	:	Plasma Cholinesterase
PAM	:	Pralidoxime
IV	:	Intravenous
IM	:	Intramuscular
SO	:	Sphincter of Oddi
PEEP	:	Positive end expiratory pressure
POP	:	Peradeniya organophosphorus poisoning
N	:	Total number of patients
WHO	:	World Health Organization

ABSTRACT

Background and Objectives: Poisoning due to Organophosphorus (OP) compounds is most commonly seen. Earlier plasma cholinesterase level was used to assess the severity of poisoning and determine the clinical course. Presently serum amylase is being recommended as a better indicator of severity. Hence in this study correlation between plasma cholinesterase and serum amylase is being studied as a prognostic indicator in OP poisoning.

Methods: A observational study was conducted on eighty consecutive patients admitted to emergency wards and intensive care unit within 24 hours of OP intoxication to Shri B. M. Patil Medical College. Serial estimation of plasma cholinesterase and serum amylase was done at the time of admission, day 3, day 5.

Results: study revealed significant inhibition of plasma cholinesterase and elevation of serum amylase at admission in OP poisoning patients with subsequent return to normal values on day 5. The overall mean value of plasma cholinesterase at admission is 3369 U/L, and mean value of serum amylase at admission is 196.6 U/L.

Interpretation: plasma cholinesterase inhibition <10% is associated with high degree of mortality. Hyperamylasemia >200 U/L has poor prognosis and are more prone for respiratory failure. In such cases quick transfer of the patient to a intensive care unit will reduce the degree of mortality associated with OP poisoning.

Keywords : Organophosphorus poisoning, serum amylase, plasma cholinesterase.

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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 compounds are commonly used as pesticides. Pesticides are designed to kill various pests (both plants and insects). They are used in most countries around the world to protect agricultural and horticultural crops against damage. They are used at home and at work to assure a pest- free environment. Insecticides are the most commonly encountered pesticides in the developing countries; herbicides are more commonly encountered in developed countries. The importance of pesticides in India can be understood from fact that agriculture is major component of Indain economy. Incidence of poisoning by pesticides and consequent admission to the hospital has been increasing in recent decades.[2]

Organophosphorus ranks the foremost in the list of agents which cause acute pesticide poisoning. Causes of poisoning are suicidal, accidental and homicidal.[2] Suicidal poisoning is the most commonest cause in developing countries because of cheap and easy available in market. Their ease of access and socio cultural factors play important role in choice of organophosphorus compound as self poison .[3]

Organophosphorus compound inhibit the enzyme acetyl cholinesterase leading to accumulation of acetyl choline, which binds to muscarinic and nicotinic receptors throughout nervous system. Signs and symptoms of op poisoning are due to persistent acetylcholine hyperstimulation at muscarinic and nicotinic receptor sites.[4]

There are two forms of cholinesterase's one is true cholinesterase or acetyl cholinesterase, it is located in erythrocytes, neuromuscular junctions and grey matter of brain, another one is Pseudocholinesterase or plasma cholinesterase, is synthesized by liver and found in plasma, pancreas, heart and brain. Both these types of enzymes are inhibited by insecticide poisoning.

Number of studies has been done correlating between serum amylase and organophosphorus poisoning. No conclusion has been derived as whether serum amylase levels can be used along with cholinesterase levels for monitoring OP poisoning.

OBJECTIVE

- To study plasma cholinesterase and serum amylase levels in acute Organophosphorus poisoning.
- To correlate the serum amylase levels with clinical severity and outcome.

REVIEW OF LITERATURE

HISTORICAL REVIEW

The first known pesticide was probably elemental sulphur dust used in Sumeria about 4500 years ago. In recorded history, nicotine sulphate was extracted from tobacco leaves for use as an insecticide in the seventeenth century. In the nineteenth century pyrethrum derived from chrysanthemums, and rotenone derived from roots of tropical vegetables were introduced. After its discovery in 1939 by Paul Muller, dichlorodiphenyltrichloroethane (DDT) found widespread use.

In India, the use of pesticides began in 1948 with the introduction of DDT for the control of malaria and Benzene hexachloride (BHC) for locusts. Production of these compounds in India started in 1952.[5]

INCIDENCE OF ORGANOPHOSPHORUS POISONING

Poisoning by organophosphorus kills hundreds of thousands of people each year especially in developing countries. It is estimated that 3 million cases of pesticide poisonings occurs world- wide annually with 220,000 deaths, the majority are intentional. The WHO estimates, based on 2001 data, that 849,000 people die globally from self harm each year. However , poisoning is the commonest form of fatal self – harm in rural Asia, accounting for over 60% of all deaths. [6] Pesticides are common means of self poisoning in many rural areas and is associated with high mortality rate.[7] In India use of insecticides accounted for 67% of total pesticide consumption in 2006.

The effective number of cases of pesticide poisoning occurring in India annually has been estimated by G . Ravi et al in 2007 is 76,000. Gunell et al , in 2007 calculated that the number of intentional cases are 126,000 annually. [8]

Organophosphorus compounds bind to cholinesterase molecules and share a similar chemical structure. Normally the cholinesterases rapidly hydrolyze the neurotransmitter acetylcholine into inactive fragments of choline and acetic acid after the completion of neurochemical transmission.

Acetylcholine is a neurotransmitter found throughout the central nervous system, the sympathetic and parasympathetic autonomic ganglia, postganglionic parasympathetic nervous system, most sympathetic glands and at the skeletal muscle motor end plate. The major toxicity of organophosphorus compounds is the covalent binding of phosphate radicals to the active sites of the cholinesterase's, transforming them in to enzymatically inert proteins.[9] Acetylcholine binds to and activates muscarinic and nicotinic receptors. Activating muscarinic receptor stimulates or inhibits cellular function through G protein at visceral smooth muscle, cardiac muscle and secretory glands. On the other hand, nicotinic receptors are Na^+channels at post synaptic membranes in autonomic ganglia and at skeletal muscle motor end plates.

The actions of acetylcholine in the body depend on the receptor involved and site.

Actions of acetylcholine at muscarinic receptor are as follows:

Site	**Action**
Heart	Bradycardia Cardiac arrest AV block
Blood vessels	Vasodilation, which in turn causes fall in blood pressure and flushing.
Smooth muscle:	
A Gastrointestinal	Increases contraction
B Bronchial	Constriction
C Bladder	Detrusor contraction and sphincter relaxation
Glands	Increased secretions (Sweat, saliva, lacrimal, gastric and tracheobronchial)
Eye	Constriction of circular muscles of iris which causes Miosis

Actions of acetylcholine at nicotinic receptors are as follows:

- At skeletal muscles it produces twitching and fasciculation.
- At autonomic ganglia it causes stimulation which in turn causes tachycardia and rise in blood pressure.
- Acetylcholine in brain causes stimulation, then depression.

True cholinesterase (RBC cholinesterase or Acetyl cholinesterase)

True cholinesterase is also a tetramer of four identical subunits. The enzyme is a glycoprotein containing 16% of carbohydrates and is found in nerves, neuromuscular junctions and erythrocytes.

Plasma cholinesterase (pseudo or serum cholinesterase)

Plasma cholinesterase also known as pseudo cholinesterase (PchE). Plasma cholinesterase is synthesized by liver and is found in plasma, pancreas, heart and brain. It is Alpha 2 globulin, a tetramer of 342000 molecular weight, that exists in aggregate form.[10] its serum half-life is 8 to 12 days. The gene coding for plasma cholinesterase is situated on chromosome 3. Pseudo cholinesterase is deficient in Vysya community.

Decreased plasma cholinesterase activity-

Plasma cholinesterase deficiency could be due to physiological variation, disease, iatrogenic causes and genetic defects.

Physiological variations:

A newborn has 50% plasma cholinesterase activity; its activity reaches normal levels at puberty. In old age (i.e. 75- 80 years), the activity is 75% of normal. Reductions in plasma cholinesterase activity are said to begin approximately in the 10^{th} week of pregnancy, with further decreases postpartum before normalizing

between 10 days and 6 weeks postpartum. Activity is said to be reduced 24% during pregnancy, 25% at 1 day postpartum, and at 33% at 3 days postpartum. 60% of individuals are with HELLP Syndrome; this effect is due to liver damage seen in HELLP syndrome.[11]

Disease:

Plasma cholinesterase is primarily synthesized in the liver. When liver function is impaired, plasma cholinesterase synthesis is also impaired. Plasma cholinesterase activity decreases to 30% to 50% in acute hepatitis, 50% decrease in Liver cirrhosis and liver metastasis. In patients with end-stage liver disease, normal plasma cholinesterase levels were again seen after liver transplant, with the transplanted liver assuming the role of production immediately.[12]

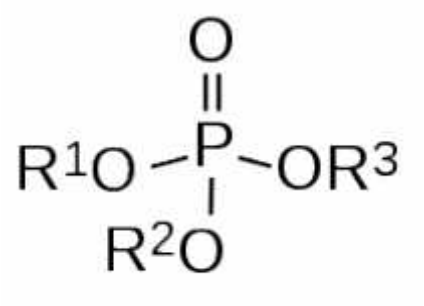
Plasma cholinesterase activity was found to be 2 standard deviations below normal in 60% of individuals with renal failure. Those undergoing renal transplantation experienced an initial drop in plasma cholinesterase activity, with subsequent normalization approximately 15 days after transplant.[13]

Reduction of plasma cholinesterase activity up to 37% with the initiation of cardiopulmonary bypass, with values remaining low after the termination of bypass.[14] Plasma cholinesterase was reduced in population with leprosy.[15]

Drugs that reduce plasma cholinesterase are Organophosphorus and organocarbamate compounds and anticancer compounds (Cyclophosphamide), Ecothiophate eye drops, Bambuterol (bronchodilator).

ORGANOPHOSPHORUS COMPOUNDS

Organophosphorus compounds are available as spray dust, emulsions and granular formulations. The general formula of organophosphorus compounds is as follows;



The basic structure phosphorus, which is bound to oxygen (O) by a double bond, R1 and R2 are alkyl, alkoxy, aryloxy, amido, mercaptan or other groups. R3 represents the leaving group, a conjugate base of a weak acid is found as a cyanide, halide, thiocyanate, phenoxy, and thiocholine or carboxylate group.

Organophosphorus compounds inhibit enzyme acetyl cholinesterase. The mechanism of inhibition of the enzyme is by reacting with the esteratic site of acetyl cholinesterase molecule. The bond formed between the phosphorus and the esteratic site of the enzyme is stable and requires hours to weeks to reverse depending on the type of organophosphorus compounds. The phosphorylated enzyme is inhibited because of occupation of its active site. It is incapable of carrying out its normal function of hydrolysing acetyl choline.

The effect of organophosphorus compound poisoning is therefore the result of continuous increased production of acetylcholine at the neuromuscular junctions resulting in a depolarization block. This phosphorylated enzyme can undergo spontaneous hydrolysis or dealkylation. Due to the active hydrolysis, the active enzyme cholinesterase is released, and this is called reactivation. The phosphorylated enzyme can also undergo dealkylation. Once this occurs reactivation is impossible.

This process is called ageing and this period is known as “critical interval” because during this period administration of antidote is still effective in reversing the process. Once ageing occurs, recovery of cholinesterase activity depends on the synthesis of new enzyme by liver, which takes days or weeks. There are three independent reactions determine the speed of onset and severity of poisoning i.e., Phosphorylation of cholinesterase by organophosphorus compounds, reactivation, and ageing.

Organophosphorus compounds are divided into two series of compounds, alkyl phosphates (direct inhibitors) like malathion and arylphosphates (indirect inhibitors) like parathion. Poisoning by direct inhibitors of acetyl cholinesterase presents as an acute cholinergic crisis, they do not develop late type muscular weakness. Response to atropine is rapid. Indirect inhibitors do not show the signs of cholinergic crisis but show persistent fasciculation’s along with sudden increase in atropine requirement. The incidence of development of late type muscular weakness is high.

In acute poisoning, manifestations generally occur only after more than 50% serum cholinesterase is inhibited and severity of manifestations parallels the degree of inhibition of acetyl cholinesterase activity.

- Mild poisoning - cholinesterase levels reduces to 20- 50%
- Moderate poisoning - cholinesterase levels reduces to 10- 20%
- Severe poisoning - cholinesterase levels reduces to less than 10%.

Organophosphorus compounds-

Compound Name	Chemical Structure
Abate	- O,O,O'O'tetramethyl O,O thiodi- p-phenylenephosphorotioate.
Azinphos-methyl	S (2,4-dihydro 4 oxobenzo (d)(1,2,3,) triazin 3-yl methyl O,O Di methyl phosphorodithiote.
Bidrin	3 hydroxy- N,N dimethyl cis- crotonamide dimethyl phosphate
Carbophenothion	S- ((p- chlorophenylthiomethyl) O,O diethyl phosphoro - Dithioate
Chlorothion	O,O dimethyl O(3- chloro 4 nitrophenyl) phosphorothioate
Coumaphos	O,O diethyl O-(3-chloro 4-methyl 2-oxo 2H-1-benzopyran 7-yl) Phosphorothioate
DEF	S,S,S- tributylphosphorothioate
Demeton	beta ethyl mercapto ethyl diethytthiono phosphate
DFP	di isopropyl phosphorofluoridate
Diazinon	O,O diethyl O-(2- isopropyl 4 methyl- 6 pyrimidyl) phosphorothioate
Dicapthon	O,O dimethyl O-(2-chloro-4-nitrophenyl) phosphorothioate
Dichlovos	O,2,2 dichlorovinyl O,O di-methyl phosphate
Dimethoate	O,O dimethyl S(N- methyl carbomyl methyl) phosphoro- Dithioate
Dioxathon	S,S' p-dioxane-2,3 diyl-O.O.-diethyl phosphorodithioate
Disulfoton	O,O diethyl S(2- ethylthiol-ethyl) phosphorodithioate
Echothiophate	2 diethoxyphosphinylthioethyltrimethyl ammonium
EPN	Ethoxy-4-nitro phenoxy phenyl phosphine sufide

Ethion	O-O-O'O'- tetraethyl S,S'- methylene bisphosphorodithioate
Fenthion	O,O-dimethyl O(4-(methyl thio)-m- tolyl)phosphorothioate
Monocrotophos	Dimethyl (E)-1-methyl-2-(methylcarbamoyl)vinyl phosphate
Malaoxon	S-(1,2 bis(ethoxy carbonyl) ethyl) O,O dimethyl phosphorothioate
Malathion	S(1,2 bis (ethoxy carbonyl)-ethyl) O, O - dimethyl phosphorodithioate
Menazon	S,((4,6,diamino-s-triazin-syl)methyl) O,O- dimethyl phosphoro-Dithioate
Merphos	Tributylphosphorotrithioate
Methyl demeton	O,O-dimethyl S- (2- ethyl sulfonyl) ethyl) phosphorothioate

CLINICAL FEATURES-

Acute organophosphorus poisoning is characterized by the following clinical features depending upon receptors involved like:

1. ACUTE CHOLINERGIC SYNDROME - (Acute muscarinic syndrome / Wadia type-1syndrome). It usually lasts 24- 48 hours. Its manifestations include

1.1 Ophthalmologic: Opthalmic manifestations are miosis, lacrimation and blurred vision or dim vision.

1.2 Cardiovascular: Cardiovascular manifestations are based on type of receptors involved. If muscarinic receptors are involved it cause hypotension and bradycardia. If nicotinic receptors are involved it cause hypertension and tachycardia. Other manifestations are arrhythmias (atrial fibrillation, ventricular tachycardia), Q-Tc prolongation and transient elevation of ST segment.[16]

1.3 Respiratory: Respiratory manifestations are Bronchial hypersecretion and Wheezing (muscarinic), muscle weakness or paralysis of respiratory center (nicotinic) and non- cardiogenic pulmonary oedema (severe exposure).

1.4 Neurologic: Neurological manifestations are miosis, impaired consciousness, fasciculation's, convulsions, toxic delirium and paralysis. Toxic delirium was due to treatment with atropine. Paralytic signs were divided in to

1.4.1 Type 1 (present on admission) signs are impaired consciousness and bilateral pyramidal tract signs, respond to atropine.

1.4.2 Type 2 (appearing later while on atropine treatment) signs are proximal limb weakness, areflexia and cranial nerve palsies.[17]

1.5 Gastrointestinal: Excessive salivation, gastrointestinal smooth muscle contraction resulting in nausea, vomiting, diarrhoea, faecal incontinence and intestinal cramping (muscarinic).[9]

1.6 Genitourinary: Urinary incontinence (muscarinic).

1.7 Hematologic: inhibition of acetyl cholinesterase.

1.8 Dermatologic: Sweating (muscarinic).

1.9 Immunity: organophosphorus compounds adversely affect the immune system; causing cell mediated immune deficiency, allergy and auto immunity.[18]

1.10 Musculoskeletal: skeletal muscle fasciculation's and twitching, weakness and paralysis (nicotinic).

1.11 Metabolic and Endocrine: an increase of plasma corticosterone, TSH concentration, and glycosuria. Hyperamylasemia occurred in 22% of organophosphorus poisoning patients .[19]

1.12 Vocal cord: organophosphorus poisoning cause vocal cord paralysis.

1.13 Temperature regulation: Hypothermia (muscle paralysis and excessive diaphoresis).

2 INTERMEDIATE SYNDROME:

First termed by Wadia et.al in 1974 as type of paralysis, it is a syndrome characterized by muscle paralysis following the acute cholinergic phase.[17]The terminology was later changed by Senanayake and Karalliedde in 1987 to Intermediate syndrome due to the fact that it arises between the period of early cholinergic syndrome and the late onset peripheral neuropathy.[20] It's incidence in different studies reported between 20-68%.[21] The intermediate syndrome which occurs 12-96 hours after acute cholinergic crisis is characterized by the following clinical features are muscular weakness in the ocular, neck, bulbar, proximal limb and respiratory muscles with occasional dystonic posturing. Complete recovery occurs within 4- 18 days if adequate ventilatory support is provided. Parathion was the causative agent in upto 75% of these cases in a medline search study between 1965 and 1985.

3 DELAYED POLYNEUROPATHY-

Delayed polyneuropathy usually sets in 7- 14 days after the exposure to organophosphorus agent results in disability due to symmetrical peripheral muscle weakness. The sensory component if present is milder than the motor component.[22]The mixed sensory- motor neuropathy usually begins in the legs causing burning or tingling, then weakness and ataxia.

Severe cases progress to complete paralysis, impaired respiration and death. The nerve damage of organophosphate- induced delayed neuropathy is frequently permanent. Mechanisms appears to involve phosphorylation of esterases in peripheral nervous tissue and results in a "dying back" pattern of axonal degeneration. Recovery

requires weeks to months, and may never be complete. There seems to be no relationship between the severity of acute cholinergic effects and delayed neurotoxicity.

4 OTHER MANIFESTATIONS-

Other manifestations of organophosphorus poisoning include the following:

4.1 Landry- Guillian-Barry syndrome

4.2 Delayed neurotoxicity, which appears 8-10 days following exposure and lasts for weeks and months.

4.3 Hyperamylasaemia and acute pancreatitis have been reported after oral or dermal exposure in man.

Diagnosis:

1. History or evidence of exposure to organophosphate
2. Signs and symptoms of poisoning
3. Improvement of these signs and symptoms after the administration of pralidoxime and atropine
4. Inhibition of cholinesterase activity of blood.

In most patients, history of consumption of organophosphorus insecticide can be obtained. After suicidal attempt a container is often found. Most organophosphorus used as insecticide has characteristic garlic like odour and patients who have ingested or absorbed these compounds usually retain such an odour for several days. The organophosphorus compound can frequently identified in gastric aspirate, skin urine or clothing by use of gas or thin layer chromatography, or by demonstration of anticholinesterase activity in vitro. Metabolites of organophosphorus may also be

detected in gastric aspirate, blood or urine. P- nitrophenol is a metabolite of parathion, methyl- parathion chlorthion, dicapthon and EPN and its detection in urine indicates prior exposure to one of these or related compounds. However, a history of exposure and detection of organophosphorus compound or its metabolites does not always indicate that signs and symptoms are due to organophosphorus poisoning since the patients may have other diseases. Signs and symptoms do not occur unless the amount of absorbed organophosphorus is so great acetyl cholinesterase of synapses is inhibited over the critical level.

The signs of organophosphorus poisoning that are most helpful diagnosis are miosis and muscular fasciculation which are almost always present in moderately or severe poisoning. Other signs that are helpful in the diagnosis include excess salivation, sweating Lacrimation and bronchial secretions. The occurrence of frothy sputum and basal pulmonary rates may lead to an erroneous diagnosis of pulmonary edema. Careful observation of the effect of pralidoxime and atropine is valuable for differential diagnosis. Intravenous injection of 1gm pralidoxime generally causes some recovery from signs and symptoms, particularly in parathion poisoning. Patients with organophosphorus poisoning are resistant to the action of atropine, and therefore failure of 1- 2mg of atropine administered parenterally to produce signs of atropinisation (flushing, mydriasis, tachycardia, or dryness of the mouth and nose) indicates organophosphorus poisoning, whereas the occurrence of these signs casts doubt in the diagnosis or indicated that poisoning is of mild degree.

Inhibition of cholinesterase activity of the blood is the most specific test for the systemic absorption of an organophosphorus anticholinesterase compound. Most of the organophosphorus compound used as insecticides inhibit both pseudo cholinesterase and acetyl cholinesterase. Estimation of erythrocyte cholinesterase is

theoretically preferred, since it would reflect the degree of inhibition of synaptic cholinesterase. Estimation of plasma cholinesterase (pseudo cholinesterase) has an advantage because the measurement is simpler and more accurate than estimation of erythrocyte cholinesterase following pralidoxime administration. Erythrocyte cholinesterase indicates the effectiveness of pralidoxime and plasma cholinesterase indicates the prior presence of cholinesterase inhibition even after the recovery erythrocyte cholinesterase activity by pralidoxime.

The correlation between the degree of plasma cholinesterase inhibition and the severity of manifestations is present only in the initial stage of acute poisoning and inhibition is greater in repeated exposures, inhibition remains even after recovery from symptoms.

In severe poisoning return to normal level requires about 3-4 weeks for plasma cholinesterase and about 5 weeks or more for erythrocyte cholinesterase when pralidoxime is not administered. Therefore plasma cholinesterase seems to recover far more rapidly than true cholinesterase.

Causes of death in organophosphorus poisoning:

1) Respiratory causes[23]
    - Respiratory failure due to excess bronchial secretions
    - Bronchospasm
    - Pulmonary edema
    - Respiratory muscle paralysis
    - Respiratory failure of central origin
2) Cardiovascular causes can be:
    - Arrhythmias
    - Heart block

- Circulatory collapse

3) Central nervous system causes are:
   - Convulsions
   - Respiratory center depression leading to respiratory failure
   - Severe anoxia and brain damage
4) Intermediate syndrome

The factors which help in assessing the severity and outcome in organophosphorus poisoning are;

1) Toxicity of chemical consumed
2) Dose and concentration of poison
3) Time interval between ingestion and treatment
4) Sex of the patient
5) Age of the patient
6) Route of exposure
7) Grade of poisoning
8) Cholinesterase level in blood.

1. Toxicity of the chemical compound:

Organophosphorus compounds are classified based on the toxicity into most dangerous, dangerous, less dangerous and least dangerous compounds. Most dangerous compounds are tetra ethyl pyrophosphate (TEPP), chlorpyriphos, monocrotophos. Dangerous compounds are diazinon, dichlorous, ethion. Less dangerous compounds are dimethoate, trichlorfon. Least dangerous compounds are chlorthion and malathion. There is increased mortality in patients who consume the most dangerous organophosphorus compounds than the least dangerous.

2. Dose and concentration of poison:

There will be higher mortality in patients who consume large quantity Higher rate of mortality in those consuming >40 ml than those consuming <40ml .[24]

3. Time interval between ingestion of organophosphorus compound and treatment:

As the time interval between the consumption of poison and hospital admission increases the mortality also increases because a greater amount of the compound gets absorbed into the systemic circulation.[25] The time interval is also important because the bond formed between the organophosphorus compounds with the cholinesterase enzyme is initially reversible which after sometime becomes irreversible. This is called ageing. Once ageing occurs, the recovery of cholinesterase activity depends on the synthesis of the new enzyme by the liver, which takes days or weeks.

4. **Sex of patient**:

In the study conducted showed preponderance of females compared to males.[24,26] In a study conducted by Ramesha et al[27] showed male preponderance.

5. Age of the patient:

The younger age group is more susceptible than older age group(18-35 yrs) as the enzymes like mixed function oxidases which metabolize organophosphorus compounds are less matured in young individuals[26].

6. Route of exposure to organophosphorus compounds:

Poisoning by route of ingestion is more toxic compared to other routes like inhalation or cutaneous exposure.

7. Grade of organophosphorus poisoning:

Clinical grading of organophosphorus poisoning has been described by various workers- Dreisbach[28], POP scale[29].The higher grade is associated with increased mortality.

8. Cholinesterase level in blood:

Plasma cholinesterase levels are decreased in blood in organophosphorus poisoning. Nambe. T et al (1971) first studied the correlation of plasma cholinesterase activity with severity of organophosphorus poisoning. [4]

MONITORING:

- Body temperature
- Blood pressure
- Level of consciousness
- Respiratory rate
- Minute volume
- Pulse oximetry
- Fluid balance
- Continuous cardiac monitoring for dysrrhythmias and ischemia.
- Blood/ serum chemistry:
  - Serum electrolytes, random blood glucose, serum creatinine
  - Hematology (including white cell count as leukocytosis is common)
  - Plasma cholinesterase
  - Serum Amylase
  - Arterial blood gas.

- Urine analysis: Estimation of excretory products of organophosphorus agents.
- Chest radiograph
- Ultrasound/ CT scan: To evaluate pancreatic status.

MANAGEMENT OF ORGANOPHOSPHATE POISONING

Treatment includes

1. Maintenance of vitals
2. Minimizing further absorption
3. Specific antidotes to counter the effects of poisoning
4. Supportive measures

1. Maintenance of vitals:

Ensure a patient airway by frequent suctioning. Endotracheal intubation may be necessary to protect the airway from aspiration and guarantee the adequate tissue oxygenation. Maintain hemodynamic status using the specific treatment.

2. Minimizing the further absorption:

2.1 Dermal exopsure:

Contaminated clothing should be removed from the body; skin should be washed thoroughly with soap and water or with hypochlorite (household bleach).

2.2 Gastric lavage:

Gastric lavage is indicated once patient is stabilized, calm enough to give consent and in unconscious intubated patient, which is recommended to be repeated after 2-3 hrs[30].Though it has been recommended only to be carried out within 1-2 hrs of ingestion op/carbamate elsewhere it has been started even after 12 hrs of ingestion and repeated thrice at an interval of 4 hrs[31]. After aspirating the contents of Ryle's

tube, water or normal saline about 300ml to be given and aspirated. Continue it till the returning fluid is colourless and odourless.

Lavage fluid:

2.2.1 Lavage with 150 to 200 millilitres/Kg normal saline per wash (in children over 5 years or adults) and 10 millilitres/ kilogram body weight of normal saline in young children. Continue until lavage return is clear.

2.2.2 The volume of lavage return should approximate amount of fluid given to avoid fluid- electrolyte imbalance.

Caution: avoid the risk of electrolyte imbalance and water intoxication and hypothermia in young children and the elderly.

Complications are aspiration pneumonia, hypoxia, hypercapnia, mechanical injury to the throat, oesophagus or stomach, fluid and electrolyte imbalance.

2.3 Activated charcoal:

Single –dose activated charcoal should not be administered routinely in the management of poisoned patients. The effectiveness of activated charcoal decreases with time, greatest benefit is within one hour of ingestion. There is no evidence that administration of charcoal is contraindicated. [32]

3. Specific antidotes of organophosphorus poisoning:

There are two antidotes available for treatment of organophosphorus poisoning.

3.1 Anticholinergics agents

3.1.1 Atropine sulphate

3.1.2 glycopyyrolate

3.2 Oximes

3.1.1Atropine:

According to WHO atropine, recommended doses are as follows:

Mild cases : 1-2 mg IM/IV repeated every 30 minutes.

Moderate cases : 2-4mg IM/IV repeated every 10 minutes.

Severe cases : 4-6mg IM/IV repeated every 3-8 minutes.

Doses should be repeated till signs of atropinisation (drying of pulmonary secretions) occur. A state of mild atropinisation should always be maintained. Drying of excessive secretions is a preferable indicator for completeness of atropinisation rather than heart rate or pupil size, because tachycardia and mydriasis can be signs of nicotinic effects of severe organophosphorus poisoning. Also miosis can persist, thus resolution of miosis should not be used as a therapeutic end point.

Paediatric treatment with atropine comprises of dose 0.02- 0.05 mg/kg every 10-30 minutes. Continuous infusions of atropine can be used in the dose of 0.02- 0.08 mg/kg/hr this regimen saves time, requires less observation, produce less fluctuation in plasma atropine concentration and makes weaning easier.[33]

If a patient is hypoxic and cyanosed, it should be corrected before atropine administration, in order to avoid the risk of ventricular tachycardia as associated with hypoxia.

Inhalational atropine:

As an adjunct to intravenous atropine, atropine sulphate 2 milligrams via hand-held nebulizer may be used intermittently to treat local pulmonary effects.

3.1.2 Glycopyyrolate:

A quaternary ammonium compound with its high selectivity for peripheral cholinergic sites has been a useful drug in organophosphorus intoxication for controlling secretions, with minimal side effects compared to atropine.

Glycopyyrolate has the advantages of better secretion control, less tachycardia, and inability to cross the blood brain barrier; but it is less effective in treating bradycardia and may not affect central neurologic effects from organophosphorus.

3.2 Oximes:

Several oximes have been used in the management of acute organophosphorus poisoning.[34] These include:

3.2.1 Pralidoxime

3.2.2 Obidoxime

3.2.1 Pralidoxime (PAM):

It is a cholinesterase deactivator. Chemically is pyridine-2-aldoxime methyl chloride.

Types-

- Pralidoxime iodide
- Pralidoxime chloride
- Pralidoxime methyl sulphate

Indications:

Severe poisoning with nicotinic (muscle and diaphragmatic weakness, fasciculation, muscle cramps, etc) and/ or central (coma, seizures) manifestations should be treated with PAM in addition to atropine.

Mechanism of action:

- A direct action converting the inhibitor to harmless compound.
- A transient reaction protecting the enzyme from prolonged inhibition.
- Reactivation of the inhibited alkyl phosphorylated enzyme to free the active unit.[34]

Pralidoxime does not reverse the muscarinic manifestations of organophosphorus compounds. It has a short elimination half- life of 1-2 hr when given IV. Effect of pralidoxime is seen within 10-40 minutes. Pralidoxime is probably more effective when administered in the first 1-3 hrs.

Pralidoxime chloride is a useful agent in the treatment of organophosphorus poisoning. Poisindex, a widely used poisoning treatment resource, recommends dosing pralidoxime chloride as an intermittent IV infusion every 8-12 hrs, whereas others have used continuous IV infusions with good results. Available animal data suggest that a serum concentration of 4 micrograms/ml may be a minimal level to protect against the toxic effects of organophosphorus poisoning. Pharmacokinetic simulations, based on parameters obtained from healthy non-poisoned subjects, show that pralidoxime levels fall rapidly to less than 4 micrograms/ ml within 1.5-2 hrs after a 1 gm IV bolus. Continuous IV infusion (0.5 gm/hr) maintains pralidoxime levels greater than 4 micrograms/ ml throughout the length of infusion.

Dose in adults is 1-2 gms intravenously mixed in 250 millilitres of normal saline and infused over 20 to 30 minutes, in view of short elimination half- life of pralidoxime, a continuous infusion of 0.5 gm/hr would produce constant therapeutic concentration. In cases where intravenous administration is not possible, pralidoxime can be given intramuscularly at an initial dose of 1 gram in 3 millilitres of diluents. Dose of pralidoxime in children is 20 milligrams per kg diluted to a 5 percent concentration in normal saline and infused. It can be repeated with 1 gram after 20 min if no improvement is seen. Maximum recommended dose is 12 grams in 24 hours for adults.

Adverse reactions:

- Minimal toxicity- when administered as directed, pralidoxime has minimal toxicity. Dizziness, nausea and dry mouth may occur.
- Neuromuscular blockade- high doses have been reported to cause neuromuscular blockade.
- Visual disturbance- oximes may produce visual disturbances and transient increase in intraocular pressure.
- Asystole- pralidoxime administered intravenously at an infusion rate of 2 grams over 10 minutes may result in asystole.
- Atropine side effects- concomitant administration of pralidoxime may enhance the side effects of atropine administration.[30]

3.2.2 Obidoxime:

Obidoximedichloride may be a less toxic and more efficacious alternative to pralidoxime in poisonings from organophosphates containing a dimethoxy or diethoxy moiety. It is apparently favoured over pralidoxime in clinical practice in Belgium, Israel, The Netherlands, Scandinavia and West Germany and is the only oxime available in Portugal.

- Obidoxime may be given as an intravenous or intramuscular injection of 250 milligrams to achieve a therapeutic blood level of 4 milligrams per litre.
- Subsequent injections of 250 milligrams every 2 hours or continuous infusion of 35 milligrams per hour.
- Adverse effects of obidoxime in humans may include hypertension, facial warmth and numbness.

EXPERIMENTAL THERAPY:

1. Benzodiazepines- these are useful adjuncts to atropine. They increase survival and decrease the incidence of associated neuropathies.
2. Sodium bicarbonate- alkalinisation of the serum to pH 7.5 may be useful as hydrolysis of the esteratic portion of the organophosphorus molecule.
3. Adenosine receptor agonists
4. Glutamate receptor antagonists- e.g. felbamate and selective NMDA receptor channel blockers such as dizocilpone and procyclidine.
5. Clonidine- blocks acetylcholine release but also causes transient inhibition of acetyl cholinesterase.
6. Heamoperfusion.
7. Annealed erythrocytes- can constantly remove organophosphorus compound that is being slowly released into the blood stream from fatty tissues.
8. HI-6 (Asoxime chloride)

   An alternative oxime, has excellent acetyl cholinesterase regenerating action. HI-6 is three to five times more effective than 2-PAM Cl. HI-6 has been administered as a single intramuscular injection of 500mg, administered 4 times daily for a maximum of 7 days, in conjunction with atropine and diazepam therapy, for organophosphorus poisoning.
9. Pyridostigmine

   It is an inhibitor of acetyl cholinesterase and protects the enzyme against inhibitory effects of nerve agents.
10. TMB-4 (trimedoxime)
11. BI-6 (Bispyridinium oxime)
12. Magnesium :

Ventricular premature contractions were successfully eliminated; it was thought to counteract direct toxic inhibitory effect of organophosphorus agents on Na-K ATPase and inhibitory effect on acetylcholine release.

Supportive measures:

- Supplemental oxygenation
- Frequent suctioning of secretions
- Fluid replacement to prevent dehydration
- Antibiotics to check aspiration pneumonia and nosocomial infections
- Inhaled beta agonists to treat bronchospasm if atropine alone is inadequate
- Standard antiarrhythmic agents may be required to treat dysarrhythmias

COMPLICATIONS OF ORGANOPHOSPHORUS POISONING-

MANAGEMENT-

- Seizures

  Administer a benzodiazepine

  Diazepam IV (adult: 5 to 10 mg repeats every 10- 15 min as needed.

  Child: 0.2- 0.5 mg/ kg, repeat every 5 min as needed).

  If seizures recur, Phenobarbital 30 mg (adults) or 10 mg (children > 5 yrs).

- Pulmonary edema (non-cardiogenic):

  Maintain ventilation and oxygenation and evaluate with frequent arterial blood gas or pulse oximetry monitoring. Early use of PEEP and mechanical ventilation may be needed.

- Hypotension:

  Infuse 10- 20 mL/ kg isotonic fluid

  Place in trendelenburg position.

If hypotension persists, administer dopamine (2.5 to 20 mcg/kg/min) or norepinephrine (0.1- 0.2 mcg/kg/min), titrate to desired response.

- Eye exposure:

  Irrigate exposed eyes with copious amounts of tepid water for atleast 15 minutes.

PATHOPHYSIOLOGY OF SERUM AMYLASE

The serum amylase concentration reflects the balance between the rate of amylase entry into and removal from the blood. The pancreas and salivary glands have amylase concentrations that are several orders of magnitude greater than that of any other normal tissue, and these two organs probably account for almost all of the serum amylase activity in normal persons.

Cholinergic stimulation of the pancreas and the Sphincter of Oddi (SO) results in both increased pancreatic secretion and increased SO activity in animal models. It has been shown that excessive cholinergic stimulation using an acetylcholine agonist can result in acute pancreatitis. In animal models organophosphorus results in acute pancreatitis associated with raised pancreatic duct pressure. This is thought to be secondary to "obstruction" at the SO level coupled with cholinergic stimulation of pancreatic secretion[35.]

Organophosphorus compound irreversibly inhibits cholinesterase resulting in delayed breakdown of synaptic acetylcholine and has been noted to cause acute pancreatitis in humans. Organophosphorus compound causes prolonged hyperstimulation of pancreatic acinar cells.[36] Excessive exocrine secretion from pancreas increases internal pressure of the pancreatic duct due to Sphincter of Oddi contraction. Effect of organophosphorus on pancreas disappears in approximately 72 hrs and complicated acute pancreatitis often improves in 3-5 days.[37] The mortality

rate of hospitalized acute pancreatitic patients is between 5 and 10%.[36] Acute pancreatitis in organophosphorus poisoning is more common. Serum pancreatic enzymes and appropriate imaging studies should be done. Awareness of this complication should prompt earlier investigation because early diagnosis coupled with timely therapeutic measures may improve the patient's prognosis. Some reports suggest OP is associated with severe necrotic pancreatitis or pancreatic pseudocyst.[38]

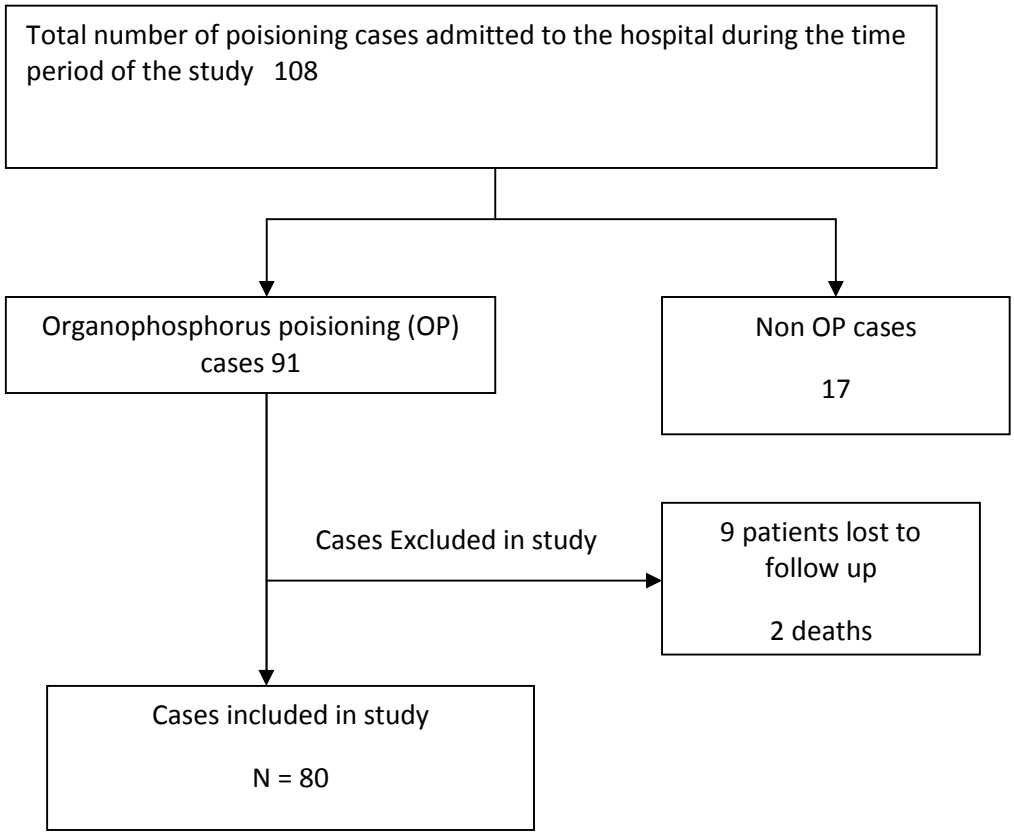
MATERIALS AND METHODS

A observational study was undertaken in eighty Consecutive patients of either sex, age >15 yrs, with history of consumption of organophosphorus poison with characteristic clinical symptoms and signs admitted to _____ _____Karnataka.

Presumptive diagnosis of organophosphorus poisoning was made based on history, circumstantial evidence and characteristic clinical features. Basic laboratory investigations were undertaken and treatment given. Institutional ethical committee clearance was taken for the study

Diagnosis of poisoning was confirmed by forensic science laboratory analysis of gastric fluid.

Blood samples for serum amylase and plasma cholinesterase were collected during the following periods.



- Sample-1: At time of admission
- Sample-2: After 72 hours
- Sample-3: On the day of discharge.

Inclusion criteria

Patient admitted to hospital less than 24 hrs of history of poisoning

Exclusion criteria included:

- Chronic alcoholism
- History of pancreatitis
- Disease of salivary glands
- Associated cardiac, renal, hepatic or metabolic diseases
- Patients with neuromuscular disease
- Women on oral contraceptives and pregnant women

In addition to the above, following investigations were undertaken:

1. Random blood glucose estimation
2. Serum electrolytes (Sodium and Potassium)
3. Blood urea and serum creatinine
4. Complete blood picture
5. Chest radiograph
6. Electrocardiogram
7. HIV, HBs Ag
8. Liver function test
9. ABG (if necessary)

Statistical Method:

Data was analyzed using

Mean $\pm$ SD

Diagrammatic presentation

Correlation coefficient

Chi- square test

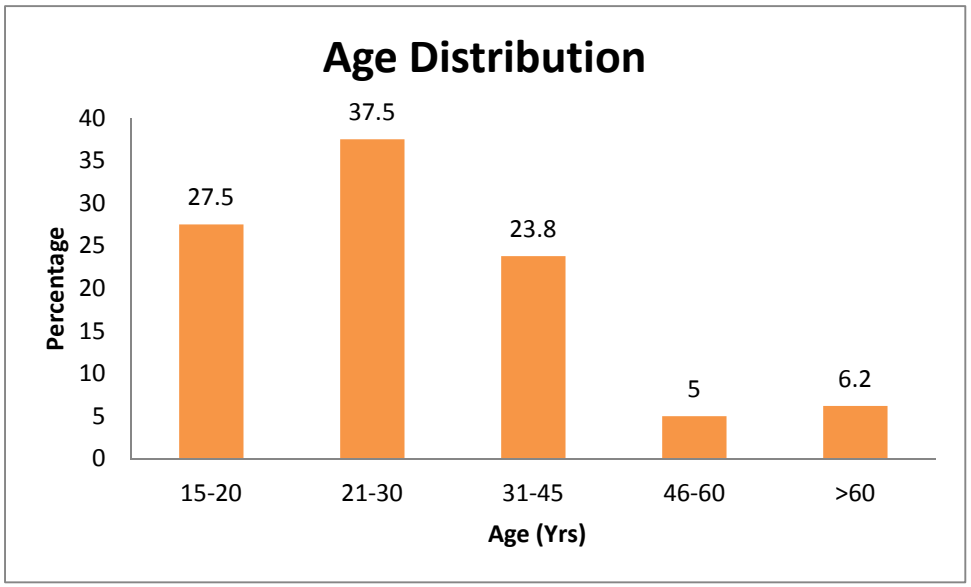
RESULTS

A hospital based, observational study was conducted between December 2013 to June 2015. A total of 80 patients were recruited into the study.

Table:1 Distribution of Age

Age (Yrs)	N	Percentage
15-20	22	27.5
21-30	30	37.5
31-45	19	23.8
46-60	4	5
>60	5	6.2
Total	80	100

Graph 1

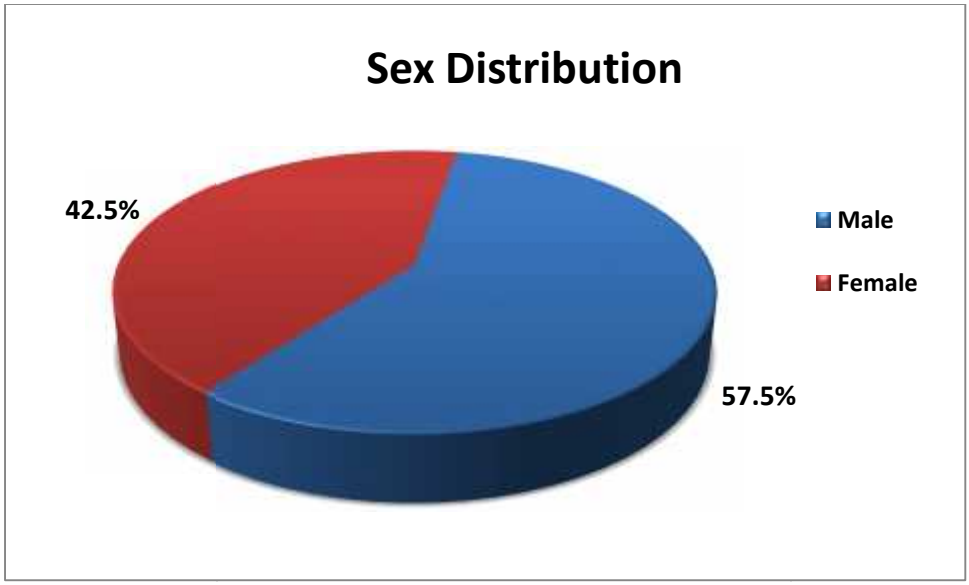


The age of the patients ranged between 16 years to 90 years, with mean age was 29.9 years. Maximum incidence of 37.5% was in the age group 21-30.

Table: 2 SEX Distribution

SEX	N	Percentage
Male	46	57.5
Female	34	42.5
Total	80	100

Graph 2

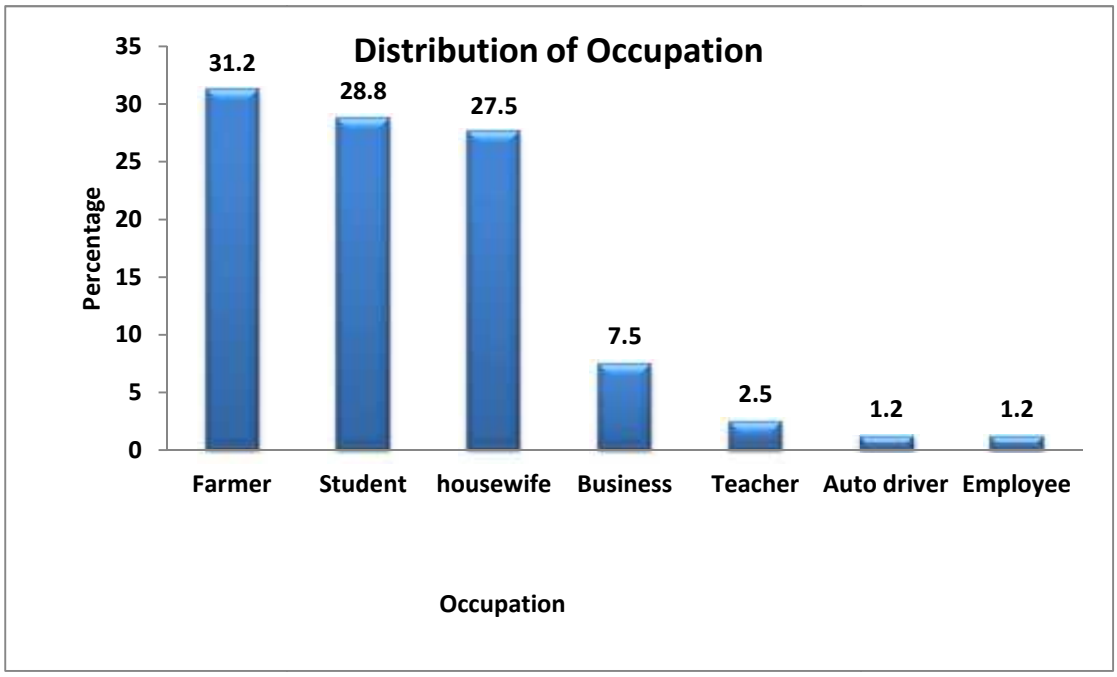


In our study of 80 patients, 46 (57.5%) were males and 34(42.5%) were females. There was male preponderance.

Table: 3 Distribution of OCCUPATION

OCCUPATION	N	Percentage
Farmer	25	31.2
Student	23	28.8
housewife	22	27.5
Business	6	7.5
Teacher	2	2.5
Auto driver	1	1.2
Employee	1	1.2
Total	80	100

Graph 3

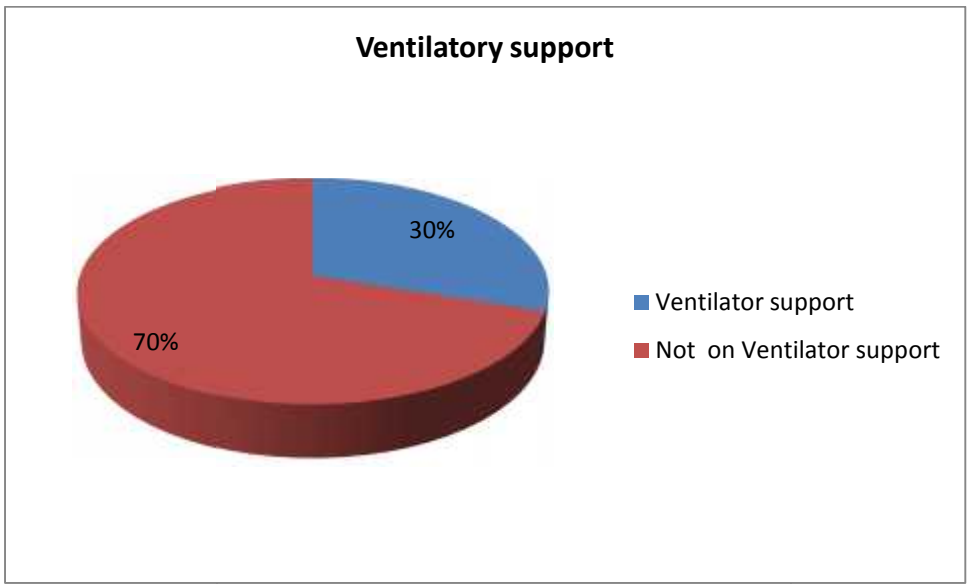


In our study of 80 patients, organophosphorus poisoning was most common among farmers(31.2%), next followed by students(28.8%).

Table: 4 Distribution of Ventilator support

REMARKS	N	Percentage
Ventilator support	24	30.0
Not on Ventilator support	56	70.0

Graph 4

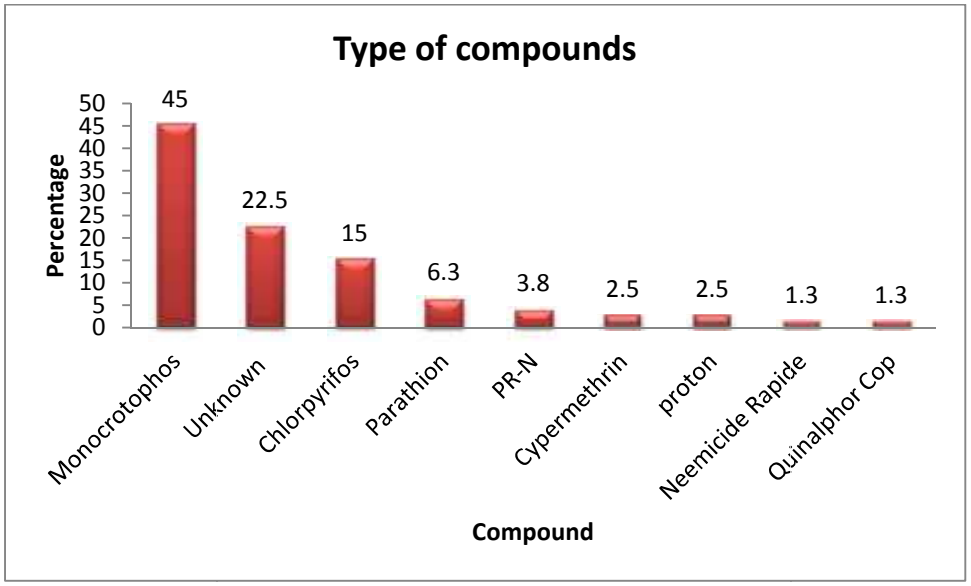


In our study of 80 patients, 24 patients (30.0%) required ventilator support

Table: 5 Distribution Type of Compounds

COMPOUNDS	N	Percentage
Monocrotophos	36	45.0
Unknown	18	22.5
Chlorpyrifos	12	15.0
Parathion	5	6.3
PR-N	3	3.8
Cypermethrin	2	2.5
proton	2	2.5
Neemicide Rapide	1	1.3
Quinalphor Cop	1	1.3
Total	80	100

Graph 5

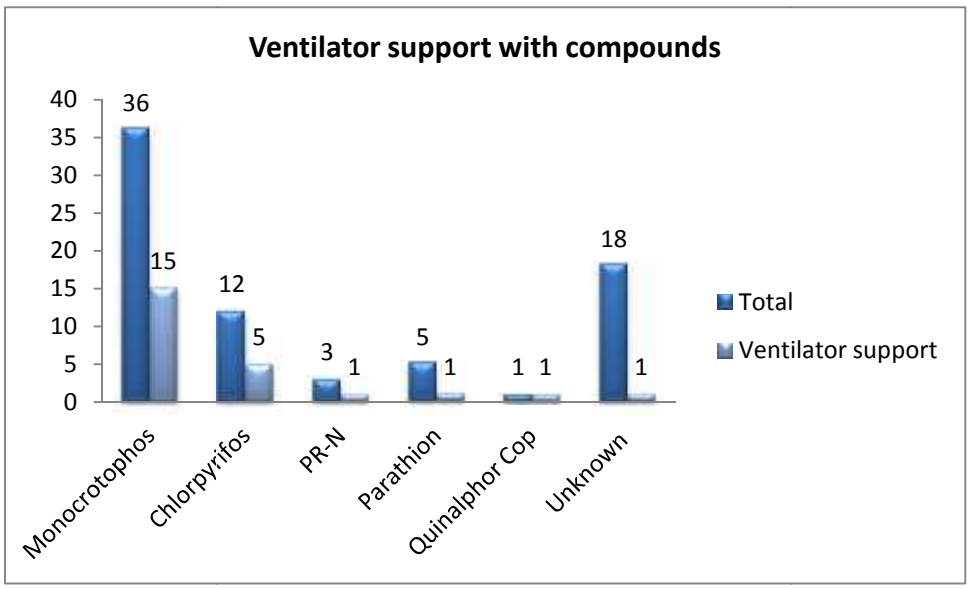


In our study of 80 patients most common organophosphorus compound used was monocrotophos 45.0%.

Table: 6 Association of Ventilator support with Compounds

Compounds	Total	Ventilator support
Monocrotophos	36	15
Chlorpyrifos	12	5
PR-N	3	1
Parathion	5	1
Quinalphor Cop	1	1
Unknown	18	1

Graph 6

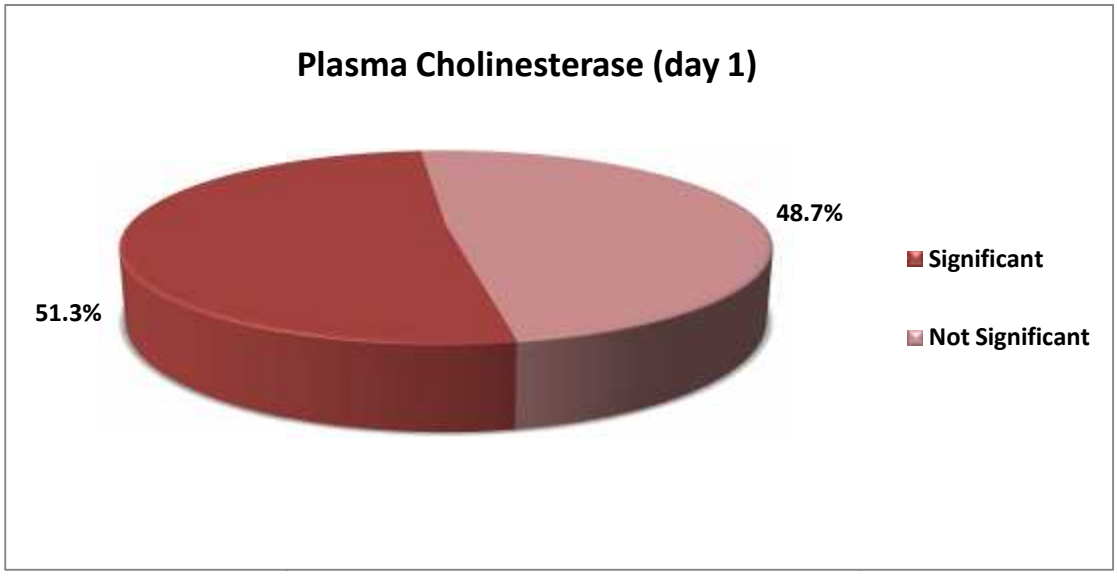


Total 24 patients required ventilator support, out of them 15 had Monocrotophos poisoning, 5 had chlorpyrifos poisoning and one patient each from other group of poison required ventilator support.

Table: 7 Distribution of Level of Plasma Cholinesterase (day 1)

Plasma Cholinesterase (day 1)	N	Percentage
Significant(<2180 IU)	41	51.3
Not Significant(>2180 IU)	39	48.7
Total	80	100

Graph 7

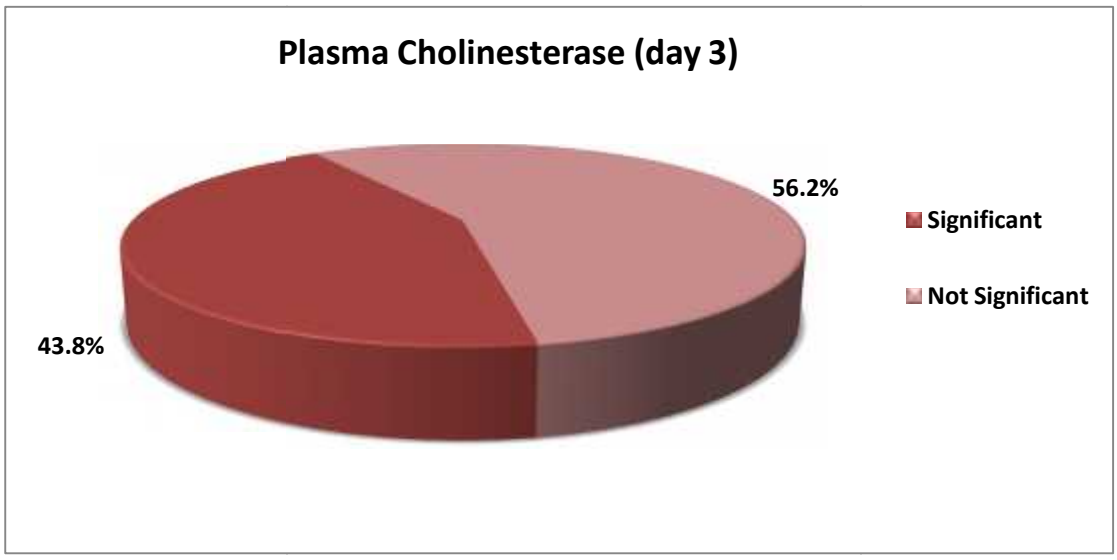


In our study of 80 patients, plasma cholinesterase on Day 1 was significantly reduced in 41 (51.3%) patients.

Table: 8 Distribution of Level of Plasma Cholinesterase (day 3)

Plasma Cholinesterase (day 3)	N	Percentage
Significant (<2180 IU)	35	43.8
Not Significant (>2180 IU)	45	56.2
Total	80	100

Graph 8

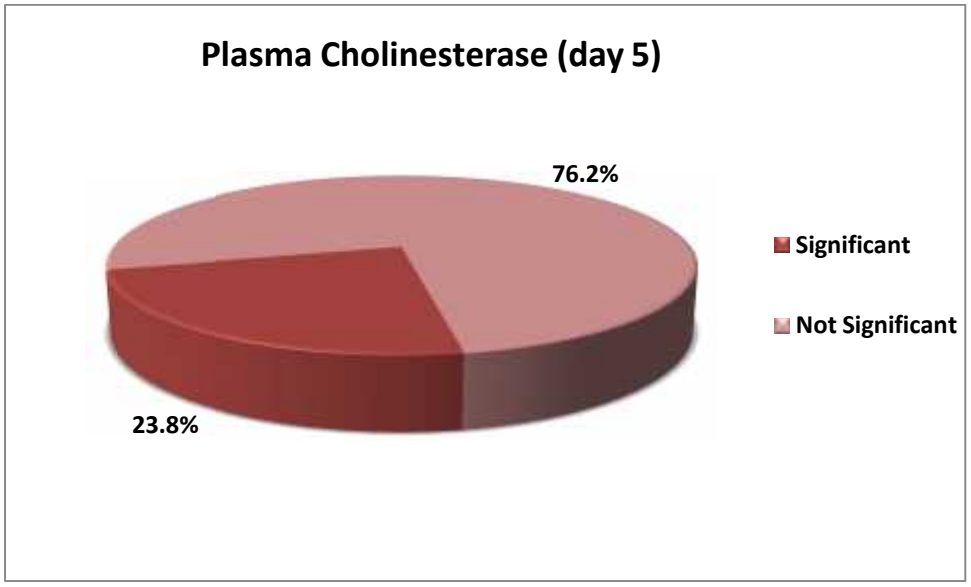


In our study of 80 patients, plasma cholinesterase on Day 3 was significantly reduced in 35 (43.8%) patients.

Table: 9 Distribution of Level of Plasma Cholinesterase (day 5)

Plasma Cholinesterase (day 5)	N	Percentage
Significant (<2180 IU)	19	23.8
Not Significant (>2180 IU)	61	76.2
Total	80	100

Graph 9

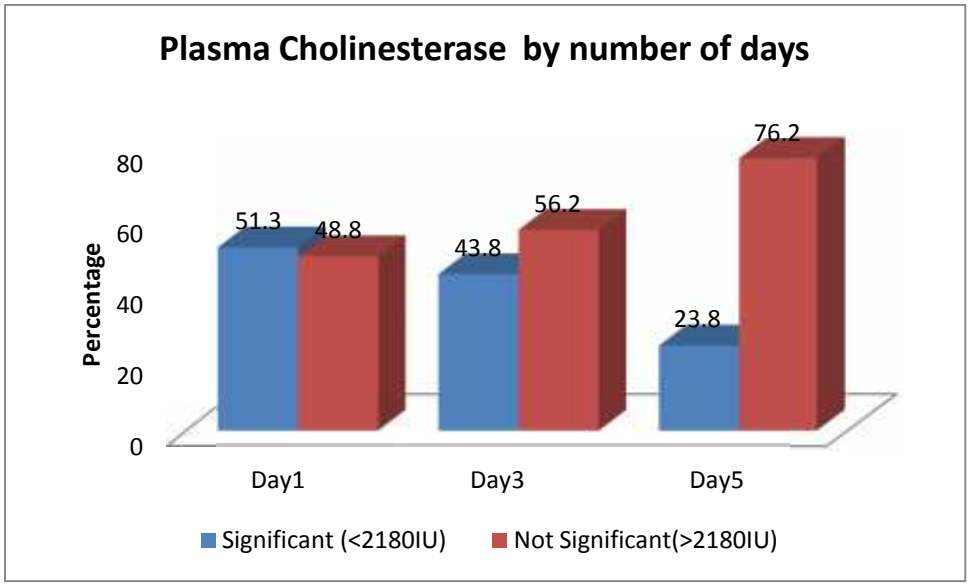


In our study of 80 patients, plasma cholinesterase on Day 5 was significantly reduced only in 19 (23.8%) patients.

Table: 10 Distribution of Plasma Cholinesterase by number of days

Plasma Cholinesterase	Day1	Day3	Day5
Significant (<2180IU)	51.3	43.8	23.8
Not Significant(>2180IU)	48.8	56.2	76.2

Graph 10

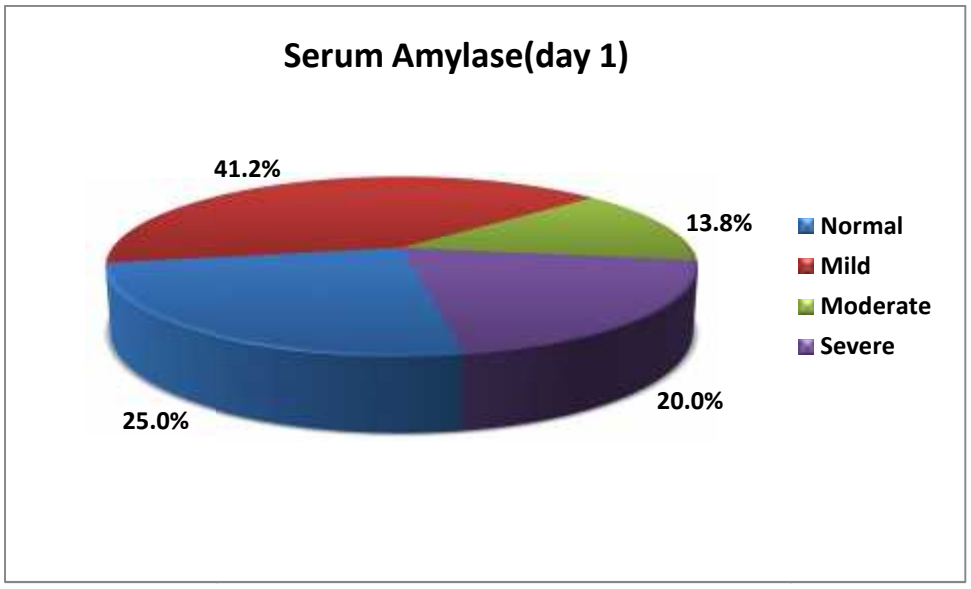


In our study reduction of plasma cholinesterase reduction was significant in 51.3% patients on day 1, it has reduced to 23.8% on day 5 after receiving treatment.

Table: 11 Distribution of Level of Serum Amylase (day 1)

Serum Amylase (day 1)	N	Percentage
Normal (0-90 U/L)	20	25
Mild (91-200 U/L)	33	41.2
Moderate (201-300U/L)	11	13.8
Severe (>301 U/L)	16	20
Total	80	100

Graph 11

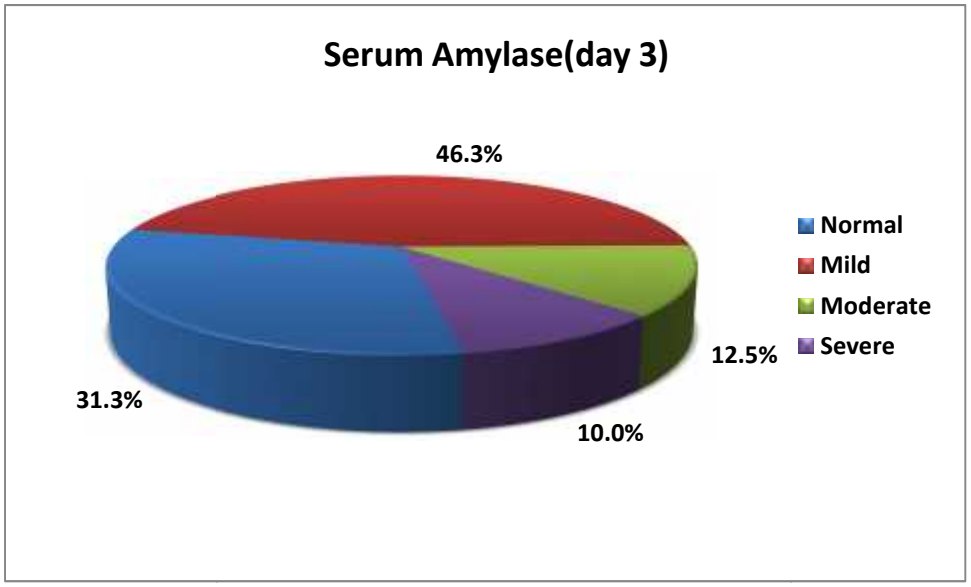


In our study of 80 patients, serum Amylase on Day 1 was elevated mildly in 33(41.2%) patients, moderately in 11 (13.8%) patients and severely in 16 (20.0%) patients.

Table: 12 Distribution of Level of Serum Amylase (day 3)

Serum Amylase (day 3)	N	Percentage
Normal(0-90U/L)	25	31.2
Mild(91-200U/L)	37	46.2
Moderate(201-300U/L)	10	12.5
Severe(>301U/L)	8	10.0
Total	80	100

Graph 12

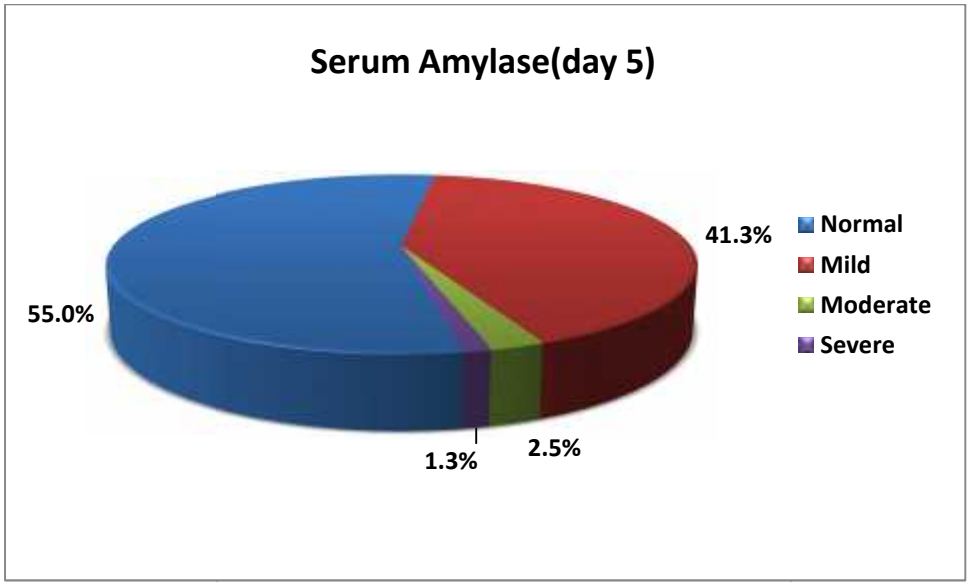


In our study of 80 patients, serum Amylase on Day 3 was mildly raised in 37 (46.2%) patients, moderately raised in 10(12.5%) patients and severely raised in 8 (10.0%) patients.

Table: 13 Distribution of Level of Serum Amylase (day 5)

Serum Amylase (day 5)	N	Percent
Normal(0-90U/L)	44	55.0
Mild(91-200U/L)	33	41.2
Moderate(201-300U/L)	2	2.5
Severe(>300U/L)	1	1.2
Total	80	100

Graph 13

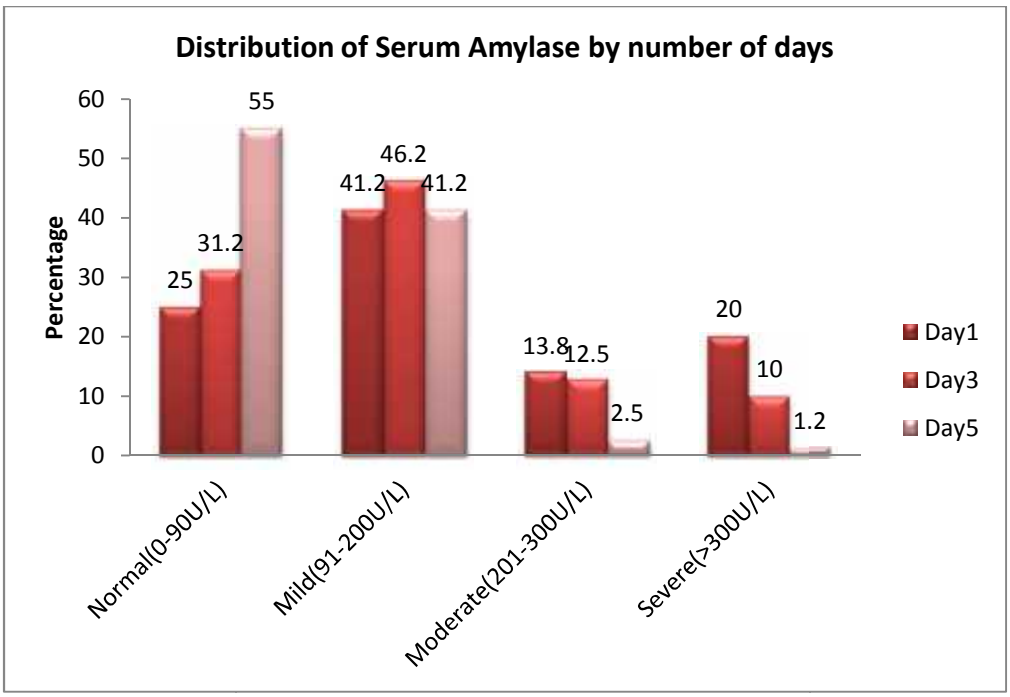


In our study of 80 patients, serum Amylase on Day 5 was mildly raised in 33(41.2%) patients, moderately raised in 2(2.5%) patients and severely raised only in 1(1.2%) patient.

Table: 14 Distribution of Serum Amylase by number of days

Serum Amylase	Day1	Day3	Day5
Normal(0-90U/L)	25.0	31.2	55.0
Mild(91-200U/L)	41.2	46.2	41.2
Moderate(201-300U/L)	13.8	12.5	2.5
Severe(>300U/L)	20.0	10.0	1.2

Graph 14

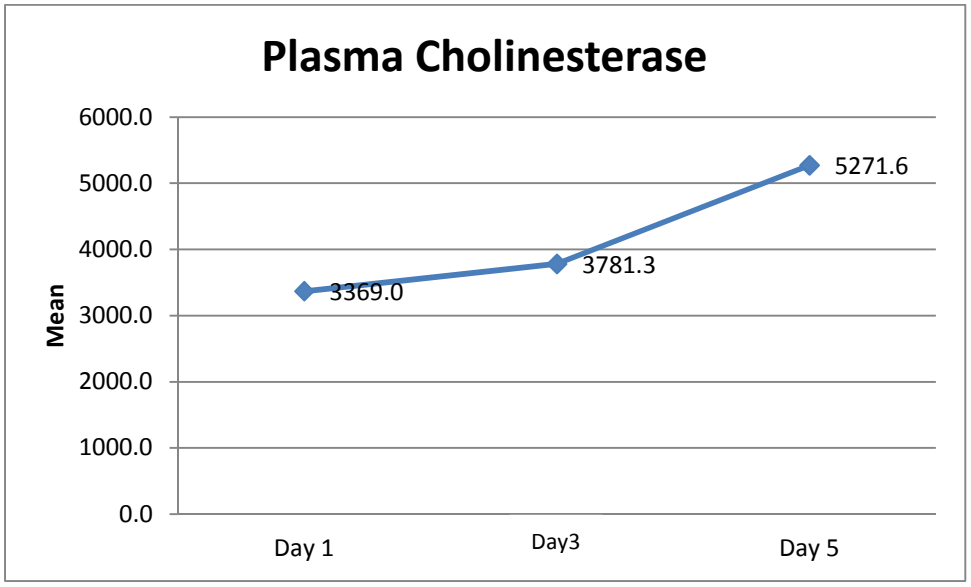


There was progressive decrease in the mean of serum amylase from admission to discharge. Our study also shows that greater the serum amylase at admission, higher was the complication and prolonged the hospital stay.

Table: 15 Comparison of Mean Plasma Cholinesterase level by Days

Plasma Cholinesterase	N	Mean U/L	SD U/L	ANOVA p value
Day 1	80	3369.0	3193.2	<0.001
Day 3	80	3781.3	3216.8	
Day 5	80	5271.6	3322.7	

Graph 15

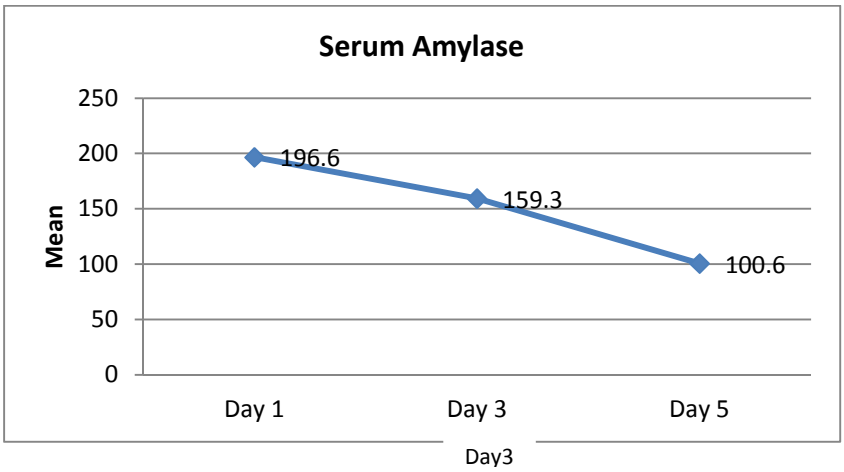


The maximum plasma cholinesterase level at admission was 9800 U/L. while minimum level was 80 units. The overall mean plasma cholinesterase level at admission was 3369 U/L. Mean plasma cholinesterase level on day 3 is 3781.3 U/L and mean plasma cholinesterase level on day 5 is 5271.6 U/L. The p value is significant (<0.001).

Table: 16 Comparison of Mean Serum Amylase level by Days

Serum Amylase	N	Mean U/L	SD U/L	ANOVA p value
Day 1	80	196.6	143.4	<0.001
Day 3	80	159.3	113.9	
Day 5	80	100.6	69.0	

Graph 16



The minimum serum amylase level a ion was 27 U/L while maximum level was 714 units. The overall mean serum amylase level at admission was 196.6 U/L. Mean serum amylase level on day 3 is 159.3 U/L and mean serum amylase on day 5 is 100.6 U/L. The p value is significant (<0.001).

Table: 17 Correlation between Plasma Cholinesterase and Amylase

	r value	p value
Plasma cholinesterase and Serum Amylase day 1	-0.477	<0.001
Plasma cholinesterase and Serum Amylase day 3	-0.513	<0.001
Plasma cholinesterase and Serum Amylase day 5	-0.510	<0.001

DISCUSSION

Acute organophosphorus poisoning ranks foremost in the list of agents that cause acute poisoning in the developing countries. Globally poisoning due to organophosphorus compounds are responsible for approximately 3 million episodes, which results in nearly 200,000 deaths every year. Acute poisoning often presents as medical emergencies requiring monitoring and management in intensive care unit. The acute cholinergic syndrome carries a high risk of death in the absence of timely diagnosis, adequate support and specific therapy.

The management of organophosphorus poisoning depends very much on its severity. In mild cases, removing the patient from the area of exposure and a low dose of atropine may sufficient. However in severe cases, artificial respiration, high doses of antidotes and resuscitation become necessary.

Organophosphorus intoxication inhibits both acetyl cholinesterase and plasma cholinesterase causing excessive concentration of acetyl choline and characteristic nicotinic and muscarinic over stimulation symptoms. Estimation of acetyl cholinesterase is theoretically preferred, since it would reflect the degree of inhibition of synaptic cholinesterase. Estimation of plasma Cholinesterase has an advantage because the measurement is simpler and more accurate than estimation of acetyl Cholinesterase. The characteristic manifestations of acute poisoning occur only after more than 50% of plasma cholinesterase is inhibited. The severity of manifestations parallels the degree of inhibition of plasma cholinesterase activity, this is significant only in the initial stage of acute poisoning.

The inhibited enzyme is unable to metabolize acetyl choline. The resultant excessive concentration of acetyl choline produces excessive stimulation of excessive

cholinergic stimulation of the glandular secretion through muscarinic receptors and results in pharmacological ductal obstruction. Hyperamylasemia is frequent in severe organophosphorus poisoning.

Age and Sex incidence

In our study out of 80 patients, 46(57.5%) were male, 34(42.5%) were females. Male: female ratio is 1.3: 1. There was male preponderance. A study conducted by Gupta SK et al in 413 patients found 273 patients were male. Male: female ratio is 1.9:1. [39]

In our study, the incidence of organophosphorus poisoning was more among the age group 21-30 years (37.5%). This is the most critical period, when one is likely to face various problems that may lead to Psychological stress so a person may take drastic steps to end his life, consuming available poisons. Similar results were seen in studies conducted by Gupta SK et al[39], Dayanand Raddi et al,[3] Indira A et al.[18] A study conducted by Gupta SK et al out of 413 patients, 139 cases were in the age group 21-30 years. A study conducted by Dayanana Raddi et al out of 320 patients, 144 cases were in the age group 21-30 years. A study conducted by Indira et al out of 92 patients, 58 cases were in the age group 15-25 years.

Compound

In our study most commonly used op compounds were Monocrotophos (45.0%), chlorpyrifos (15.0%). Monocrotophos is commonly used pesticide in the paddy fields and its easily available in the market. Monocrotophos was most common compound in a study conducted by Gupta SK et al. Most common compounds in Gupta SK et al were Monocrotophos (30.17%), Methyl Parathion (28.44%), Quinolphos (18.96%).[39]

Nature of poisoning

In our study we found that maximum cases were suicidal poisoning 75(93.4%). It might may be due to rapid urbanization, social and economic factors which mainly contribute to frustration and depression in the people. The persons who are not able to cope up the stressful situations are the major victims of suicidal poisoning. Choice of OP compound for suicide is mainly due to cheap and easy availability. Similar result was seen in a studies conducted by Dayanand Raddi et al (97.5%)[3], Indira A et al (95.3)[18], S. M. Kar et al (95.2%)[40]. A study conducted by Dayanand Raddi et al out of 320 cases, suicidal cases were 312 (97.5%). A study conducted by Indira et al out of 150 cases, 143 (95.3%) cases were suicidal. A study conducted by S .M. Kar et al out of 65 cases, 64 cases were suicidal.

Occupation

In our study most of the patients were Farmers (31.2%), Students (28.8%) and Housewives (27.5%). Farmers are more prone for OP poisoning, it might be due to easy availability and accessibility of the pesticides among them. Students are most common because of presence of educational institutes surrounding our area and stress related to academic performance.

Symptoms

Among the symptoms vomiting was most common symptom.Out of 80cases , 60(75.0%) cases had vomiting. Vomiting is most common symptom because of the practice of induced emesis by giving salt water in our area because of lack of knowledge.

Ventilator support

Total 24 patients required ventilator support, out of them 15 had Monocrotophos poisoning, 5 had chlorpyrifos poisoning and one patient each from other group of poison required ventilator support.

Plasma cholinesterase

Plasma cholinesterase inhibition is correlating well with clinical severity in case of op poisoning. Our findings reduction of plasma cholinesterase on day of admission and severity of OP poisoning are consistent with Wadia et al, who showed good correlation between plasma cholinesterase level and severity of poisoning. [17] Plasma cholinesterase showed a trend of increase in activity with treatment of Atropine and PAM during the course of hospital stay.

Serum Amylase

Mean serum Amylase at admission was 196.6 units, where as it was 100.6 units on day 5. This shows that in OP poisoning there is elevation of serum amylase level according to the degree of cholinergic stimulation. Our findings correlate with Lee WC et al who demonstrated hyperamylasemia is frequent in severe op poisoning and finding of hyperamylasemia was closely related to clinical severity.[41] There was progressive decrease in the mean of serum amylase from admission to day 5. Our study also shows that greater the serum amylase at admission, higher was the complication and prolonged the hospital stay. In a study conducted in Japan an increase in plasma amylase levels above the normal range was found in 50% of the patients who developed respiratory failure. The study found a positive correlation with amylase levels with respiratory failure in organophosphorus poisoning[23]. A study conducted by S Singh et al found that serum amylase was elevated in 47% of

patients with organophosphorus poisoning[42]. I Sahin et al conducted a study, acute pancreatitis was observed in (12.76%) patients[43].

Aspiration

In our study, two patients had aspiration and developed lobar consolidation requiring prolonged ventilator support.

Mortality -

The overall mortality in our study was 2.5%. one case had atropine induced arrhythmias and sudden cardiac arrest, another patient was in respiratory failure.A study conducted by Kamath et al out of 25 cases, mortality was seen in two cases[44]. A study conducted by Kora S.A et al out of 148 cases, mortality was seen in eleven cases (4.7%)[45].

CONCLUSION

Study was undertaken to study plasma cholinesterase and serum amylase levels in organophosphorus poisoning.

- There was male preponderance in our study.
- Middle age groups between 21-30 years are more commonly encountered in poisoning by organophosphorus compounds.
- Clearly, there is no age factor associated with severity of clinical manifestations or mortality.
- Suicidal is the most common manner of poisoning.
- Farmers are more prone for OP poisoning, it might be due to easy availability and accessibility of the pesticides among them
- Vomiting is the most common symptom in organophosphorus poisoning.
- There was higher mortality with organophosphorus compounds like monocrotophos and chlorpyrifos which are categorized as highly lethal compounds.
- There was good correlation between plasma cholinesterase and serum amylase levels on admission and severity of poisoning.
- There is greater probability of the patient being ventilated if the serum amylase level at admission is more than 200 units.
- Both plasma cholinesterase and serum amylase levels decreased on day 5.

SUMMARY

A observational study was undertaken in patients with history of consumption of organophosphorus compound admitted to Shri B . M .Patil Medical College, Vijaypur from December 2013 to June 2015.

The objectives of the study were to study of plasma cholinesterase and serum amylase levels in OP poisoning and to correlate serum amylase levels with clinical severity and outcome.

All patients of age > 15years with history of consumption of OP compound with in 24hrs where included in the study. The sample size was 80 consecutive patients. Blood samples for plasma cholinesterase and serum amylase were collected at time of admission, day 3 and day 5.

Silent Features of the study:

- Male to female ratio is 1.2:1
- The mean age of the study population was 29.9 years.
- Maximum incidence was in the age group 21-30 years.
- Most common OP compound is monocrotophos.
- Most manner of poisoning is suicidal.
- Farmers are more prone for OP poisoning.
- Reduction of plasma cholinesterase and elevation of serum amylase level was seen on admission.
- Degree of reduction of plasma cholinesterase and elevation of serum amylase levels correlated with severity of poisoning.
- Serum amylase levels more than 200 U/L are more prone for respiratory failure.

BIBLIOGRAPHY

1. Toit PWD, Muller FO, Tonder WMV, Ungerer MJL. Experience with the intensive care management of organophasphate insecticide poisoning. South African Medical Journal 1981;60:227-229.
2. Murat Sungur and MuhammedGuven. Intensive care management of organophosphate insecticide poisoning. Critical care 2001;5:211-215.
3. DayanandRaddi, Anikethana G V. Clinical profile of organophosphorus poisoning in a tertiary care hospital. Indian Journal of Basic and Applied Medical Research 2014;4:14-22.
4. Namba T, Nolte CT, Jackrel J, Grob D. Poisoning due to organophosphate insecticides: Acute and Chronic manifestations. American Journal of Medicine 1971;50:475-492.
5. Goel A, Aggarwal P. Pesticide Poisoning. The national medical journal of India 2007; 20:184-191
6. Kumar SV, Fareedullah M, Sudhakar Y, Venkateswarlu B, Kumar EA. Current review on organophosphorus poisoning. Archives of Applied Science Research 2010;2:199-215.
7. Eddleston M. Patterns and problems of deliberate self- poisoning in the developing world. Quaterly Journal of Medicine 2000;93:715-731.
8. Ravi G, Rajendiran C, Subramanian PT, Babu N. Poision control, training and research center, Institute of Internal Medicine, Government General Hospital, Madras Medical College, Chennai, India. Presented at 6th Annual congress of Asia Pacific Association of Medical Toxicology, Bangkok, Thailand 2014 December 2007.

9. Yatendra S, Joshi SC, Singh M, Joshi A, Kumar J. Organophosphorus Poisoning: An overview. International journal of health sciences and research 2014;4: 245-257.
10. Abdallah C and Udomtecha D. Pseudocholinesterase activity: Determination and interpretation in pediatric anesthesia. Middle East Journal of anesthesiology 2007;19: 423-428.
11. Lurie S, Sadan O, Oron G. Reduced pseudocholinesterase activity in patients with HELLP syndrome. Reproductive Sciences 2007;14:192-196.
12. Mullan DP, Williams NE. Left-sided amoebic liver abcess with pulmonary involvement, pericarditis, and pseudocholinesterase deficiency. British Medical Journal 1965;1:235-236.
13. Simon NM, Greco DF, Dietz AA, Rubinstein HM. Serum cholinesterase deficiency in renal failure. American Society for Artificial Internal organs 1969;15:328-332.
14. Rump AF, Schierholz J, Biederbick W. Pseudocholinesterase activity reduction during cardiopulmonary bypass: the role of dilutional process and pharmacological agents. General Pharmacology 1999;32:65-69.
15. Navarrete JI, Lisker R, Briceno PR. Serum atypical pseudocholinesterase and leprosy. International Journal of Dermatology 1979;18:822-823.
16. Pankaj M, Krishna K. Acute organophosphorus poisoning complicated by acute coronary Syndrome. Journal of the Association of Physicians of India 2014;62:614-616.
17. Wadia RS, Sadagopan C, Amin RB, Sardesai HV. Neurological manifestations of organophosphorus insecticide poisoning. Journl of Neurology, Neurosurgery and Psychiatry 1974;37:841-847.

18. Hundekari IA, Surykar AN, Dongre NN, Rathi DB. Acute poisoning with organophosphorus pesticide: patients admitted to a hospital in Bijapur, Karnataka. Journal of Krishna Institute of Medical Sciences University 2012;1:38-47.
19. Weizman Z, Sofer S. Acute pancreatitis in children with anticholinesterase insecticide intoxication. Journal of Pancreas 1992;90:204-206..
20. Senanayake N, KaralliedeL. Neurotoxic effects of organophosphorus insecticides. New England Journal of Medicine 1987;316:761-763.
21. Leon S, Fidas E, Pradilla G. Neurological effects of organophosphorus pesticides. British Medical Journal 1996;313:690-691.
22. Moretto A, Lotti M. Poisoning by organophosphorus insecticides and sensory neuropathy. Journal of Neurology, Neurosurgery and Psychiatry 1998;64:463-468.
23. Sumiya MN, Tanaka M, Iwai M, Konda T, Takahashi S, Sato S. Elevated serum amylase is related to development of respiratory failure in organophosphate poisoning. Human and experimental toxicology 1996;15:250-253.
24. Laudari S, Patowary BS. Analysis of organophosphorus compound poisoning patients attending CMS-TH, Bharatpur, Nepal. Journal of College of Medical Sciences-Nepal, 2011;7:9-19.
25. M .I. Suliman, R. Jibran, M. Rai. The analysis of organophosphates poisoning cases treated at Bahawal Victoria Hospital, Bahawalpur in 2000-2003. Pakistan journal of medical sciences 2006;22:244-249.
26. Bashir F, Rather MA ,Salem B, Hamid A, Kadri SM. Socio demographic profile of the poisoning cases in Kashmir valley. Global Journal of Medicine and Public Health 2014;3:11-18.

27. Ramesha KN, Rao BHK, Kumar GS. Pattern and outcome of acute poisoning cases in a tertiary care hospital in Karnataka, India. Indian Journal of Critical Care Medicine 2009;113:152-155.

28. Dreisbach RH. Cholinesterase inhibitor pesticides. In: Handbook of poisoning 11th ed. Lange medical publications. California. 1983: 106-114.

29. Rehiman S, Lohani SP, Bhattarai MD. Correlation of serum cholinesterase level, clinical score at presentation and severity of organophosphorus poisoning. Journal of Nepal Medical Association 2008;47:47-52.

30. Wadia RS.Treatment of organophosphate poisoning. Indian Journal of Critical Care Medicine 2003;7:85-87.

31. Yili, Zhongyu X, Wang Z, Wang H, Zhao X, Cao Y, *et al,*. Gastric lavage in acute organophosphorus pesticide poisoning (GLAOP) –a randomized controlled trial of multiple Vs single gastric lavage in unselected acute organophosphorus pesticide. Boston Medical Center emergency medicine 2006;6:10-17.

32. American Academy of Clinical Toxicology and European Association of poison centers and clinical Toxicologists: position statement: single dose activated charcoal. Journal of Clinical Toxicology 1997;37:731-751.

33. World Health Organisation. World Health Report 2002. Reducing risks, promoting healthy life. Geneva, World Health Organisation, 2002.

34. Eddleston M, Buckley NA, Eyer P, Dawson A H. Management of acute organophosphorus pesticide poisoning. Lancet 2008; 371 : 597-607.

35. Chaturvedi AN, Dutta S, Sarkar S, Saha TK, Adhikary S, Das S, *et al,*. Prevalence of hyper amylasemia and acute pancreatitis in organophosphate poisoning. International Organisation of Scientific Research Journal of dental and medical sciences 2014;13:59-62.

36. Banks PA. Acute and chronic pancreatitis. In: Feldman M, Sleisenger MH, Scharschmidt BF. Sleisenger and Fordtran's gastrointestinal and liver disease. 6th edition. Philadelphia , PA: W.B. Saunders Company 1998:809-862.
37. Dressel TD, Goodale jr RL, Arneson MA, Borner JW. Pancreatitis as a complication of anticholinesterase insecticide intoxication. Annals of Surgery 1979;189:199-204.
38. Kawabe K, Ito T, Arita Y, Sadamoto Y, Harada N, Yamaguchi K, et al. Pancreatic pseudocyst after acute organophosphate poisoning. Fukuoka Igaku Zasshi 2006; 97:123-129.
39. Gupta SK, Kumar S, Sheikh MI. Study of organophosphorus poisoning in Surat, India . Journal of Indian Academy of Forensic Medicine 2006;28:971-973.
40. Kar SM, Timsinha S, Agarwal P. An epidemiological study of organophosphorus poisoning at Manipal teaching hospital, Pokhara, Nepal. Journal of Indian Academy of Forensic Medicine 2010;32:971-973.
41. Lee WC, Yang CC, Deng JF, Mu ML, Ger J, Lin HC, *et al*,. The clinical significance of hyperamylasemia in organophosphate poisoning. Journal of Toxicology 1998;36:673-681.
42. Bhardwaj SSU, Verma SK, Bhalla A, Gill K. Hyperamylasemia and acute pancreatitis following anticholinesterase poisoning. Human Experimental Toxicology 2007;26:467-471.
43. Sahin I, Onbasi K, Sahin H, Karakaya C, UstunY, Noyan T. The prevalence of pancreatitis in organophosphate poisonings. Human Experimental Toxicology 2002;21:175-177.
44. Kamath PG, Daglia AJ, Patel MB. Diazinon poisoning. Journal of the Association of Physicians of India 1964;12:477- 481.

45. Kora SA, Doddamani GB, Halagali GR, Vijayamahantesh SN, Umakanth B. Sociodemographic profile of the organophosphorus poisoning cases in Southern India. Journal of clinical and Diagnostic and Research 2011;5:953-956.

ANNEXURES

CONSENT FORM

TITLE OF RESEARCH: "STUDY OF SERUM AMYLASE AND SERUM CHOLINESTERASE IN ORGANOPHOSPHORUS POISONING"

GUIDE :

P.G. STUDENT :

PURPOSE OF RESEARCH:

I have been informed that this study is about study of serum amylase and plasma cholinesterase in organophosphorus poisoning. I have also been given a free choice of participation in this study

PROCEDURE:

I understand that I will undergo detailed history and clinical examination and investigations.

RISKS AND DISCOMFORTS:

I understand that there is no risk involved and I may experience mild pain during the above mentioned procedures.

BENEFITS:

I understand that my participation in this study will help to patient's survival and better outcome.

CONFIDENTIALITY:

I understand that the medical information produced by the study will become a part of hospital record and will be subjected to confidentiality and privacy regulations of hospital. If the data is used for publications the identity of the patient will not be revealed.

REQUEST FOR MORE INFORMATION:

I understand that I may ask for more information about the study at any time.

REFUSAL OR WITHDRAWAL OF PARTICIPATION:

I understand that my participation is voluntary and I may refuse to participate or withdraw from study at any time.

INJURY STATEMENT:

I understand in the unlikely event of injury to me during the study I will get medical treatment but no further compensations.

(Signature of Guardian) (Signature of patient)

Contact no-

(If the patient is conscious, well oriented and fully aware)

PROFORMA

Name: CASE NO:

Age: IP NO:

Sex: DOA:

Religion: DOD:

Occupation:

Residence:

Presenting complaints with duration:

History of presenting complaints:

Past History:

Personal History:

Diet

Appetite

Sleep

Bladder and bowel habits:

Smoking/Tobacco chewing/Snuff Inhalation

Duration

Number of cigarettes/beedis pack year smoked

Amount of tobacco chewed/snuff inhaled

Alcohol

Duration

Quantity/Frequency

Type

3

Family History:

Treatment History:

General Physical Examination

Pallor: present/absent

Icterus: present/absent

Clubbing: present/absent

Generalized lymphadenopathy: present/absent

Built:

Nourishment:

Vitals

PR:

BP:

RR:

Temp:

SYSTEMIC EXAMINATION.

- Cardiovascular system
- Respiratory System
- Per Abdomen
- Central Nervous System

INVESTIGATIONS

HAEMATOLOGY –

Haemoglobin	gm %
Total WBC counts	Cells/mm^3
Differential counts -	
Neutrophils	%
Lymphocytes	%
Eosinophils	%
Monocytes	%
Basophils	%
ESR	mm after 1 hour

HIV	
HBsAG	

BIOCHEMISTRY

SODIUM	
POTASSIUM	
UREA	
CREATININE	
RBS	

LIVER FUNCTION TEST :

Total bilirubin	Conjugated	Unconjugated	Total protein	Albumin	A/G	SGOT	SGPT

	At admission	72 Hrs	At Discharge
Plasma Cholinesterase			
Serum Amylase			

URINE EXAMINATION -

Albumin	
Sugar	
Microscopy	Epithelial cells
	Pus cells

CHEST RADIOGRAPH :

USG :

ECG :

KEY TO MASTER CHART

PchE	:	Plasma cholinesterase
S.A.	:	Serum Amylase
OP	:	Organophosphorus
TLC	:	Total Leukocyte counts
Hb	:	Haemoglobin
Na	:	Sodium
K	:	Potassium
Cr	:	Creatinine
RBS	:	Random Blood Sugar
T. Bilirubin	:	Total bilirubin
T. Protein	:	Total Protein
ECG	:	Electrocardiogram
IHD	:	Ischemic Heart Disease
LVH	:	Left Ventricular Hypertrophy
HTN	:	Hypertension

MASTER CHART

SR NO	IP NO	NAME	AGE	SEX	OCCUPATION	RESIDENCE	PchE. Cr day 1	PchE. Cr day 3	PchE. Cr day 5	S.A day 1	S.A day 3	S.A day 5	pupils	OP COMPOUND	REMARKS
1	18829	suma vinoba	27	F	Housewife	vijayapur	243	272	1025	428	240	115	pin point	detected	ventilatory support
2	20083	snehal shrisail	20	F	housewife	vijayapur	7358	8538	9602	74	65	48	reactive	detected	
3	20086	Bhimanagouda	62	M	Farmer	Sindagi	1107	1560	3764	27	54	48	pinpoint	detected	IHD with UTI
4	21373	vishwanath	19	M	Student	vijayapur	2752	5096	6943	184	146	132	reactive	detected	
5	21623	Basavaraj	46	M	Farmer	vijayapur	477	2247	3884	321	174	158	pinpoint	detected	ventilatory support
6	21637	Bhimashi	30	M	Business	Indi	7916	5464	6853	116	102	94	pinpoint	detected	
7	23129	Ganga	18	F	Student	Bagewadi	1607	2409		114	68		pinpoint	detected	
8	23228	Irasangappa	25	M	Farmer	Sindagi	4865	5035	6437	118	44	38	pinpoint	detected	
9	23369	Bhimappa	32	M	Farmer	Bagewadi	1076	1151	5328	60	74	40	pinpoint	detected	
10	23439	Akshay	19	M	Student	vijayapur	268	1459	2243	207	159	149	pinpoint	detected	ventilatory support
11	23448	Madhukar	62	M	Business	vijayapur	449	380	878	714	638	530	pinpoint	detected	cholecystectomy
12	24148	Kenchappa	22	M	Farmer	Sindagi	9800	10364	11857	145	121	89	reactive	detected	
13	24153	Kempa basappa	26	M	Farmer	Balgalkot	310	352	1083	149	152	103	reactive	detected	
14	25423	Ashok	22	M	Farmer	Sangali	7852	3852	4083	194	176	112	pinpoint	detected	
15	26475	Jayashree	20	F	housewife	vijayapur	1246	1887	3287	187	156	84	pinpoint	detected	
16	26751	Chandrasekhar	21	M	Student	vijayapur	103	453	5675	196	145	130	pinpoint	detected	ventilatory support
17	27342	Raju dyamu	22	M	Student	vijayapur	1280	2566	4093	208	183	165	pinpoint	detected	
18	27462	Bibifatima	25	F	housewife	yadagiri	169	639	817	238	168	127	pinpoint	detected	ventilatory support
19	27580	Neranna	22	M	Student	Bagalkot	606	524	1344	168	142	103	pinpoint	detected	
20	27738	Santosh	22	M	Farmer	vijayapur	296	565	1893	177	130	87	pinpoint	detected	
21	27825	Bappana	15	M	Student	vijayapur	313	111	1028	593	497	118	pinpoint	detected	Ventilatory
22	28227	Bhimawwa	35	F	housewife	vijayapur	6555			43			pinpoint	detected	
23	28203	Javid	25	M	Business	vijayapur	15290	16480		107	84		reactive	detected	
24	30589	Shivakumar	30	M	Farmer	Sindagi	3284	1800	2354	264	230	138	pinpoint	detected	
25	30823	Mayashri	17	F	Student	vijayapur	1934	2513	3268	118	51	38	pinpoint	detected	
26	30838	Egappagouda	79	M	Farmer	vijayapur	2480	1143	1960	345	208	124	pinpoint	detected	DM
27	31019	Mehaboob	36	M	Business	vijayapur	8146	8101	9354	66	39	34	reactive	detected	
28	31137	Basavaraj	45	M	Farmer	yadagiri	7004	5928		177	166		pinpoint	detected	AMA
29	32089	Rajendra	34	M	Business	vijayapur	7592	3583	4083	165	117	92	reactive	detected	Partial Hanging, ventilatory
30	35750	Gurushanth	21	M	Farmer	vijayapur	1589	2289	4052	142	103	78	reactive	detected	
31	35865	Dhareppa	55	M	Auto driver	vijayapur	5099	4322	6332	158	135	96	reactive	detected	
32	210	Sadashiv	29	M	Business	vijayapur	8352	7260	9650	83	73	54	reactive	detected	
33	4094	Sunanda	17	F	housewife	yadagiri	140	223	952	261	224	112	pinpoint	detected	ventilatory support
34	4266	Manesh	16	M	Student	vijayapur	7439	8034	10422	328	298	146	pinpoint	detected	

35	4357	Sunanda	35	F	housewife	Bagewadi	140	223	1793	321	273	149	pinpoint	detected	Ventilatory support
36	4421	Siddamma	35	F	housewife	yadagiri	209	538	1536	228	194	143	pinpoint	detected	ventilatory support
37	11523	Sangappa	35	M	Farmer	vijayapur	6713	8136	9246	75	56	42	reactive	detected	
38	11686	Manohar	35	M	Farmer	Indi	519	840	2486	442	221	184	pinpoint	detected	Ventilatory support
39	14219	vishwanath	42	M	Farmer	vijayapur	468	749	5224	421	327	38	pinpoint	detected	VEntilatory support
40	14680	Umashree	18	F	Student	vijayapur	4127	3257	7422	70	133	38	reactive	detected	tablets consumption
41	17084	Saraswati	16	F	Student	Indi	892	1596	3096	182	174	54	pinpoint	detected	
42	15195	Jyoti	17	F	Student	vijayapur	2194	4218		68	56		reactive	detected	
43	15467	Sakrubai	18	F	Student	Sangali	4439	4956	8428	66	84	48	reactive	detected	
44	15569	Swapana	16	F	Student	vijayapur	6035	6528	9346	116	94	78	reactive	detected	tablets consumption
45	15754	Sidaray	64	M	Farmer	Indi	846	1345	4165	164	156	134	pinpoint	detected	HTN, Urethral stricture, ven
46	15780	Mosidda	35	M	Business	Indi	7534	8236		62	54		reactive	detected	
47	16556	Prakash	33	M	Teacher	vijayapur	1379	1984	3589	337	206	182	pinpoint	detected	
48	15651	Sadashiva	18	M	Student	vijayapur	907	1248	2484	256	138	89	pinpoint	detected	
49	16300	Prakash	22	M	Student	vijayapur	3286	5864	6429	72	69	34	reactive	detected	
50	16458	Ramesh	18	M	Student	vijayapur	5464	7084		43	38		reactive	detected	
51	16576	Parasuram	45	M	Farmer	Bagewadi	784	985	2048	116	102	76	pinpoint	detected	Ventilatory support
52	16654	Vanishree	20	F	Student	Bagewadi	2234	4578	6056	124	94	89	reactive	detected	
53	16745	Dannawwa	20	F	housewife	vijayapur	640	789	1529	214	189	156	pinpoint	detected	Ventilatory support
54	16974	Savita	30	F	housewife	Bagewadi	1044	2057	4021	165	144	56	pinpoint	detected	
55	17095	Shivaji	18	M	Student	vijayapur	207	284	1882	426	404	248	pinpoint	detected	Ventilatory support
56	17249	Roopa	23	F	Student	vijayapur	8280	9056	11248	46	34	56	reactive	detected	
57	17250	Rajeshwari	20	F	housewife	Indi	451	1056	4084	73	54	46	pinpoint	detected	
58	17247	Mamataz	40	F	housewife	vijayapur	1560	3589	5082	54	68	54	reactive	detected	
59	17483	Kallappa	40	M	Farmer	Indi	1843	4061	6894	79	75	66	reactive	detected	
60	18268	Savitri	17	F	Student	vijayapur	4348	4982	6275	135	78	56	reactive	detected	
61	18366	Bagawwa	25	F	housewife	vijayapur	5523	6084	8184	68	62	54	reactive	detected	
62	18843	Siddappa	19	M	Student	vijayapur	8063	9104	10453	112	86	74	reactive	detected	
63	18832	Somaray	22	M	Student	yadagiri	1849	2359	4572	176	154	88	pinpoint	detected	
64	19750	Renuka	22	F	housewife	Indi	5066	4803	6781	116	84	58	pinpoint	detected	
65	19905	Appala	55	M	Farmer	vijayapur	8820	7953	6459	45	83	56	reactive	detected	
66	20555	Laxman	36	M	Farmer	vijayapur	9046	11354	6259	142	112	88	reactive	detected	
67	20552	Sidray	40	M	Teacher	vijayapur	7189	8845	10406	67	58	48	reactive	detected	
68	21194	Shivanand	26	M	Farmer	vijayapur	7963	8596	9553	57	66	54	reactive	detected	
69	21218	Baghaya	17	F	Student	vijayapur	4145	6749	5608	373	268	146	pinpoint	detected	Ventilatory support
70	21692	Rekha	25	F	housewife	vijayapur	7330	8149	10405	56	65	46	reactive	detected	
71	22271	Ramappa	25	M	Employee	Bagewadi	7462	8236	9058	104	96	56	reactive	detected	
72	22248	Radikha	25	F	housewife	vijayapur	2395	4073	6512	78	68	48	reactive	detected	
73	22566	Renuka	24	F	housewife	Bagewadi	6461	8706	10284	69	56	48	reactive	detected	
74	23066	Reshma	20	F	Student	yadagiri	3740	5642		142	98		reactive	detected	
75	23245	Sushilabai	45	F	housewife	vijayapur	9800	10426	11305	56	43	38	reactive	detected	
76	23327	Pavitra	19	F	Student	Indi	584	820	2106	500	393	112	pinpoint	detected	Ventilatory support

77	23994	Hulegamma	40	F	housewife	yadagiri	8005	6346	9327	106	84	49	reactive	detected	
78	24577	Deepa	16	F	Student	vijayapur	150	761	603	259	164	146	pinpoint	detected	
79	24681	Ismail	27	M	Business	vijayapur	6882	7089	9536	196	146	89	pinpoint	detected	
80	24734	Yallawwa	40	F	housewife	vijayapur	550	517	1949	226	216	154	pinpoint	detected	HTN,DM
81	26583	Praveen	24	F	Business	vijayapur	581	1783	3084	500	402	184	pinpoint	detected	Ventilatory support
82	26815	Shridevi	25	F	housewife	vijayapur	300	150	905	125	186	144	pinpoint	detected	Ventilatory support, GTCS
83	27675	Sharanappa	90	M	Farmer	Indi	127	304	1174	500	442	168	pinpoint	detected	Ventilatory support, IHD
84	29120	Mallamma	22	F	housewife	Bagewadi	2645	6573	8290	117	98	75	pinpoint	detected	Ventilatory support
85	29064	Deelip	35	M	Farmer	Indi	6657	5640	7084	236	138	111	reactive	detected	Partial Hanging, ventilatory
86	29021	Neelama	55	F	housewife	Sindagi	1374	2091	3856	250	236	132	pinpoint	detected	Cardiac Arrest, Ventilatory
87	30678	Bhemanna	55	M	Farmer	Sindagi	80	354	940	500	401	244	pinpoint	detected	Ventilatory , IHD
88	30668	Ningamma	22	F	housewife	yadagiri	7373	8042	10356	110	93	75	reactive	detected	
89	30671	Rehana	25	F	housewife	Bagewadi	5803			106			reactive	detected	33 Wks pregnancy
90	30851	Jyoti	16	F	Student	vijayapur	8852	9047		138	102		reactive	detected	
91	30882	Butali	45	M	Farmer	Sangali	221	574	1630	107	142	96	pinpoint	detected	

sr No	COMPOUND	SYMPTOMS	HIV	HBSAG	TLC	Hb	ESR	Na	k	CREAT	RBS	T. BILIRUBIN	T.PROTEIN	ALBUMIN	A/G	SGOT	SGPT	ECG
1	Monocrotophos	vomitting, unconsciousness	Negative	Negative	15260	13.4	30	142	4.4	0.6	193	0.7	7.8	4.9	1.7	16	26	
2	Chlorpyrifos	vomitting, Abdominal pain	Negative	Negative	8500	11.4	30	138	4	0.7	161	2	6.1	4.1	2	56	39	
3	Monocrotophos	vomitting, drowsy	Negative	Negative	18890	12.5	5	143	3	1.1	198	0.7	6.8	4	1.4	24	16	Twave inversion in 2,3,avf
4	Parathion	vomitting	Negative	Negative	10340	14	10	143	4.2	0.8	105	0.5	7.4	4.3	1.3	64	54	
5	Monocrotophos	vomitting, drowsy	positive	Negative	6110	13.6	45	139	4.7	0.9	92	0.5	7	3.5	1	58	38	
6	PR-N	vomitting	Negative	positive	8800	15.5	20	138	6.4	0.7	106	1.3	7	4.3	1.5	29	26	
7	Parathion	Abdominal pain	Negative	Negative	7740	10.7	80	138	3.4	0.6	161	1.6	4.3	2	0.9	58	20	
8	Neemicide Rapide	vomitting	Negative	Negative	4290	12.5	20	136	3.3	0.7	104	0.4	5.8	3.8	1.9	29	15	
9	Monocrotophos	irritable	Negative	Negative	8100	13.4	10	138	3.8	0.8	106	0.5	7.4	4.3	1.3	64	54	
10	Quinalphor Cop	vomitting, unconsciousness	Negative	Negative	20230	15.2	15	139	4.2	0.8	148	1.1	7.3	4.7	1.8	31	14	
11	Cypermethrin	vomitting	Negative	Negative	24340	12.3	20	145	4.2	0.7	184	0.6	5	3	1.5	31	15	
12	Monocrotophos	Abdominal pain	Negative	Negative	11100	15.6	10	135	4.1	0.7	109	0.9	5.8	3.7	1.8	20	12	
13	Chlorpyrifos	vomitting	Negative	Negative	17600	17.3	10	133	3.6	0.7	126	0.6	7.9	5	1.7	27	28	
14	Monocrotophos	vomiiting,loose stools	Negative	Negative	23320	15.3	10	137	3.5	1	108	0.8	6.2	4	1.8	30	25	
15	Monocrotophos	Abdominal pain	Negative	Negative	8500	12.6	20	140	4.1	0.6	116	1.1	6.4	2.7	1.2	48	35	
16	Parathion	vomitting, unconsciousness	Negative	Negative	19090	11.8	15	141	2.5	0.5	204	0.7	4.3	2.7	1.6	17	10	
17	Monocrotophos	vomitting	Negative	Negative	8230	14.2	10	143	6.7	0.7	103	1.6	4.3	2	0.9	58	20	
18	Monocrotophos	vomitting, drowsy	Negative	Negative	4100	12.4	35	140	3.5	0.6	94	0.6	7	3.9	1.1	81	21	
19	Chlorpyrifos	vomitting	Negative	Negative	13650	13.8	5	139	4	1.8	104	1.2	3.9	2.5	0.7	36	26	
20	Monocrotophos	vomitting,loose stools	Negative	Negative	7100	13.7	30	142	3.4	0.7	107	0.7	7.2	4	1.1	38	26	
21	Monocrotophos	unconsciousness	Negative	Negative	17870	12.9	20	136	4.4	0.6	89	0.5	6.9	4.4	1.7	23	16	
22	Don't know	Abdominal pain	Negative	Negative	9680	13.2	30	140	3.8	0.7	92	0.6	6.9	4.3	1.6	16	18	
23	Don't know	vomitting	Negative	Negative	18020	13.8	5	136	4.2	0.6	144	0.5	6.7	4.3	1.7	31	20	
24	Monocrotophos	vomitting	Negative	Negative	6600	14.7	9	143	4.1	0.8	200	1.1	6.9	4.2	1.5	37	36	
25	Chlorpyrifos	vomitting	Negative	Negative	21300	12.5	30	139	4	0.6	150	0.6	7.1	4.3	1.5	21	18	
26	Monocrotophos	vomitting, unconsciousness	Negative	Negative	27770	13.5	30	135	4.1	0.9	472	3.2	6.8	3.5	1	20	16	
27	Monocrotophos	vonitting	Negative	Negative	7910	14.3	10	141	4	0.8	77	0.7	6.8	3.5	1	38	36	
28	proton	vomitting	Negative	Negative	13310	13.9	5	140	4.5	1.1	98	0.7	7.2	4	1.1	25	15	
29	PR-N ,HANGING	vomitting, unconsciousness	positive	Negative	15470	13.8	10	140	4	0.7	196	1.1	6.9	4.2	1.5	37	36	
30	Monocrotophos	vomitting	Negative	Negative	11040	15	35	136	4.5	0.7	114	0.9	7.1	4.3	2.1	26	18	
31	Don't know	Abdominal pain	Negative	Negative	10380	12.1	30	139	3.6	0.7	161	2.2	6.9	3.7	1.6	24	14	
32	Don't know	vomitting, Abdominal pain	Negative	Negative	5180	13	15	142	3.8	0.6	114	0.5	6.2	4	1.8	44	27	
33	Monocrotophos	vomitting, unconsciousness	Negative	Negative	18700	11	45	136	3.4	0.6	247	0.6	7.3	4.3	1.4	29	20	
34	Monocrotophos	vomitting	Negative	Negative	11240	13.9	50	138	4.4	0.6	80	0.7	7	4.2	1.5	34	15	

35	Chlorpyrifos	vomitting, unconsciousness	Negative	Negative	5270	9.5	60	147	3.6	0.6	141	0.9	6.9	4.3	2	36	38	
36	Monocrotophos	vomitting, drowsy	Negative	Negative	12800	14.3	20	145	5.2	0.8	190	1.2	7.3	4.3	1.4	25	26	
37	Monocrotophos	vomitting	Negative	Negative	6290	14.1	5	128	3.6	1.1	85	2.3	6.2	4	1.8	30	20	
38	Monocrotophos	vomitting, drowsy	Negative	Negative	22030	16.3	5	140	3.9	0.8	222	1.2	6.9	4.3	1.6	29	22	Multiple VPCS
39	Monocrotophos	vomitting, unconsciousness	Negative	Negative	15340	16.8	10	143	3.6	0.8	195	0.5	7.2	4	1.1	38	26	
40	Don't know	vomitting	Negative	Negative	8730	10.2	15	152	4.5	0.7	84	0.6	6.7	4.3	1.7	31	20	
41	Monocrotophos	vomitting, drowsy	Negative	Negative	6810	10.3	20	143	4.6	0.7	146	0.5	7.4	4.3	1.3	64	54	
42	Chlorpyrifos	Abdominal pain	Negative	Negative	17010	10.6	60	143	4	0.6	82	0.5	7	3.5	1	58	38	
43	Don't know	vomitting	Negative	Negative	5950	11.7	35	137	4.5	0.8	148	0.7	6.8	4	1.4	24	16	
44	Chlorpyrifos	Abdominal pain	Negative	Negative	19620	12.3	15	137	3.5	0.7	156	0.5	7.2	4.6	1.8	19	16	
45	Monocrotophos	vomitting, unconsciousness	Negative	Negative	12830	9.2	25	128	2.5	1	114	0.5	7.8	4.3	1.2	39	22	LVH
46	Parathion	vomitting, Abdominal pain	Negative	Negative	11710	16.3	10	150	4.8	0.8	98	0.8	6.2	4	1.8	30	25	
47	Monocrotophos	vomitting , drowsy	Negative	Negative	5960	13.2	10	148	3.7	0.6	88	0.4	5.7	3.8	2	27	28	
48	Monocrotophos	vomitting, unconsciousness	Negative	Negative	11200	15	10	144	3.8	0.6	85	0.7	4.3	2.7	1.6	17	10	
49	Don't know	Abdominal pain	Negative	Negative	8080	8.7	10	156	4	0.9	134	0.6	6	3.6	1.6	22	14	
50	Don't know																	
51	Monocrotophos	vomitting, drowsy	Negative	Negative	22860	14.4	15	144	3.8	1.3	113	0.5	7.5	3.9	1	31	36	
52	Don't know	Abdominal pain	Negative	Negative	9200	12.6	10	137	3.3	1.1	106	0.4	5.8	3.8	1.9	18	24	
53	Monocrotophos	vomitting, unconsciousness	Negative	Negative	11200	7.9	55	141	4.1	0.7	138	0.6	6.3	3.8	1.6	19	10	
54	Monocrotophos	vomitting, drowsy	Negative	Negative	21360	13.1	30	151	3.6	0.7	108	0.5	5.2	2.9	1.2	17	20	
55	Chlorpyrifos	vomitting, unconsciousness	Negative	Negative	18490	13.2	5	147	3.2	1.1	306	0.5	6.8	3.5	1	12	29	
56	Don't know	Abdominal pain	Negative	Negative	22360	13.4	15	143	3.8	0.8	146	0.5	6.2	4	1.8	24	26	
57	Chlorpyrifos	vomitting	Negative	Negative	9750	11.2	35	142	4.1	0.6	118	0.7	6.7	4.2	1.7	18	13	
58	Don't know	vomitting	Negative	Negative	10820	15.5	10	144	4.3	0.9	134	0.5	6.7	4.1	1.6	25	27	
59	Monocrotophos	vomitting	Negative	Negative	13020	13.3	5	143	5.3	0.7	90	0.8	73	4.6	1.8	34	36	
60	Don't know	Abdominal pain	Negative	Negative	11790	12.6	75	145	4.4	0.7	116	0.5	5.8	2.9	1	24	13	
61	proton	Abdominal pain	Negative	Negative	9790	7.8	20	140	3.9	0.6	124	0.6	6.5	4	1.6	20	14	
62	Don't know	vomitting	Negative	Negative	10700	15.2	5	150	3.6	0.7	103	0.7	6.7	4.3	1.9	37	21	
63	Cypermethrin	vomitting	Negative	Negative	7370	14.9	30	145	4.1	0.7	107	0.9	7	3.5	1	18	24	
64	Don't know	vomitting, Abdominal pain	Negative	Negative	25260	14.3	10	139	4.7	0.7	112	0.5	7.5	4.5	1.5	27	18	
65	Monocrotophos	vomitting, drowsy	Negative	Negative	4850	13.7	10	139	4.1	0.8	112	1.2	6	3	1.5	36	54	
66	Parathion	vomitting	Negative	Negative	22650	20.4	5	160	5.4	1	154	0.5	7.8	4.3	1.2	39	22	
67	Don't know	vomitting	Negative	Negative	9660	15.1	15	142	4.5	0.9	152	0.8	6.9	4.3	1.7	24	23	
68	Chlorpyrifos	vomitting	Negative	Negative	10540	7.4	5	137	4	0.7	91	0.8	6.7	4.2	1.6	22	20	
69	Don't know	unconsciousness	Negative	Negative	20570	13.2	50	142	4.5	0.8	259	0.5	7.4	4.1	1.2	32	13	
70	Monocrotophos	Abdominal pain	Negative	Negative	9490	10.4	40	142	4.2	0.8	112	0.9	7.8	4.9	1.7	16	26	
71	Don't know	vomitting	Negative	Negative	22060	15.1	25	141	3.6	0.9	135	0.5	7.7	4.4	1.3	55	25	
72	Don't know	vomitting	Negative	Negative	10150	10.2	20	140	4	0.6	117	1.2	7.4	4.5	1.6	36	24	
73	PR-N	vomitting, Abdominal pain	Negative	Negative	10000	12	25	140	3.6	0.8	116	0.8	73	4.6	1.8	48	35	
74	Chlorpyrifos	vomitting	Negative	Negative	17200	10.8	55	147	4.3	0.8	96	0.6	6.7	4.1	1.6	15	10	
75	Parathion	vomitting, drowsy	Negative	Negative	7630	12.7	40	141	4.3	0.8	108	0.6	6.8	4	1.4	28	27	
76	Chlorpyrifos	unconsciousness	Negative	Negative	29300	14.4	5	138	2.9	0.6	96	0.9	7.6	4.3	1.4	28	26	

77	Parathion	vomitting	Negative	Negative	9120	7.7	40	141	3.7	0.6	138	0.5	6	3	1.5	20	10	
78	Don't know	Abdominal pain	Negative	Negative	13160	12	50	143	4.5	0.7	88	0.5	7.1	4.4	1.7	35	28	
79	Monocrotophos	vomitting	Negative	Negative	17650	15.5	5	150	3.3	0.9	124	1.2	6.9	4.2	1.5	26	16	
80	Monocrotophos	vomitting, drowsy	Negative	Negative	23300	12.6	40	139	3	0.6	234	0.8	7.4	4.1	1.2	39	24	LVH
81	Chlorpyrifos	vomitting, unconsciousness	Negative	Negative	17300	15.4	60	140	4.3	1	186	0.8	6.5	4	1.6	27	12	
82	Monocrotophos	vomitting, unconsciousness	Negative	Negative	15170	11.5	10	144	3.8	0.6	119	0.6	6.7	4.5	2	36	19	
83	Monocrotophos	unconsciousness	Negative	Negative	6760	8.8	20	147	3.2	1.2	174	1.8	5.8	3.7	1.8	20	12	Twave inversion in 2,3,avf
84	Chlorpyrifos	vomitting, drowsy	Negative	Negative	14650	8.7	65	141	2.9	0.7	194	0.6	7.1	4.3	1.5	21	18	
85	Monocrotophos	unconsciousness	Negative	Negative	16670	12.6	10	145	3.9	1	109	0.5	7.1	4	1.3	33	18	
86	Monocrotophos	vomitting, unconsciousness	Negative	Negative	25610	11.7	50	145	3.2	1.7	289	1.4	6.9	4.2	1.5	38	35	Cardiac Arrest
87	Monocrotophos	unconsciousness	Negative	Negative	19100	12.8	20	140	4	1	256	0.5	6.2	3.5	1	11	20	Twave inversion in v1-v4
88	Don't know	vomitting	Negative	Negative	15610	10.7	70	140	3.9	0.6	134	0.8	6.9	4.3	1.5	36	38	
89	Don't know	vomitting, drowsy	Negative	Negative	16720	8.8	35	137	3.7	1.3	124	3.2	6.8	3.5	1	20	16	
90	Don't know	Abdominal pain	Negative	Negative	7010	11.6	15	136	4	0.6	118	0.6	7.3	4.2	1.4	18	24	
91	Don't know	vomitting	Negative	Negative	9560	13.8	35	142	3.5	0.8	128	1.2	6.8	4	1.4	34	26	