DOCTOR OF MEDICINE IN GENERAL MEDICINE

"A STUDY TO EVALUATE SERUM MAGNESIUM AND POTASSIUM LEVELS AS A PROGNOSTIC MARKER IN ORGANOPHOSPHORUS POISONING AND ITS CLINICAL SEVERITY USING PERADENIYA POISONING SCALE"

ABSTRACT

Organophosphorus poisoning is a critical public health problem in developing countries, especially India, where intentional self-harm causes about 500,000 deaths yearly. About 60% of these are caused by pesticides, of which 66% consist of organophosphorus consumed poisoning. (1)

Organophosphorus compounds inhibit acetylcholinesterase and butyrylcholinesterase enzymes which results in excess acetylcholine in the neuromuscular junction causing overstimulation at the cholinergic synapses. Acetylcholine (Ach) , the main neurotransmitter of the central and peripheral nervous system, is present at all the postganglionic parasympathetic nerve endings, at synapses of both the sympathetic and parasympathetic ganglia, and at musculoskeletal muscle junctions. (86)

It is estimated that about 95% of fatal pesticide poisonings occurs in the developing countries. India, reports a rate of suicidal poisoning with OPC which range between 10 to 43 %. Within these patients the mortality rate has been estimated to be 20 to 70%. (6) The mortality and morbidity in such patients depend on time lag between the exposure to the poison and onset of management. Hence essential to evaluate the overall symptoms in OP poisoning to predict the outcome in a short duration of time. (87)

Early recognition with aggressive treatment of such a condition are often lifesaving. Such situations highlight the need for specific predictive prognostic markers. Various clinical and laboratory parameters have been proposed to evaluate the severity of poisoning and to predict the prognosis in patients with OP toxicity. The study aims at analysing certain clinical and biochemical parameters in the prediction of the severity and clinical outcome of OP poisoning cases.

LIST OF ABBREVIATIONS

Ach	Acetylcholine
anti-ChE	Anticholincstcrasc
DDT	Dichloro diethyl trichloroethane.
EDRF	Endothelium derived relaxing factor
x'	Chi-square value
HS	Highly significant
IMS	Intermediate syndrome
IV	Intravenous
No	Number
OP	Organophosphorus
OPC	Organophosphorus compound
OPLDP	Organophosphate-induced delayed polyneuropathy
2-PAM	Pralidoxime
PChc	Pscudocholincstcrasc
POP scale	Peradeniya Organophosphorus poisoning scale
S	Significant.
TEPP	Tctracthyl pyrophosphate
TOCP	Organophosphate triorthocrcsyl phosphate
GABA	Gamma-aminobutyric acid
GTP	Guanosine Triphosphate
GDP	Guanosine Diphosphate

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INTRODUCTION

Organophosphorus poisoning is a critical public health problem in most developing countries, especially south of India, where intentional self-harm causes about 500,000 deaths yearly. About 60% of these are caused by pesticides, of which 66% consist of organophosphorus consumed poisoning. (1)

In the southern states of India, insect poisoning is very common, largely due to the intensive activities done in agriculture fields. It has accounted for a specific proportion of intensive care unit visits in the region. Easy availability and light sales rules and regulations make organophosphorus compounds the most used way of intentional self-destruction. Injuries among manufacturing and agricultural workers are common.

Hospital statistical analyses have claimed that death rates for OP poisoning range from about 20% till 40%. (2) Commonest cause of death in organophosphate poisoning is respiratory arrest and acidosis due to respiratory muscle paralysis associated with hypokalaemia, which is muscle weakness. Thus, hypokalaemia can be considered the reason for the intensification of poisoning. (3) Acute OP compound causes hypomagnesemia due to prolonged nasogastric suctioning, dysentery, severe diarrhoea, concomitant medical conditions such as starvation, chronic alcoholism, diabetes mellitus, hyperthyroidism, etc. (4)

Early recognition and aggressive treatment of such a condition are often lifesaving. Such situations highlight the need for specific predictive prognostic markers. Various clinical and laboratory parameters have been proposed to evaluate the severity of poisoning and to predict the prognosis in patients with OP toxicity. The study aims to analyse certain biochemical parameters correlated clinically in the prediction of severity and its outcome clinically in OP poisoning cases.

OBJECTIVES

1. The effect of hypokalemia and hypomagnesemia on organophosphate poisoning.

2. Correlate with various parameters to study clinical severity by Peradeniya organophosphorus poisoning scale.

LITERATURE REVIEW

"Anything in excess is poison"

Organophosphorus pesticides (OPCs) are among the most widely used pesticides in India and Asia [5], reporting nearly 2,00,000 mortality annually. (6) In a few cases, critical poisoning appears as an occupational hazard. Due tothe high toxicity of these pesticides and insecticides, suicidal or unintentionalexposure to these pesticides and insecticides is often fatal to humans. It can enter the human body through skin absorption, ingestion or inhalation.

Tetraethyl pyrophosphate (TEPP) is the first pesticide of the organophosphorus group to be discovered. Organophosphorus complex compounds (OPCs) and the carbamates are worked around on a daily bases in India. These pesticides have anticholinesterase properties, which cause the phosphorylation of acetylcholinesterase in nerve endings. This eventually leads to the accumulation of excessive Ach at the nerve endings, and this causes clinically symptoms such as muscarinic and nicotinic with central effects.

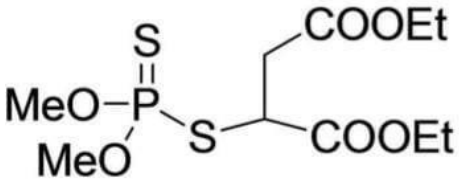
Extreme usage of these compounds in many areas of lives have caused hazardous pollution environmentally and noticeable health risks due to poisoning. Since acetylcholinesterase inhibition is a vital action in the pathophysiological action of the OP poisoning, essentially it is required to understand the physiological transmissions at the cholinergic level in humans.

Chemically Organophosphorus Compounds are categorised into four subgroups,

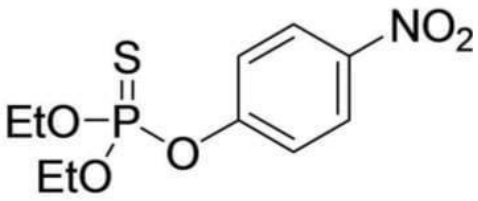
GROUP 1: Phosphorylcholines
GROUP 2: Fluorophosphates
GROUP 3: Cyanophosphates
GROUP 4: Multiple constituents

WHO classification of insecticides comprises of (TABLE 1) :

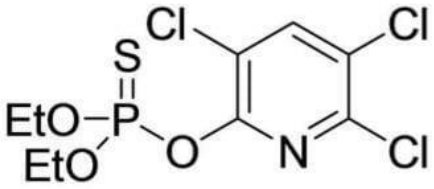
HIGHLY TOXIC	MODERATELY TOXIC	OTHERS
Monochrotophos,	Fenthion,	Ediphenophos,
Phosphomidan,	Formothion,	Phosphenidon,
Ethyl parathion,	Malathion,	Parathion,
Methyl parathion, and Phroate.	Chlorpyriphos, and Methyl primiphos.	Quinalphos, and Jodfenphos.



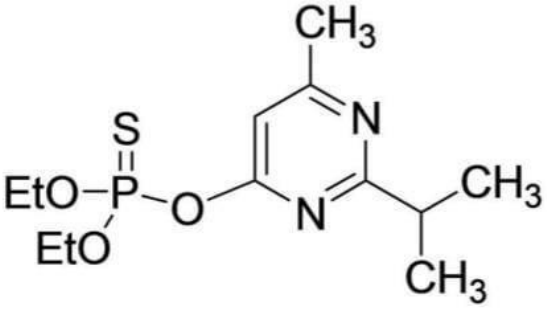
Malathion



Parathion



Chlorpyrifos



Diazinon

WHO acute toxicity classification

WHO Toxicity classification		Rat LD50 (mg of chemical per kg of body weight) solid			
Class	Description	Solids (oral)	Liquids (oral)	Solids (dermal)	Liquids (dermal)
Ia	Extremely hazardous	<5	<20	<10	<40
Ib	Highly hazardous	5-50	20-200	10-100	40-400
II	Moderately hazardous	50-500	200-2000	100-1000	400-4000
III	Slightly hazardous	>500	>2000	>1000	>4000

TABLE 1 : CLASSIFICATION OF ACUTE TOXICITY

ACETYLCHOLINE

Acetylcholine is one of the human body's most common and essential neurotransmitters. The chemical organically as C7NH16O2, is a derivative of choline and acetic acid. Its action mimics stimulation of the vagus nerve. It is present in the junction of neuromuscular of peripheral nervous system, while found mainly at interneurons in central nervous system. It plays a role as a neurotransmitter in the autonomic nervous system's preganglionic parasympathetic and sympathetic neurons. It is abundantly found in main organs like the adrenal medulla, piloerector muscles and the sweat glands. In the neurological system, acetylcholine plays a role in thinking, movement, inhibition of nociception and general brain activity. (7)

The characteristic functions of acetylcholine in the nervous system are :

-) **Wakefulness and the sleep cycle**: Forebrain basal complex consists a mixture of both nicotinic and non-nicotinic connections, which are monitoring the arousal and sleep cycle. The cholinergic neurons are responsible for behavioural arousal by stimulating the nucleus basalis/septum. (8)

-) **Cognitive function**: Hippocampus and the posterior parietal cortex mediate covert inhibits by cholinergic stimulation. Cholinergic innervation to the frontal cortex of the basal ganglia is known to mediate attentional functions. Its other importance is attention division, which are mediated by the peduncle pontine, tegmental nucleus striatum and the dopaminergic system . Receptors of the muscarinic also can mediate the cognitive process in the hippocampus, prefrontal cortex and amygdala. (9) Destruction of the cholinergic neurons leads to degenerative conditions like Alzheimer's disease, Parkinson's disease, Lewy body dementia and supranuclear palsies.

-) **Motivation with reward**: The mesolimbic tegmental nucleus and ventral tegmental areas are designated for motivation with rewards. The peduncular pontine tegmental nucleus can stimulate the ventral tegmental area and produce the mesostriatal dopaminergic transmission , which causes motivational stimulus. (10)

Production of Acetylcholine:

Choline is produced by cholinergic cell bodies acetyltransferase that is transferred to axons. Choline acetyltransferase works on choline and acetyl-CoA which is a one-step reaction since it is present abundantly in the clefts of the synapse from phosphatidylcholine breakdown and recycles acetylcholine metabolites. Calcium regulates and absorbs these metabolites.

Acetylcholine Storage:

Most acetylcholine is preserved in the vesicles presynaptically, and a few quantities are free in the cytosol. Acetylcholinesterase does not degrade acetylcholine in the bladder. An energy-dependent pump acidifies the bladder and depletes acetylcholine. Vesicular acetyl is used by acidified vesicle transporters to exchange protons (H) for acetylcholine molecules.

Receptors of Acetylcholine:

Acetylcholine receptors are membrane-bound proteins used for binding acetylcholine. The types of acetylcholine receptors: nicotinic receptors and muscarinic receptors.

A) Receptors of nicotinic bind nicotine and mediate target cell excitability. They are connected to ion channels and trigger short, fast reactions. They are situated at the junction of neuromuscular, autonomic ganglia, and central nervous system. In the cranium, presynaptic regulation of GABA releases the nicotinic beta2 (β2) subunit in all areas, beta mediates nicotinic acetylcholine release in interstellar regions, and the α7 subunit in the hippocampus mediates the same action. [11]

B) Receptors of muscarinic: G protein-coupled receptors group, which is composed of the subunits alpha α, beta β, and gamma γ are examples which consists of a single polypeptide. These specific amino acids are located at seven regions of this polypeptide as an alpha helix. (12)

The specific subunit α, G protein releases the GDP that binds to the GTP. This G protein is activated and dissociates the α subunit that mediates specific responses. GTPases hydrolyse GTP to GDP and terminate GTP activity. This involves the cessation of adenyl cyclase, potassium channel activation, and phospholipase C stimulation. Muscarinic receptors exist in both presynaptic and postsynaptic areas (Table 2).

Muscarinic Cholinergic Receptor Subtypes

Receptor	Tissue	Example of response	G - Protein	2nd messengers
M1	CNS, ANS ganglia, glands, enteric nerves	increased cognition, seizure, secretion	G_q	↑ IP3, DAG, Ca^{++}
M2	heart, smooth muscle, ANS nerve terminals, CNS	bradycardia, A-V block	G_i	↓cAMP, activate some K^+ channels, inhibit Ca^{2+} channels
M3	smooth muscle, exocrine glands, heart, CNS	sm. muscle contraction, salivation	G_q	↑ IP3, DAG, Ca^{++}
M4	Especially in CNS	Analgesia, catalepsy, regulate transmitter release	G_i	↓cAMP, activate some K^+ channels, inhibit Ca^{2+} channels
M5	localized to select CNS neurons and in a few peripheral nerves	Promotes drug-seeking behavior	G_q	↑ IP3, DAG, Ca^{++}

TABLE 2: THE SUBTYPES OF MUSCARINIC CHOLINERGIC RECEPTORS

Chemical morphology of the receptor Ach:

Morphologically, pentameric complex with four important proteins - α 2 βγδ defines Ach receptor (Figure 2) in which the cytoplasmic side of the membrane consists of intracellular proteins. Phosphatase activity and actin-binding activity are seen in some proteins. This element as a funneled shape structure enters synapse. These subunits gather around the ion channel, extend into the synaptic space. Ach receptors at the neuromuscular junction show functional and morphological similarities to cells called “electrolytes” found in electric fishes and torpedoes, the knowledge comes from studying these complex structures after analyses.

The subparts are geometrically aligned so that each subunit can be proteolytically cleaved off the membrane on both sides by trypsin. The receptor has an extracellular membrane with a cytoplasmic domain based on hydrophobicity of amino acid residues.

Most characteristic are the ligand-binding sites on the receptor which are the two high-affinity agonist-binding sites, one on an α subunit. Binding of agonist to these sites triggers a conformational change that leads to opening of channels or desensitisation. Binding of the agonists are affected by the glycosylation of the alpha subunit domain.

Predominant are the membrane domain with the amino acid residues involved in ion channel functioning . The composition is of a closely helix packed amphipathic, with each of the subunit contributing to forming a hydrophilic portion. Conducting these property of the ion channels depend on changes conformationally in the side chains, as they indirectly act with cations.

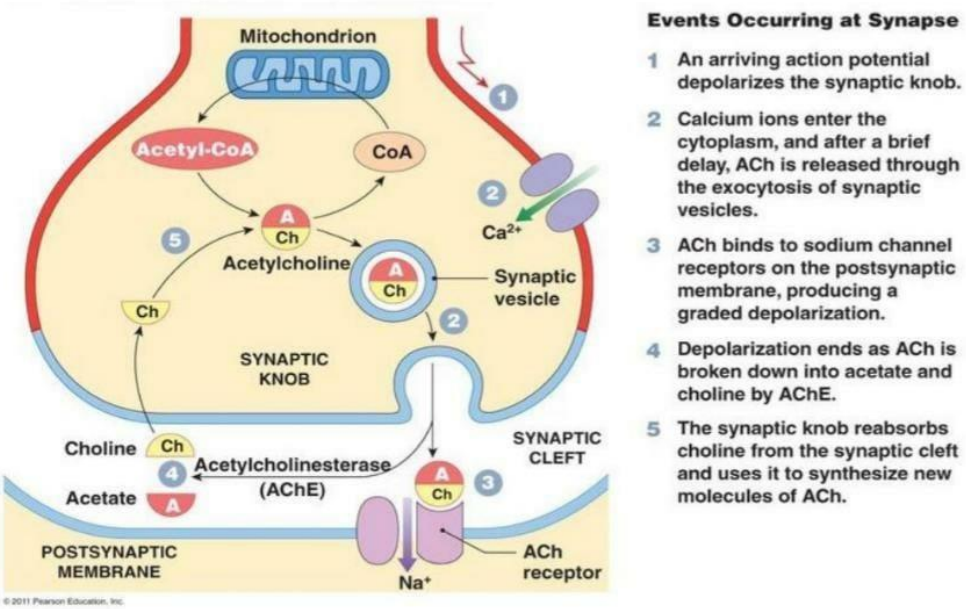


Figure1: Schematic diagram of cholinergic synapse.

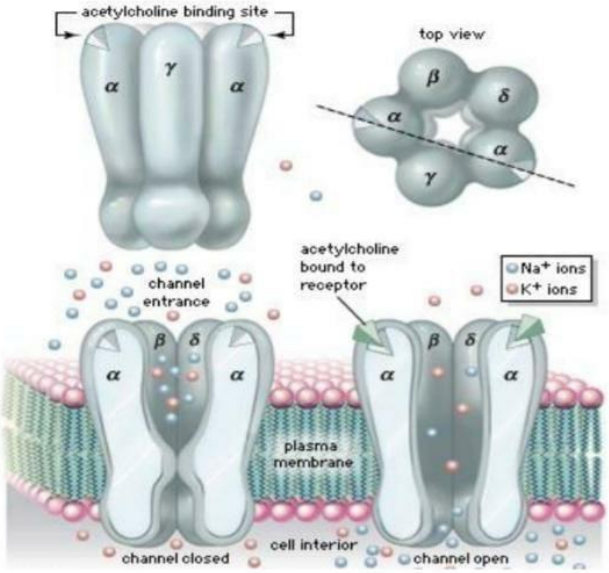


Figure 2: structure of acetylcholine receptor

NEUROTRANSMISSION OF ACETYLCHOLINE:

Ach is released quantitatively from the presynaptic vesicles. Calcium influx through voltage-gated calcium channels is affected with each release. The opening of these calcium channels is triggered by axonal voltage-gated sodium channels. Release of Ach occurs upon plasma membrane joining with adjacent Ach-containing vesicles (Figure 1).

When Ach binds to the receptor, the ion channel opens, and sodium ions are transported into the synaptic space via the sodium-potassium or sodium-potassiumATPase. Each Ach receptor molecule is known to conduct approximately per millisecond ten ions. At least two Ach molecules per Ach receptor are required to open an ion channel. [13] Two alpha subunits bind to Ach and contain the binding sites for agonist activation. Its takes about 0.1–10 ms for each Ach receptor to shut.

In the synaptic space, Ach is hydrolysed by acetylcholinesterase and loses its effect. [14] The long-term presence of agonists sensitises the receptor. Receptor activity is regulated by calcium, and presence of fatty acids , cytoplasmic site phosphorylation and N- and O-glycosylation. It is affected by non-physiological agents such as neurotoxins, muscle relaxants and the local anaesthesia.

The Ach is hydrolysed to choline and acetate by the enzyme acetylcholinesterase in the synaptic space. This enzyme is ubiquitous in neurons through axonal transport.

ENZYME ACETYLCHOLINESTERASE :

Acetylcholinesterase is an enzyme that stops the transmission of cholinergic impulses. Choline and acetate are produced due to the hydrolysation of acetylcholine. The efficiency of this enzyme is very high, breaking down approximately 10,000 such Ach molecules per second.

Organophosphorus chemicals, sulfonyl halides and carbamates, form many covalent bonds at the enzyme's active site and act as acetylcholinesterase inhibitors.

This ellipsoidal shaped enzyme belongs to hydrolases group which are unique, with eight strong β-strands attached by the alpha-helices. Particular site termed as catalytic triad, contains of three amino acids: glutamic acid, serine , histidine. This triad at its base, is the active site 'GORGE', which is half-permeable to the enzyme. (15) The active site or "GORGE" contains two exact active subsites, an ester site and an anion site. The ester site serves for catalytic activity and the anion site serves for binding the quaternary group of acetylcholine. The enzyme also gained additional binding sites for Ach and other quaternary ligands. In the GORGE sites are capped by numerous aromatic amino acid residues, primarily tryptophan, and these peripheral anionic sites at the pharynx entrance cause substrate inhibition.

Six conserved aromatic residues flanking the pox site distinguish between acetylcholinesterase and butyrylcholinesterase. Three amino acids, glutamate, histidine, and serine, in the catalytic triad, are arranged so that glutamate and histidine donate electrons to serine. This activated serine residue forms a bond covalently with the acetylcholine. This results in forming a "tetrahedral oxyanion intermediate" stabilised by interactions with amide groups, forming an oxyanion hole. (16)

This covalent bond is broken with a release of acetate and choline. Acylation and deacylation is a two-step process. The nature of the substrate also affects catalysis. Binding of substrate to the active sites of an enzyme determines effectiveness of the catalysis. Precise compatibility of carbaresters , thioesters makes it excellent catalysis substrates, whereas organophosphorus complexes irreversibly inhibit enzymes due to their different shapes. (FIGURE 3)

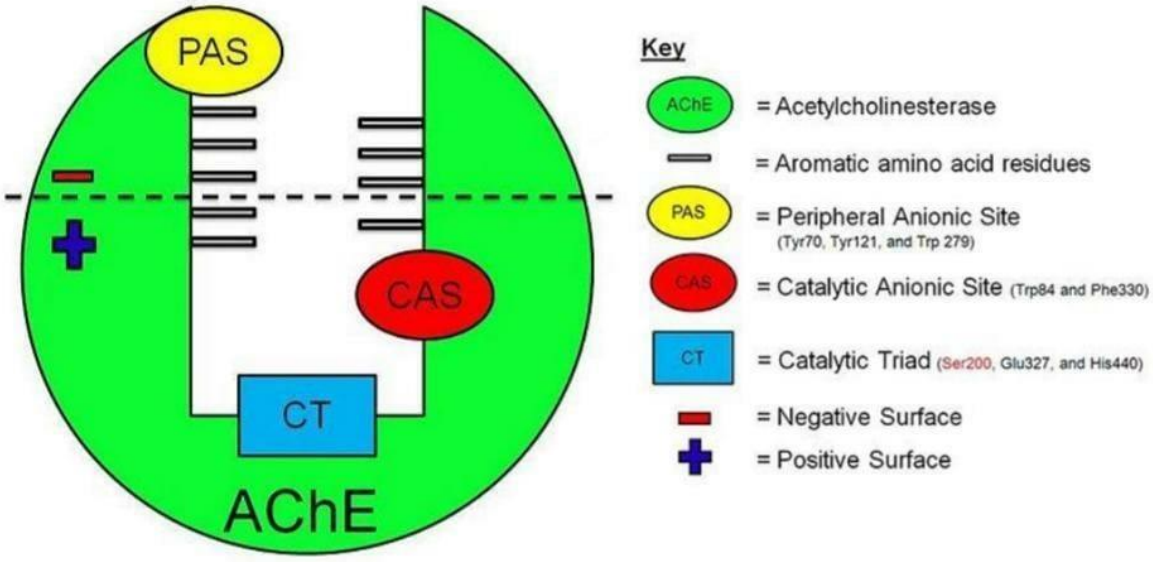


FIGURE 3 : REPRESENTING THE ACETYLCHOLINESTERASE

ORGANOPHOSPHATE COMETS

BACKGROUND HISTORY:

The utilisation of chemical agents to control pests and insects dates to the historical civilisation of Roman times. The first pesticides to be discovered early 19th century were arsenic and its derivatives when revolution of the industries brought with it a wide variety of compounds of pyrethroids, organophosphates and organochlorines. First step in this development was Zeidler's synthesis of dichlorodiphenyltrichloroethane (DDT). The history of organophosphorus compounds is closely related to the World War II when the Gerhard Schrader , a chemist from Germany (Figure 4) discovered chemicals that caused neurological paralysis in human beings. It was also termed as "nerve gases".

FIGURE 4 : Gerhard Schrader , a german chemist

MOLECULAR STRUCTURE:

Organophosphate compounds are organic containing phosphorus compounds. This includes classes of molecules with different oxidational states and phosphorus derivatives. The general chemical structure of OPCs consists of a tetrasubstituted phosphorus (V) centre, an O or S atom double-bonded to the phosphorus, a leaving group, and two substituents that differ by subclass [17] (Figure 5). The esterification reaction of phosphoric acid and alcohol synthesises OP compounds. They are usually ester, amide or derivatives of thiol.

The three important chemical classes of OP compounds are:

1. Pure phosphate - no sulfur atoms present
2. Phosphorothioates - 1 sulfur atom present
3. Phosphorodithioates - 2 sulfur atoms present

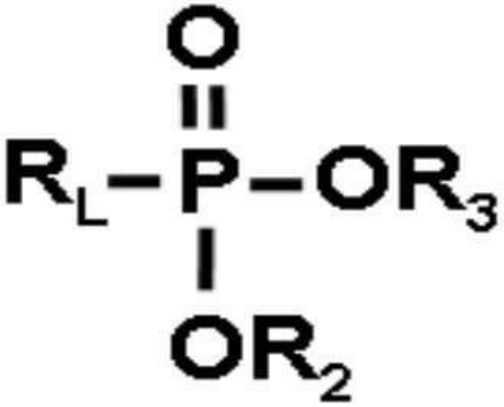


FIGURE 5: CHEMICAL MORPHOLOGY OF OP

TOXICOLOGICAL KINETICS:

Chemicals are absorbed through the skin, respiratory tract, and gastrointestinal mucosa. A preexisting inflammation locally, for example dermatitis, which increases the dermal absorption of compounds. Absorption through skin to the amount of contact time is directly proportional. Absorbed compounds are eliminated in exhaled breath, faeces, and urine. The three pathways enzymatically involved in the biotransformation of OP compounds are mixed-function oxidases (MFOs), hydrolases, and transferases. In the liver, the MFO system is present, also in the kidneys and gut flora. NADPH and oxygen are required for this step of the xenobiotic reaction to act as a catalyst. [18]

MECHANISM OF ACTION:

Organophosphate compounds bind to cholinesterase enzymes through their molecular mimicry. They create covalent phosphate bonds at the serine active site of cholinesterase-acetylcholinesterase and pseudocholinesterase or serum cholinesterase. The enzyme cholinesterase is designed to hydrolyse Ach to choline and acetate. Some choline is transferred to the presynaptic neuron and changed to acetylcholine. Enzyme phosphorylation occurs when the organophosphate group is released, and the compound forms a covalent bond with the enzyme. The kinase is stable relatively. A serine group blocked by a phosphoryl group cannot participate in the hydrolysis of acetylcholine. The senescence theory states that when the enzyme inhibition by the phosphate moiety of the OP compound occurs, the OP-serine conjugate is dealkylated, rendering the enzyme resistant to nucleophilic attack and ultimately irreversibly inhibiting the enzyme. (Figure 6). [19] Expired enzymes cannot be reactivated. Cholinesterase inhibition causes Ach accumulation and hyperstimulation of Ach receptor sites by affecting muscarinic nerve effectors, in sympathetic ganglia and skeletal muscle neurojunctions by nicotinic receptors, and the CNS by Ach receptor sites. [20]

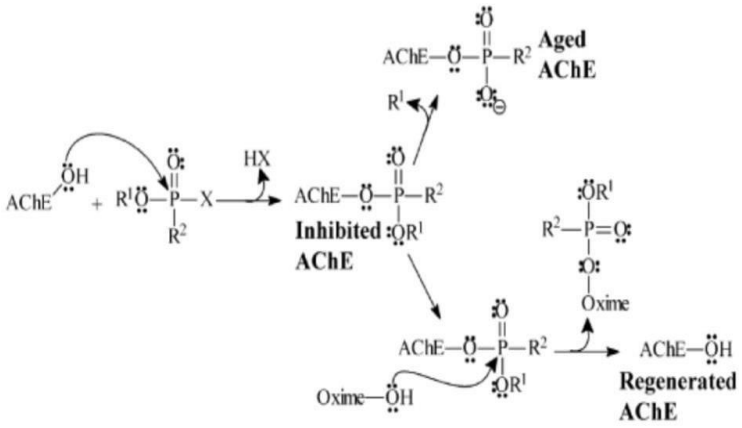


FIGURE 6: PATHWAY OF AChE INHIBITION (LEAVING GROUP IS X)

PATHOLOGICAL PHYSIOLOGY:

The negative impact of OP compounds on multi-systems in humans are as follows:

1. Respiratory effects: It causes respiratory distress due to muscle paralysis. Patients develop apnea, tightness, wheezing, and slow breathing that can lead to productive coughing. Respiratory depression is the leading reason for death due to the respiratory centre obstruction or bronchospasm. (21)

2. Cardiovascular effects: Acute toxicity causes myocardial death resulting in elevated blood lactate dehydrogenase levels and creatine kinase. (22) Bradycardia is the typical symptom. Patients may have abnormal heart rates, changes in heart sounds, and irregular rhythm. ST elevation, QT and PR interval prolongation, and low-amplitude T waves are the changes seen on ECG.

3. Central Nervous effects: There can be a delay in stimuli lasting up to six months due to nerve damage. Manifests as a cerebellar syndrome, Parkinson's symptoms, memory impairment, etc. (23)

4. Hepatobiliary effects: As the liver is the site of OP biotransformation, congestion, necrosis, hepatocyte inflammation, and sinusoidal hypertrophy can occasionally occur. (24)

5. Renal effects: Organophosphates are risk factors for comorbid conditions like diabetes,(38) renal failure and renal malignancy. (25)

6. Endocrine effects: OP compounds primarily affect sex hormones and cause hypogonadism. (26)

SYMPTOMS:

Clinical scenario of OP compound poisoning depends on which route is most rapidly absorbed: inhalational, oral administration, or through the skin. The earliest symptoms are headache, dizziness, or vomiting, with patients gradually developing signs of increased secretions, such as defecation, diaphoresis , salivation, rhinorrhea, and lacrimation. Other signs are blurred vision with miosis. The presentation progressed to miosis, with gastrointestinal symptoms and hypersalivation. The muscarinic symptoms often are the first ever clinical signs to be observed. OP toxicity can set in convulsions, and fatigue in the young. [27] Summarized symptoms in Table 3.

Cholinergic Toxidrome		
Nicotinic:	**Muscarinic:**	**Central:**
Pupil dilatation	Pupil constriction	Agitation
Tachycardia	Bradycardia	Confusion
Bronchodilatation	Lung mucous production & airway obstruction	Lethargy
Hypertension	Vomiting & diarrhoea	Coma
Sweating +++	Hypersalivation & tearing	Seizure
Muscle weakness (inc respiratory arrest)	Urinary incontinence	Death

TABLE 3: CHOLINERGIC CRISIS SYMPTOMS

Inhalational OP compounds toxicity may induce dry cough, shortness of breath, presenting as pneumonia, etc. In the case of eye contact, the patient experiences photophobia, irritation, tears or blurred vision. [28]

The patient presents with:

1. CHOLINERGIC CRISIS/SYNDROME:
The collection of Ach in nerve terminals causes overstimulation of cholinergic receptors (both muscarinic and nicotinic receptors). Hypersecretion, muscle pain, muscle spasm, miosis, diarrhoea, hypermotility of the gastrointestinal tract, etc., are observed. [29] LMN-type muscle weakness occurs, primarily affecting respiratory muscles and causing respiratory failure.

2. INTERMEDIATE SYNDROME or PARALYSIS TYPE II :
Intermediate Syndrome is due to nicotinic receptor desensitisation by prolonged cholinergic stimulation. It appears after exposure , days or after cholinergic syndrome and extends up to approximately 18 days. Neck muscle weakness is the most common symptom, followed by paralysis of eye muscles, respiratory muscles, and neck and limb muscles. [30]

3. TYPE III PARALYSIS - LATE-ONSET POLYNEUROPATHY DUE TO ORGANOPHOSPHATES:
It has been known to develop 2-3 weeks after exposure to toxic OP compounds. [31] Chronic exposure or high doses of OP compounds cause organophosphate-induced delayed polyneuropathy (OIDP). Some OPs, such as Metamorphous and Trichlorfon, are responsible for OIDP due to their unique structure that may lead to degradation. This can eventually lead to neurodegeneration. Patients experience loss of sensation, tingling in the peripherals, with a muscle weakness progressive, and with laxity of the distal skeletal muscles. The patient may take up to a year, and high-dose methylprednisolone is the optimal treatment.

4 .LONG-DURATION TOXICITY: Certain articles have shown that the acute exposures to high doses of OP compounds can lead to long-term effects that manifest primarily in neurological abnormalities such as degeneration of the brain and cerebellum degeneration. (32)

SERUM POTASSIUM (K):

This element is a vital intracellular ion required for many important functions cellularly. Severe clinical symptoms can occur when serum levels change. A typical Western diet contains between 70 and 150 millimoles of potassium per day. The level is optimised between 3.5 to 5.5 mg/dl.

Distribution: Absorption is mainly in the gastrointestinal tract, where potassium is primarily distributed to intracellular compartments and the extracellular fluid, the major cation. The concentration cytoplasmically is approximately 100-120 mmol/L. In the intracellular fluid, the average total potassium is about 3000-3500 mmol in healthy adults. About 70% are in muscle, the rest in bone, skin, red blood cells, and liver. ECF contains only 2% potassium. It is secreted via the Na, K-ATPase pump in almost all cells. The pump's mechanism is to transport three sodium ions out of the cell in exchange for the two potassium ions inside the cell. Membrane potential is determined primarily by the differential distribution of these cations, resulting in higher electronegativity in intracellular compartments. This potential is necessary for nerve function and muscle contraction. Several mechanisms tightly regulate the serum levels of this cation. It has been suggested that the GIT or portal sensor has a potassium 'forward-flow' system that contributes to renal potassium excretion through pathways unrelated to the serum aldosterone or potassium levels. (33)

The reflex mechanism helps balance daily potassium intake and potassium excretion by the kidneys. The factors that maintain potassium distribution can be divided into those that lower and those that raise potassium levels. Insulin, beta-agonists, alkalosis, and alpha-blockers lower serum levels, whereas acidosis, hyperglycemia, beta blockers, alpha agonists, hyperosmolarity, and exercise increase serum concentrations. Acidosis caused by inorganic anions such as NH Cl and HCl causes hyperkalemia by an unknown mechanism.

However, organic anions typically do not produce such effects. Beta 2 agonists and insulin activate Na and K-ATPase to transport potassium into the cell. Activation of beta2 receptors increases intracellular cAMP, which in turn stimulates her Na, K-ATPase pumps. Activation of alpha receptors has the opposite effect.

Hypokalemia in OP toxicity:

In OPC toxicity, hypokalemia is present. [34] The mechanism proposed by which hypokalemia occurs includes excessive vomiting, ganglionic stimulation-induced sympathetic hyperactivity, and hypomagnesemia which favour hypokalemia. None of these mechanisms has been proven. No randomised controlled trials evaluating hypokalemia in this setting have been conducted. There are few case reports available at hand. If hypokalemia exacerbates due to ingestion of OP, it can impair neuromuscular synaptic function, which is already affected due to the poison. It can cause arrhythmias and may adversely affect the outcomes. [35]

SERUM MAGNESIUM:

Acute organophosphate poisoning can cause hypomagnesemia [36] for the following reasons: prolonged nasogastric suctioning, dysentery, severe diarrhoea, concomitant medical conditions such as fasting, chronic alcohol consumption, type 1 or 2 diabetes mellitus, hyperthyroidism and chronic renal disease.

The concentration of normal-ranged plasma magnesium is 1.70-2.10 mg/dl. Magnesium is part of protein, fat and carbohydrate metabolism and functions as a cofactor for enzyme ATPase. The magnesium ion reacts with the release acetylcholine release and blocks neuronal synaptic transmissions extracellularly. It has been noted that the level of hypokalemia is associated with levels of hypomagnesemia.

Hypomagnesemic signs/symptoms:

INVOLVEMENT OF CARDIA: • Atrial/Ventricular Arrhythmias • Hypertension	INVOLVEMENT OF NEURO MUSCLES: • Seizures • Muscular cramps • Depression • General fatigue • Organic brain syndrome (acute)

Signs of organophosphate toxicity can mask the features of hypomagnesemia; hence its serum levels can predict outcomes in patients with acute organophosphate poisoning.

Peradeniya Organophosphate Poisoning Scale (POP):

Patients should be screened by the POP scale method as soon as admitted to the hospital and before treatment is started. Aids in evaluating effects of cholinergic and the parameters used are size of pupils, heart rate, respiratory rates, fasciculations, seizures, and conscious level. [37] Categorised to be as: Minimal: 0-3, Moderate: 4-7 and Severe: 8-11
(FIGURE 7)

Parameter	Criteria	Score
Pupil size	≥2 mm	0
	<2 mm	1
	Pinpoint	2
Respiratory rate	<20/min	0
	≥20/min	1
	≥20/min with central cyanosis	2
Heart rate	>60/min	0
	41-60/min	1
	<40/min	2
Fasciculation	None	0
	Present, generalized/continuous	1
	Both generalized and continuous	2
Level of consciousness	Conscious and rationale	0
	Impaired response to verbal commands	1
	No response to verbal commands	2
Seizures	Absent	0
	Present	1

FIGURE 7 : Peradeniya Organophosphate Poisoning Scale

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OTHER SCALES TO ASSESS THE SEVERITY OF POISONING:

A systematic strategy is required with an appropriate scoring system based on laboratory tests and clinical symptoms to assess severity and progression. It can be assessed with the GCS (Glasgow Coma Scale), P.S.S (Poison Severity Scoring System) , APACHE-II (Acute Physiology and Chronic Health Evaluation -2)

1. Glasgow Coma Scale (GCS): It is a neurological scale to assess a patient's level of consciousness. Scores are based on the high ocular response, high response to verbal command, and high response to motor. [39]

It is assigned minor with more than 13 GCS, moderate 9-12, and extreme with less than 8. The minimal value is 3, with a maximum of 15. A score less than 8 implies severity indicating that the patient needs intubation.

The score system has many advantages than other scoring systems since it is quick to assess and does not require any laboratory investigations (Table 4)

BEHAVIOR	RESPONSE	SCORE
Eye opening response	Spontaneously	4
	To speech	3
	To pain	2
	No response	1
Best verbal response	Oriented to time, place, and person	5
	Confused	4
	Inappropriate words	3
	Incomprehensible sounds	2
	No response	1
Best motor response	Obeys commands	6
	Moves to localized pain	5
	Flexion withdrawal from pain	4
	Abnormal flexion (decorticate)	3
	Abnormal extension (decerebrate)	2
	No response	1

Table 4: Glasgow Coma Scale

2. THE APACHE-II SCORING SYSTEM : Acute Physiology And Chronic Health Evaluation-II: This scoring system helps to assess the morbidity of patients with an age limit of more than 15 years. APACHE score is calculated by the addition of the total Acute Physiological Score (A), which sums all these 12 value, with age points (B) and chronic health points like any organ insufficiency. The APACHE score is inversely related to the prognosis (Table 5).

It is evaluated based on parameters which 12 in number that are mean arterial pressure, heart rate, respiratory rate, temperature, partial oxygen pressure, packed cell volume, serum creatinine ,serum sodium and potassium, white blood cell count (WBC)and Glasgow Coma Scale (GCS). (40)

APACHE II Score[9]

APACHE II score = (acute physiology score) + (age points) + (chronic health points)

Physiologic Variable	+4	+3	+2	+1	0	+1	+2	+3	+4
Rectal temperature (C)	≥41	39-40.9		38-38.9	36-38.4	34-35.9	32-33.9	30-31.9	≤29.9
Mean arterial pressure (mm Hg)	≥160	130-159	110-129		70-109		50-69		≤49
Heart rate (bpm)	≥180	140-179	110-139		70-109		55-69	40-54	≤39
Respiratory rate (bpm)	≥50	35-49		25-34	12-24	10-11	6-9		≤5
Oxygen delivery (mL/min) OR PaO_2 (mm Hg)	≥500	350-499	200-349		<200 >70	61-70		55-60	<55
Arterial pH	≥7.7	7.6-7.69		7.5-7.59	7.33-7.49		7.25-7.32	7.15-7.24	<7.15
Serum sodium (mmol/L)	≥180	160-179	155-159	150-154	130-149		120-129	111-119	≤110
Serum potassium (mmol/L)	≥7	6-6.9		5.5-5.9	3.5-5.4	3-3.4	2.5-2.9		<2.5
Serum creatinine (mg/dL)	≥3.5	2-3.4	1.5-1.9		0.6-1.4		<0.6		
Hematocrit (%)	≥60		50-59.9	46-49.9	30-45.9		20-29.9		<20
White cell count (10^3/mL)	≥40		20-39.9	15-19.9	3-14.9		1-2.9		<1

Age Points

Age	Points
≤44	0
45-54	2
55-64	3
65-74	5
≥75	6

Chronic Health Points

History of Severe Organ Insufficiency	Points
Nonoperative patients	5
Emergency postoperative patients	5
Elective postoperative patients	2

Table 5:APACHE II score

3. Poison of Severity Score (PSS):
Overall clinical characteristics analyse severity, and the results are predictable using P.S.S scoring. Rating is 0 for asymptomatics and no signs. The grading begins with the grade 1, showing mild or temporary spontaneous regression. The Grade 2 for severe or persistent symptomatically. Grade 3 indicates life-threatening signs and symptoms and grade 4 for high severe toxicity that could lead to mortality. (41)

CONFIRMATION OF INTOXICATION BY OP COMPOUNDS:
Intoxication by OP compounds can be identified by studying the concentrations of RBC AchE and Bu ChE . Less than 20% in AchE indicates severe intoxication, and 20- 40% indicates moderate intoxication. However, hepatitis/malnutrition/alcoholism/dermatomyositis may have reduced cholinesterase levels, thus indicates lower specificity.

Another method using urinary alkyl phosphate and phenol analysis to identify and quantify, after over 48 hours, specific insecticide present even at the low levels. (42)

OP COMPOUND DETECTION:

OP compound poisoning is on the rise these days. Certain platforms focus on the maximum allowable levels of these compounds in edibles and water. Some of these are FAO, WHO, and the US Environmental Protection Agency. The main methods used are the chromatographic and spectroscopic methods. The alternate ways are enzymatic assays, enzymatic biosensors, molecular imprinting with luminescence, colourimetric methods, interferometry, and surface acoustic waves.

1. BIOSENSORS BASED ON INHIBITION OF ENZYME: The biosensor works because OP compounds inhibit AchE, which is evaluated direct or indirectly. The method directly measures the thiocholine, formed from hydrolysis of the acetylcholine in presence of water and the acetylcholinesterase. (43)
OP compounds cause AChE inhibition that reduces thiocholine levels. The other approach is a two-enzyme method where Choline, formed when -acetylcholine reacts with AchE, is affected by choline oxidase, finally to the formation of the -betaine and H2O2.

Acetylcholine +water = Acetic acid + Choline
Choline + 2O2 + water = Betaine + 2H2O
The oxidation of hydrogen peroxide is evaluated. Working with carbon nanotubes and acetylcholine esterase and choline oxidase enzyme immobilisation is done with these biosensors.

2. FLUORESCENCE-BASED ANALYSIS: This method is extremely productive because it is highly specific, with short-time results and the results are available even for the small samples. The test works on a sensitive sensor, with the ability to form specific bonds between a receptor molecule and target, along with the ability to assess the gap between nano peptide and fluorophore based on target molecule concentration, is used. (44)
The alternate sensitive method for nanomole concentration detection using pH-sensitive fluorescent dye. Spot results are available with gold nanoparticle-based surface-enhanced fluorescence spectroscopy. A fluorescent signal in the organophosphate compounds shown is due to the release of Eu3+ ions from the gold nanoparticle surface.

3. IMMUNOLOGICAL ANALYSIS: This is a extremely reliable, selective, with a specificity and sensitivity methodology where the ELISA method is used for detection of diazinon, fenthion, malathion. Phosphorylated AchE, AchE Choline oxidase chlorpyrifos are used as the main biomarker of OP agents. (45)

4. MICROFLUIDICS-BASED DETECTION: Benefits of this method is that it is done on the same platform for bare minimal samples and for total samples.(46) The continuous flowing of blood and sequential analysis of whole blood and breaking down of the complex of compounds from the cholinesterase is the principal behind the detection.

PROTOCOL FOR MANAGEMENT:

The aim towards patients arriving at the hospital or health set-up, with a history of exposure to organophosphorus toxin compounds, should be studied properly and evaluated to prevent further exposure to the substance. The product has to be removed from the body by washing out any contact, and the toxins inside the stomach have to be neutralised.

The protocol to follow is the removal of contaminated clothing and cleaning of pesticides from body surfaces. Performing gastric lavage in an awake patient is to be done . In unconscious patients, endotracheal intubation should be performed before gastric lavage. This is because it is better for the patient if he arrives as soon as possible after ingestion. [47] Washing has shown that absorption decreases by 2% within 20 minutes and by 16% within 1 hour. [48] WHO recommends gastric lavage after basic stabilization. Activated charcoal is known to activate absorption. (FIGURE 8)

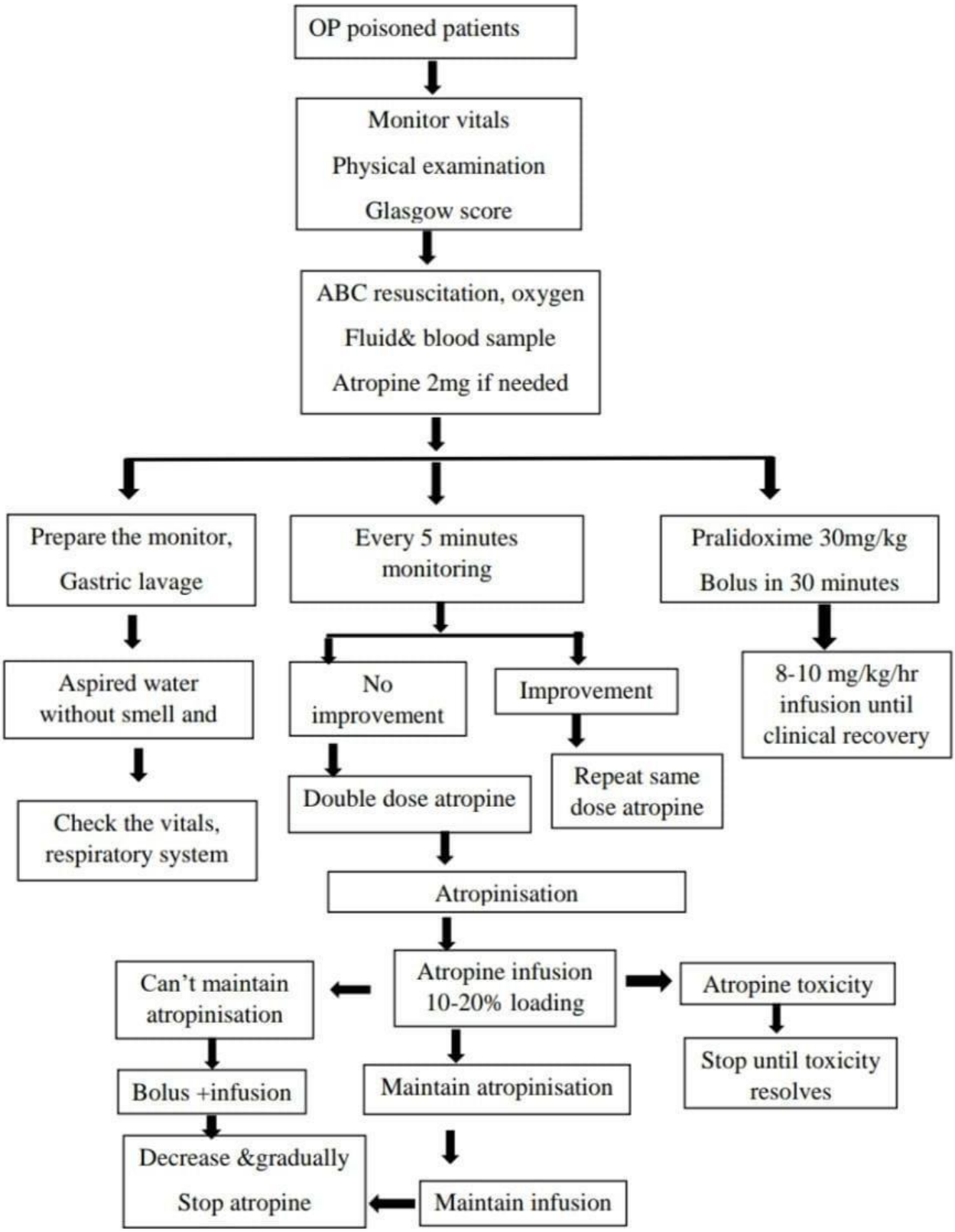


FIGURE 8: MANAGEMENT PROTOCOL FOR ORGANOPHOSPHATE POISONING

INITIAL: Monitor the airway, breathing and circulation with the patient in position of left lateral for airway patency to protect from aspiration and reduce the absorption of toxins.[49] Oxygen supplementation is required if respiratory distress present. The patient should be nil by mouth for a day, as the orally given fluids will increase rate of absorption.

MANAGEMENT :

Excessive Ach accumulation is resolved with an initial dose of 1 to 3 mg (0.05 mg/kg) of an anticholinergic such as atropine administered intravenously over 3 minutes slowly. Atropine is the drug of choice to hamper the effects of muscarinic symptoms of OPC poisoning. [50] 3 to 5 minutes of atropine injection to be given until signs of atropination set in such as lung field clearing, position of mid pupils, more than 110 per minute heart rate, systolic blood pressure of more than 90 mmHg, bowel sounds heard with dryness of nasal and oral mucosa, also achieved. [51] In infants, 0.0150–0.050 microgram per kilogram of atropine intravenously should be dosed every 15 minutes, depending on patient's condition. For very severe poisoning, continuous infusion is used. If the patient has been stable for at least 6 hours, the dose can be reduced. The patient is to be monitored for the 3 days for signs of recurrence. If symptoms recur, atropination should be performed. The side effects include dryness, tachycardia, delirium, mydriasis, and even paralysis of atropine injection. [52] If the patient develops alterted sensorium , fever, or muscle fibrillation, atropine must be discontinued.

In severe respiratory distress conditions or severe toxicity of atropine cases, glycopyrrolate is chosen. About 7.50 mg glycopyrrolate in 200ml NS infusion is given till the patient has a heart rate of more than 60/min, absent fasciculations and dry mucous membrane. [53] Reactivation of enzyme activity within 10 min will give the best results and is due to oximes.
Oximes are administered within 2 days timelapse for successful outcome. Two classes of oximes:
1) Pralidoxime is an example of Monopyridinium
2) Trimedoxime , iodide salts of pralidoxime , Obidoxime Chloride are examples of Bispyridinium- which are used commonly.

With the type of pesticide the patient is exposed to , reversal of inhibition of the enzymes vary. Reduced oxygenation in cases of aspiration pneumonia/brain damage, making usage of oximes useless. WHO has stated that every exposed patient given atropine should also be given oxime. [54]
In an adult, the dosage is continuous 500mg/hour infusion or 30mg/kg over 4-6 hours or 8-10mg/kg/hr I.V till the patient recovers completely compared to in children, pralidoxime 25mg/kg I.V, given over 15-30 minutes, with an infusion of 10-20mg/kg/hour. [55] Consequences of aspiration, tachycardia or diastolic hypertension are seen when pralidoxime is given rapidly as a bolus. Obidoxime (bispyridinium group)causes effects of hepatotoxicity, nausea, pallor, headache, face paraesthesia and generalised weakness.

Treatment for nerve agent poisonings are asoximes and used in combination with atropine and diazepam. At times, OP compound-poisoned patients develop hypoxia-induced delirium or involuntary movements, atropine toxicity, alcohol withdrawal symptoms or complications medically . 3-10 mg Diazepam IV are preferred in such situations. In fresh frozen plasma or FFP , butryl choline esterase can bind to OP compound and decrease its concentration at plasma level. Moreover, proteins and ions in blood circulation are balanced. Contraindication of FFP is for intermediate syndrome and patients on ventilators as it can increase hospital stay and at times accelerate the time of mortality.

Final phase: Symptomatic assistance in this phase is needed as there is recovery from the toxic effect.

AID OF FURTHER COMPLICATIONS:

In patients with respiratory distress, endotracheal intubation with mechanical ventilatory support is considered with diuretic frusemide of 40mg to 80 mg IV should be given prophylactically for prevention of pulmonary oedema. If heart block develops, a temporary pacemaker or a TPI may be required. Diazepam 5 to10mg IV is administered to patients to control episodes of seizures. (56) Antibiotics along with chest physiotherapy is to be done in bronchopneumonia.

For intermediate syndrome, supportive management is required. Neuroprotective drugs and corticosteroids are given in organophosphate Induced delayed polyneuropathy (OIDP). According to some articles, neuronal target esterase are protected by protease inhibitors .

MEDICAL ADVANCEMENT IN TREATMENT:

Certain advanced drugs and methods of treating OP compound addiction have evolved over time for example calcium channels that block magnesium sulfate, reduce the release of acetylcholine and can easily cope with overstimulation. A decrease in acetylcholine synthesis and release is induced by the alpha-2 agonist clonidine.(57) Alternatively, sodium bicarbonate can be used in place of the oxime. It also helps correct acidosis, especially neurotoxin toxicity. It reduces mortality and infuses about 5 mEq/kg over 1 hour, followed by 5-6 mEq/kg per day. inject the Organophosphate compounds can be filtered from the circulation by hemodialysis and hemofiltration. (58) Butyrylcholinesterase acts on toxic compounds and breaks down their action on acetylcholinesterase. A similar activity works with recombinant bacterial phosphotriesterases or hydrolases to reduce toxic concentrations in the bloodstream.The phosphotriesterase enzyme helps in detoxifying the OP circulating complex. Increasing the glutathione synthesis and decreasing the oxidative stress by antioxidants can be used to decrease OP toxicity effect. Complexes as vitamin C and E, melatonin, and spin traps can be beneficial.

PREVENTIVE MEASURES:

Organophosphorus compounds are the most common pesticide poisonings. In a rich horticultural country like India, where pesticides are widely used, there are great risks. Due to the high occupational exposure, personal protective equipment such as latex face masks and protective clothing should be provided. [59] These toxic pesticides can only be used indoors with proper air circulation and should be used according to customer instructions and bottle label. This is required. Public awareness should be raised and emergency resuscitation training recommended. Poisons should be kept out of reach of children and they should be instructed to wear gloves [60] Foods such as vegetables and fruits should be washed before consumption or preparation. Medical prophylaxis is physostigmine and pyridostigmine, which act as reversible cholinesterase inhibitors and use approximately 30 mg three times daily as neurotoxin prophylaxis.

“An ounce of prevention is worth a pound of cure.” Complete awareness , handling safely, proper usage and proper disposal helps in preventing poisonings to an extent .

REVIEWING OTHER STUDIES:

Kavya et al. [61], in the year of 2012, conducted a study on 64 patients showing a significant correlation amongst the high POP scores and low pseudocholinesterase level and the need for ventilator support. It was found by Raghu H et al. [62] the clinical and biochemical parameters have a great entity in predicting the need for ventilator support for OP-poisoned patients.

Poor prognosis is assessed based on these parameters:

i. Prolonged delay in undergoing an appropriate treatment
ii. Reduced levels of enzyme pseudocholinesterase
iii. Reduced Glasgow Coma Scale score
iv. High dose of atropine administration

In 50 such patients studied by Mahadeshwara Prasad et al. [64] it was proved that serum potassium and morbidity and mortality in OP poisoning are directly proportional as fasciculations in muscles, seizures, and respiratory depression signs in hypokalemia , and in severe cases it finally culminating in mortality. D.R.Moorthy et al. [64] observed among 50 such Patients with hypokalemia and decreased pseudocholinesterase are red flags for toxic surgery patients, as most patients develop dyspnea and are unsuccessful. Hyperamylaseemia in severely poisoned patients is directly correlated with mechanical ventilatory support studied by Subhash et al. at the HSK hospital. (65) They observed a proportional relationship between clinical and experimental parameters such as the POP scale, serum amylase and cholinesterase levels and the need for ventilatory support [66] reaching similar conclusions to Subhash et al. However, they demonstrated that serum lipase and CPK can also be considered as predictive prognostic markers for such OP poisoning. Eun-jun Kang et al. studied the factors and found that the APACHE II scoring system correlated more closely with serum cholinesterase levels and could be used as a good prognostic indicator in acute cases. Eddelston et al. proved that the Glasgow coma scale score under 13 requires intensive training [68] stating that the severity score is one of the useful indicators for knowing patient outcome .Tzeng-Jih Lin et al [69] of Taiwan in a

trial studied to know the prognostic indicators in death and survival groups, in which they found out increased rate of death is associated with levels of low acetyl choline esterase and plasma cholinesterase.

MATERIALS AND METHODS:

It is a cross-sectional study of 71 confirmed cases of organophosphorus poisoning, admitted in the medicine ICU / wards "SHRI B. M PATIL MEDICAL COLLEGE AND RESEARCH CENTRE" , VIJAYAPURA during the period of **January 2021 to June 2022**

INCLUSION CRITERION

Confirmed cases of OPC poisoning confirmed by the PDC report

EXCLUSION CRITERION

- Patients consuming other pesticides and mixed poisoning (for example: organo-carbamates).
- Compounds consumed with alcohol excluded.
- With a known medical illness such as asthma, liver and renal conditions , seizure disorders, cancer, an autoimmune disease etc.
- Chronic drug abuse with diuretics, proton pump inhibitors, antibiotics like aminoglycosides, insulin overdose, laxative abuse.
- Pregnant patients are excluded from the study.

STATISTICAL ANALYSIS

With anticipated Mean ± SD of magnesium in OP Poisoning cases 2.08±0.21 [ref], the study would require a sample size of 71 patients with 95% level of confidence and a precision of 0.05

Formula used

- $\mathbf{n=\frac{z^2\ p*q}{d^2}}$
- Where Z= Z statistic at α level of significance
- d^2= Absolute error
- **P= Proportion rate**

  q= 100-p
- Evaluation of data obtained was done in a Excel Microsoft sheet, and statistical analysis was analysed using statistical social sciences package (Version 20).
- Results are presented as Mean (Median) ±SD, counts and percentages and with diagrams.
- For normally distributed continuous variables , is compared using independent t-test. For not normally distributed variables Mann Whitney U test was used.
- The results of Day 1 , Day 5 was compared by Paired t-test/ Wilcoxon signed-rank test.
- Categorical variables was compared using the Chi-square test.
- Correlation between variables was calculated by Person's/ Spearman's Correlation.
- P<0.05 was assumed statistically significant.

RESULTS

Table 1. Age wise distribution of Patients suffering from Organophosphorous poisoning (n=71)

Age Group	Number of patients(n=71)	Percentage
>20 years	14	19.44%
21-30 years	35	48.61%
31-40 years	11	15.27%
41-50 years	3	4.166%
51-60 years	6	8.33%
61-70 years	1	1.38%
71-80 years	2	2.77%

Table 1. Shows that the patients included in the study were divided into seven age groups each having an interval of 10 years. Maximum participants belonging to the age group of 21-30 years (48.61%) were studied while least number of patients belonged to the age group of 61-70 years (1.38%).

Figure 1: Age wise distribution of Patients suffering from Organophosphorous poisoning (n=71)

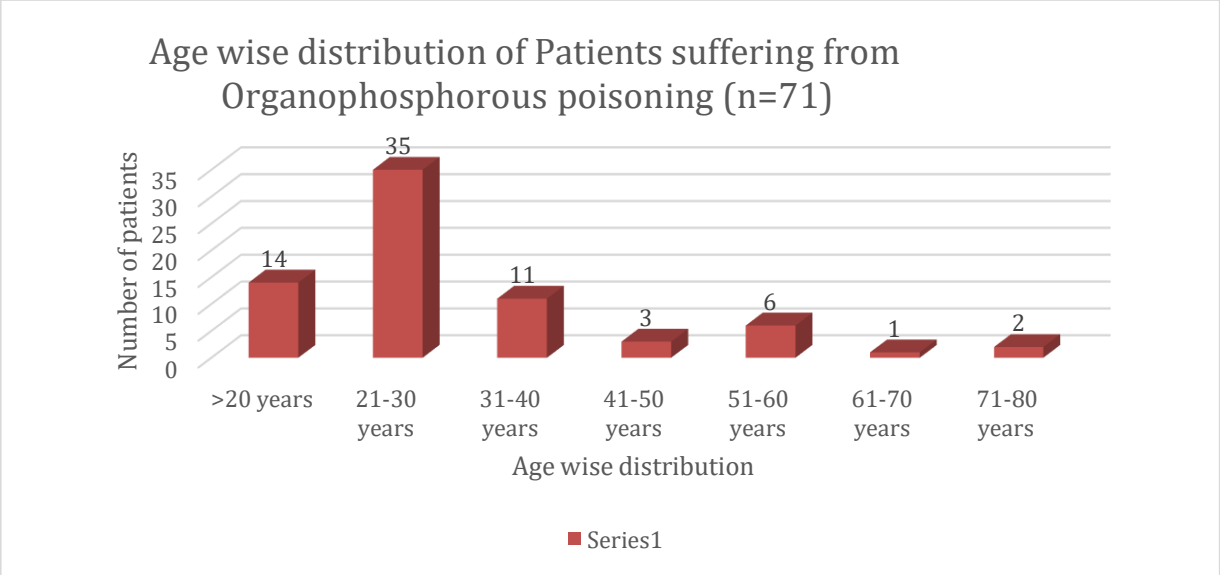


Figure 1. Shows the age wise distribution of Patients suffering from Organophosphorous poisoning during the study (n=71). Maximum

participants belonged to the age group of 21-30 years (35 patients) while least number of patients belonged to the age group of 61-70 years (1 patient).

Table 2: Gender-wise distribution of the patients with OP poisoning (n=71)

Gender	Distribution of patients (n=71)	Percentage
Female	22	30.98%
Male	49	69.01%

Table 2. shows the gender wise distribution of patients presenting with Organophosphorus poisoning. Among the 71 patients, 49 (69.01%) patients were males and 22 (30.98%) patients were females.

Figure 2: Gender-wise distribution of the patients with OP poisoning (n=71)

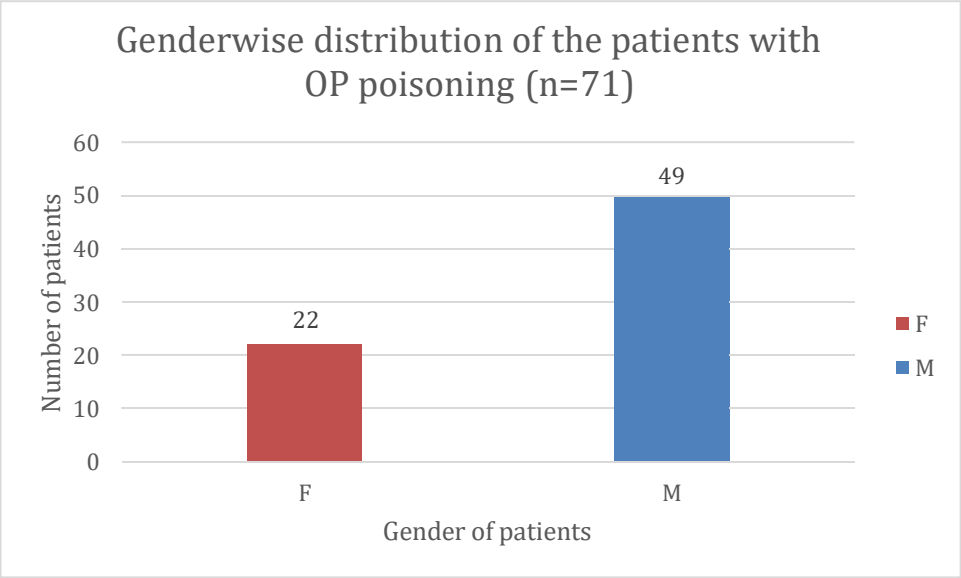


Figure 2. shows the gender wise distribution of patients presenting with Organophosphorus poisoning. Among the 71 patients, 49 (69.01%) patients were males and 22 (30.98%) patients were females.

Table 3: Age and genderwise distribution of patients suffering from OP poisoning (n=71)

Age group	Male	Female	Total	Percentage
>20 years	3 (6.1%)	10 (45.45%)	13 (18.30%)	18.30%
21-30 years	25 (51.02%)	10 (45.45%)	35 (49.29%)	49.29%
31-40 years	11(22.44%)	0	11 (15.49%)	15.49%
41-50 years	1 (2.04%)	2 (9.09%)	3 (4.22%)	4.22%
51-60 years	6 (12.24%)	0	6 (8.45%)	8.45%
61-70 years	1 (2.04%)	0	1 (1.40%)	1.40%
71-80 years	2 (4.08%)	0	2 (2.81%)	2.81%
	49	22	71	

Table 3. shows the age and gender-wise distribution of patients suffering from OP poisoning (n=71). patients included in the study were divided into seven age groups each having an interval of 10 years. Maximum participants belonging to the age group of 21-30 years (48.61%) were studied while least number of patients belonged to the group of age 61-70 years (1.38%). Maximum number of male (n=25) (51.02%) belonged to the age group of 21-30 years. Equal number of female patients (n=10) (45.45%) belonged to the age groups of >20 years and 21-30 years.

Figure 3: Age and genderwise distribution of patients suffering from OP poisoning (n=71)

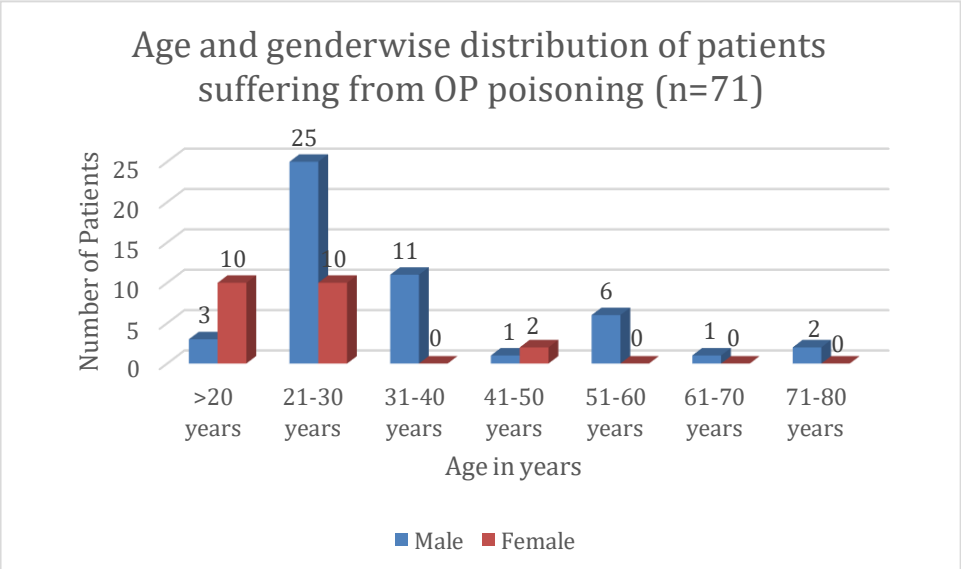


Figure 3. shows the age and gender-wise distribution of patients suffering from OP poisoning (n=71). Maximum participants belonged to the age group

of 21-30 years while least number of patients belonged to the age group of 61-70 years (1.38%). Maximum number of male (n=25) (51.02%) belonged to the age group of 21-30 years. Equal number of female patients (n=10) (45.45%) belonged to the age groups of >20 years and 21-30 years.

Table 4: Distribution of patients according to severity based on POP score (n=71).

Severity	Frequency (n=71)	Percentage
Mild	2	2.81%
Moderate	25	35.21%
Severe	44	61.97%

Table 4. shows the distribution of patients according to severity based on POP score (n=71). 2 (2.81%) patients had mild scores. 25 (35.21%) had moderate scores and 44(61.97%) patients and severe scores based on the POP scoring system.

Figure 4: Distribution of patients according to severity based on POP score (n=71)

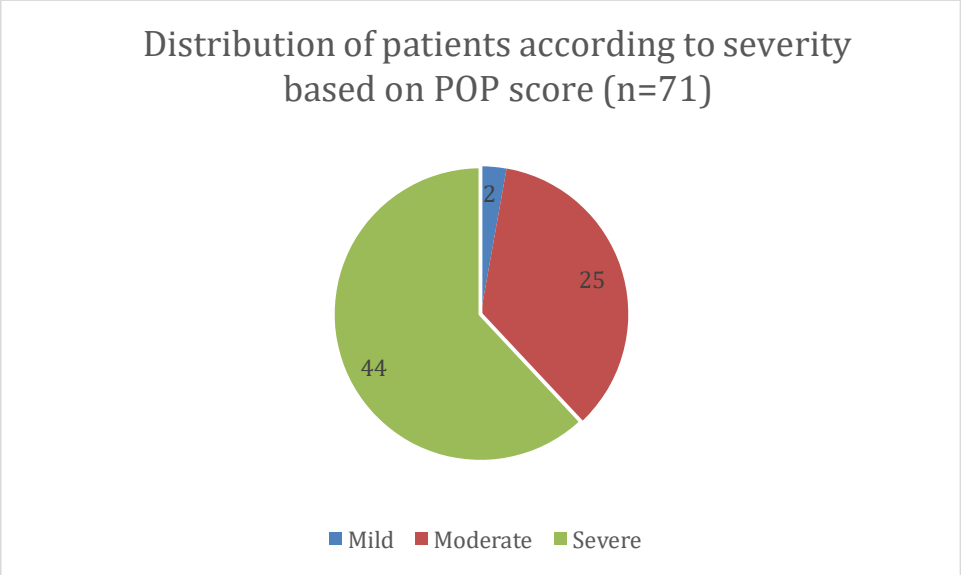


Figure 4. shows the distribution of patients according to severity based on POP score (n=71). 2 (2.81%) patients had mild scores. 25 (35.21%) had moderate scores and 44(61.97%) patients and severe scores based on the POP scoring system.

TABLE 5: Table 5: Baseline results of serological tests conducted on Day 1 of admission following Organophosphorous Poisoning.

Tests on Day 1 on admission	Lowest Value	Highest Value	Median	95% CI for median	Range
CBC: TLC (4-11ml)	4.08	30.94	10.79	9.88 to 13.3	8.63-14.85
HB (Men: 13.2 to 16.6 gm/dl) (Women: 11.6 to 15 gm /dl)	5.9	20.5	13.7	13.1 to 14.72	11.9-15.47
Platelets (1.5 to 4.5 L platelets/ microliter)	1.45	5.85	2.67	2.54 to 2.91	2.43-3.13
ESR (0 to 22 mm/hr for men) (0 to 29 mm/hr for women)	1	29	9	7 to 10.23	5 -12
RBC (men – 4.0 to 5.9 x 10*12/L. women – 3.8 to 5.2 x 10*12/L.)	1.96	7.46	4.68	4.47 to 4.93	4.25-5.13
RBS (less than 140 mg/dL)	72	276	108	100.77 to 110.46	97-124.75
CHOLIN	200	10182.1	4571.6	2814.42 to 5571.79	609.42-6206.5
Total Bilirubin *(0.1 to 1.2 mg/dL)*	0.1	7.3	0.8	0.7 to 1	0.6 -1.2
Albumin (3.4 to 5.4 g/dL)	2.9	5.1	4	3.8 to 4	3.7-4.3
SGOT (*5-40 units/L)*	15	750	28	27 to 31	24 - 40.5

SGPT (*7-56 units/litre)*	9	440	21	19 to 27	16.25 - 37.25
ALP (44 to 147 IU/L)	37	152	78	70.77 to 87.23	66.5 – 94
Creatinine (*0.6 to 1.2 mg/ dL)*	0.4	6.1	0.7	0.7 to 0.8	0.6 -0.9
Urea (6 to 24 mg/dL)	7	204	21	20 to 22	18 -27
Sodium (135 and 145 mEq/L)	102	168	143	142 to 143.23	140-145.75
Potassium (3.6 to 5.2 mmol/L)	1.2	5	3.1	3 to 3.3	2.7-3.4
Magnesium (1.7 to 2.2 mg/dL)	0.6	2.4	1.2	1.1 to 1.3	1-1.4
Potassium (Day 5) (3.6 to 5.2 mmol/L)	3.1	5.3	3.7	3.6 to 3.8	3.5-3.9
Magnesium (Day 5) (1.7 to 2.2 mg/dL)	1.2	2.1	1.6	1.5 to 1.7	1.4-1.8

Figure 5: Correlation of severity of outcome based on POP scale with Serum Potassium levels (K levels) on day 1 of Admission:

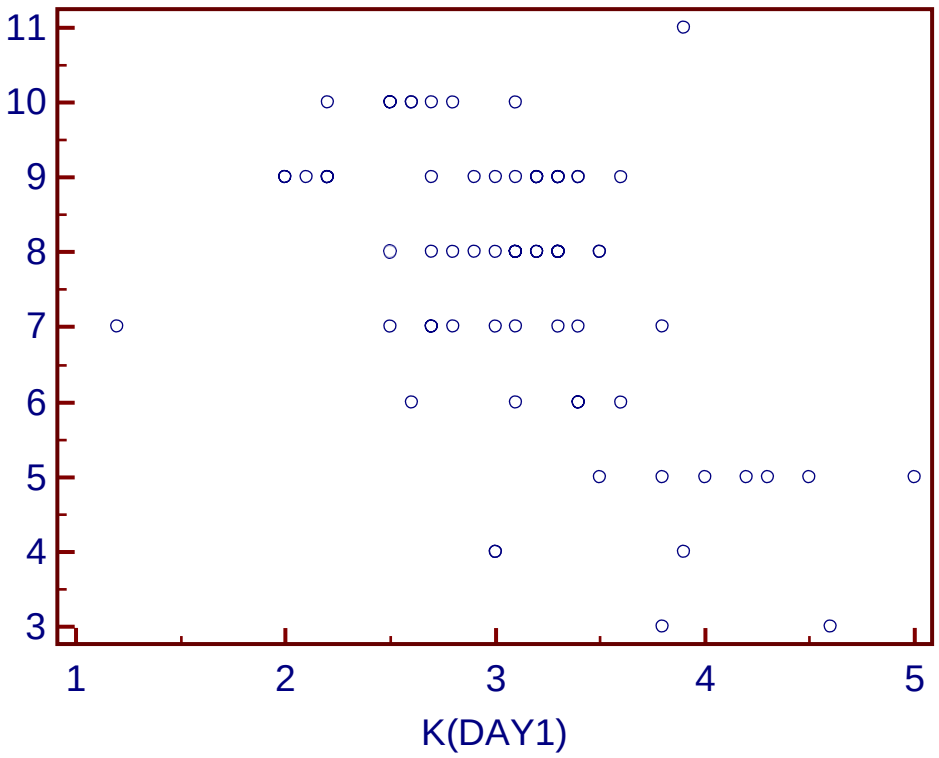


Figure 5. shows **negative correlation** of serum potassium levels on day one of admission with respect to POP scale for severity of acute organophosphorous poisoning (n=71). Coorelation coefficient of -0.5245 was found which indicates that lower potassium levels correlates to higher severity of OP poisoning outcome. (95% CI= -0.6752 to -0.3318) ($p<0.0001$)

Figure 6: Correlation of severity of outcome based on POP scale with Serum Magnesium levels (K levels) on day 1 of Admission:

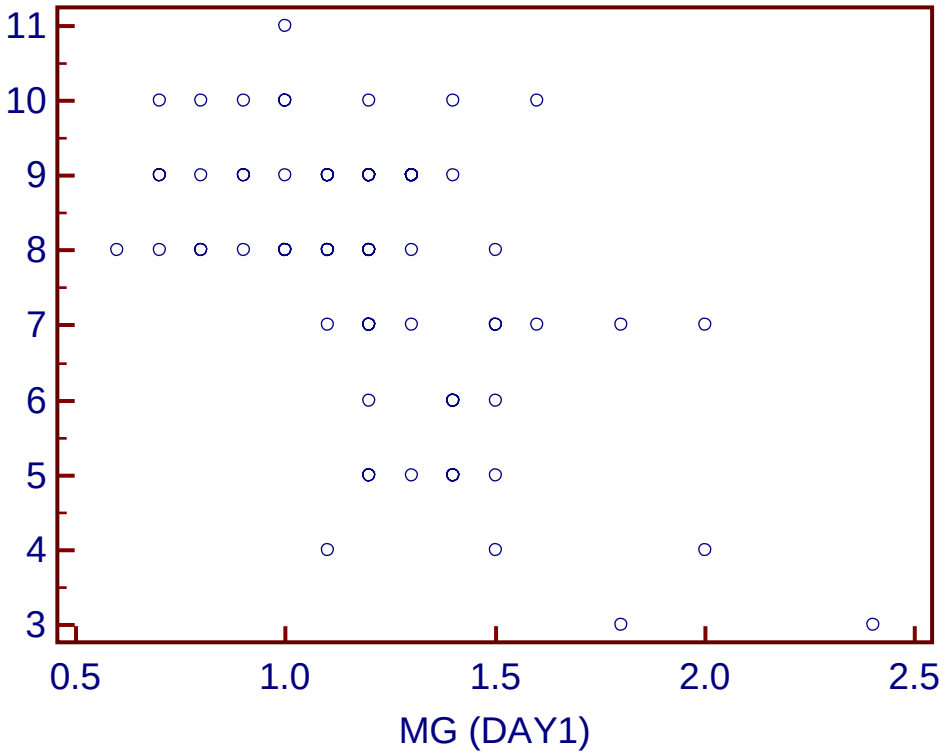


Figure 6. shows **negative correlation** of serum magnesium levels on day one of admission with respect to POP scale for severity of acute organophosphorous poisoning (n=71). Coorelation coefficient of -0.5697 was found which indicates that lower magnesium levels correlates to higher severity of OP poisoning outcome. (95% CI= -0.7088 to -0.3880) ($p<0.0001$)

Table 6: Comparison of Serum Potassium levels on Day 1 and day 5 of admission following acute organophosphorous poisoning.

	Serum Potassium Levels on Day 1	Serum Potassium Levels on Day 5
Sample size	71	71
Lowest value	1.2	3.1
Highest value	5	5.3
Median	3.1	3.7
95% CI for the median	3 to 3.3	3.6 to 3.8
Interquartile range	2.7 to 3.4	3.5 to 3.9

Table 6. shows that on Wilcoxon test there is statistically significant difference of -6.065 between the Serum Potassium levels on Day 1 and day 5 of admission following acute organophosphorous poisoning. ($p < 0.0001$)

Table 7: Comparison of Serum Magnesium levels on Day 1 and day 5 of admission following acute organophosphorous poisoning.

	Serum Magnesium levels on Day 1	**Serum Magnesium levels on Day 5**
Sample size	71	71
Lowest value	0.6	1.2
Highest value	2.4	2.1
Median	1.2	1.6
95% CI for the median	1.1 to 1.3	1.5 to 1.7
Interquartile range	1 to 1.4	1.4 to 1.8

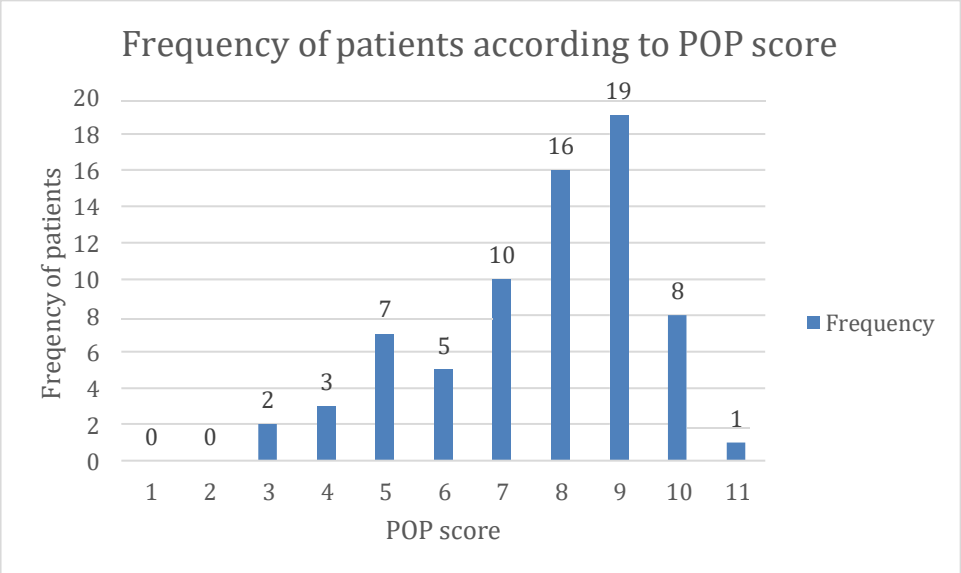
Table 7. shows that on Wilcoxon test there is statistically significant difference of -6.252892 between the Serum Magnesium levels on Day 1 and day 5 of admission following acute organophosphorous poisoning. ($p < 0.0001$)

Table 8: Frequency distribution according to POP score (n=71)

POP scores	Frequencies	Percentages
1	0	0
2	0	0
3	2	2.81%
4	3	4.22%
5	7	9.86%
6	5	7.04%
7	10	14.08%
8	16	22.53%
9	19	26.76%
10	8	11.26%
11	1	1.40%
	=71	

Table 8 shows the frequency distribution of the patients according to POP score. Maximum patients (n=19)(26.76%) showed a POP score of 9 which is of severe grade.

Figure 22: Frequency distribution of patients according to POP score



DISCUSSION:

Organophosphate (OP) compounds are a diverse group of chemicals used in both domestic and industrial settings. Organophosphates and carbamates are potent cholinesterase inhibitors capable of causing severe cholinergic toxicity. Organophosphate poisoning can occur due to occupational or accidental exposure, deliberate ingestion. Diagnosis is usually based on a history of exposure, with characteristic signs of cholinergic excess, but can be difficult when the patient is inadvertently exposed, unconscious, or confused. Severity of the poison is studied using the Peradeniya Organophosphorus Poisoning (POP) scale. This study was conducted to evaluate serum magnesium and potassium levels as a prognostic marker in organophosphorus poisoning and its clinical severity using peradeniya organophosphate poisoning scale. Timely understanding of serum markers and baseline parameters following poisoning is required for improved prevention of increased severity and better prognosis.

Our study shows that Maximum participants belonging to the age group of 21-30 years (48.61%) while least number of patients belonged to the age group of 61-70 years (1.38%). Among them, 49 (69.01%) patients were males and 22 (30.98%) patients were females. A study by A. Amir et al shows that data from National Poisoning Control Centre in Karachi, most patients were youngsters or ages below 30 years, who were referred from across the main town.[70]

In our study, the age and genderwise distribution of patients suffering from OP poisoning showed that maximum number of male (n=25) (51.02%) belonged to the age group of 21-30 years. Equal number of female patients (n=10) (45.45%) belonged to the age groups of >20 years and 21-30 years. In a study conducted in Telangana by Mohammad Liyaqat Shareef, similar findings to our study showed that maximum incidence of OP poisoning was in between 21-30 years age group (40%), and male to female ratio was 4:1. [71]

The distribution of patients according to severity based on POP scoring system in our study found that 2.81% patients had mild scores, 35.21% had moderate scores and 61.97% patients had severe scores based on the POP scoring system. 0-3 scoring indicated mild poisoning; scoring of 4-7 shows moderate poisoning toxicity and a score of 8-11 indicated severe poisoning.[72]

The same study from Karachi showed that over two- thirds of the patients had minimal disease. Mild score showed low mortality rate and high score indicated severe toxicity.[70]

Baseline serological tests conducted on Day 1 of admission on all the patients following Organophosphorous Poisoning. The CBC: TL had a median of 10.79 ml with 9.88 to 13.3 at 95% CI for median. No correlation of CBC: TL levels on day one of admission with respect to POP scale for severity of acute OP poisoning was found. A research conducted in Cundinamarca by Sandra C. Cortés-Iza et al showed that complete blood count (CBC) were outside the range in 47 % of the cases[73] The normal range is between 4-11 ml. Normally the hemoglobin levels (HB) in Men is around 13.2 to 16.6 gm/dl and for Women around 11.6 to 15 gm /dl. Our study shows median Hb levels of 13.7gm/ dl with range of 13.1 to 14.72 at 95% CI for median. No correlation of HB levels on day one of admission with respect to POP scale for severity of acute organophosphorous poisoning was found. A significant decrease in the mean value of hemoglobin in the OP poisoning patient group was found compared to the control group. It was hypothesised that this was due the decreased synthesis of hemoglobin concentration or the OP compounds bound on iron, this iron could not be incorporated in hemoglobin leading to decreased size of red blood cells. [74]
The 95% CI for median for platelet count in our study was 2.54 to 2.91 and median was 2.67 L platelets/ microliter. Normal range for Platelets is 1.5 to 4.5 L platelets/ microliter. Similarly, normal RBC level in men is 4.0 to 5.9 x 10*12/L. and women is 3.8 to 5.2 x 10*12/L. The median of 4.68 2 x 10*12/L. and 95% CI for median was 7 to 10.23 x 10*12/L. No correlation of RBC and platelet count levels on day one of admission with respect to POP scale for severity of acute organophosphorous poisoning was found. A study by Samar Iltaf et al showed that OP poisoining vauses complications such as respiratory failure , anaemia and thrombocytopenia in most of the patients. [75]
Another study showed that higher WBC to Platelet Ratio was significantly associated with worse outcomes.[76]
Our study showed median ESR levels of 9 mm/hr. Normal ESR level is 0 to 22 mm/hr for men and 0 to 29 mm/hr for women. 95% CI for median of ESR levels was 4.47 to 4.93 mm/hr. No correlation of ESR levels on day one of

admission with respect to POP scale for severity of acute organophosphorous poisoning was found.

Median RBS levels in our study was found to be 108 mg/dL. Normally RBS should be less than 140 mg/dL. The 95% CI for median for RBS levels was found to be 100.77 to 110.46. No correlation of RBS levels on day one of admission with respect to POP scale for severity of acute organophosphorous poisoning was found. A study by Raghapriya, R. Chi-square tests examining the association between random blood glucose (RBG) presentations and the established Peradeniya Organophosphate Poisoning Scale (POP) and Poisoning Severity Scale (PSS) confirmed that this study was statistically significant indicated (p-value = 0.001). Extreme glycemia is associated with greater clinical severity and poorer outcomes. They concluded that the glycemic status at presentation with acute organophosphate poisoning history, when accounted for by the clinical severity score, is a simple, inexpensive, and reliable marker for determining clinical severity and outcome. [(77)]

Pseudocholinesterase levels found in our study was 4571.6. The 95% CI for median for RBS levels 2814.42 to 5571.79. No correlation Pseudocholinesterase of levels on day one of admission with respect to POP scale for severity of acute organophosphorous poisoning was found. Usually, PChE level at presentation is a reliable indicator of the severity of OP poisoning and a predictor of the need for mechanical ventilation and the duration of stay in the ICU. Patients with PChE levels <1000 IU/L had longer ICU length of stay ($P < 0.001$) and fewer ventilator-free days ($P < 0.001$)[(78)] Another study by Mankodia H. et al showed that diminishing serum cholinesterase showed a positive equation with the seriousness of poisonousness. The degree of serum cholinesterase was 4897.7 +/ - 2809.6 IU/L.[(79)]

The baseline liver function tests conducted on the patients enrolled in this study were Total Bilirubin, Albumin, SGOT, SGPT and ALP. The median levels were 0.8mg/ dL, 4mg/dL, 28 units/L, 21 units/ L and 78 IU/L respectively. No correlation with Bilirubin, Albumin, SGOT, SGPT, ALP with POP score was found. Study conducted in Sri Lanka by R. Senarathne et al. proved that there is a significant difference in AST and ALT at admission and in AST at the time of discharge between the POP groups ($p \leq 0.001$). AST and ALT at admission were significantly higher in the moderate POP group compared to the mild POP group. In addition, treatment outcomes (length of hospital stay and duration of ventilator support) were significantly correlated with severity of intoxication and serum AST and ALT levels at admission ($p \leq 0.001$). [80]

Similarly, for serum Creatinine and Urea levels were also tested on the day of admission. Median values of 0.7 mg/dL and 21mg/dL were found respectively and the 95% CI for median was 0.7 to 0.8mg/dL and 20 to 22mg/dL for Creatinine and urea respectively. No correlation serum Creatinine and Urea levels of levels on day one of admission with respect to POP scale for severity of acute organophosphorous poisoning was found. Study by Feng-You Lee OP addiction was found to be associated with a subsequent increased risk of acute kidney injury.

Comparison with patients without surgical poisoning , patients with severe surgical poisoning were 26 times more likely to develop AKI (95% CI 12.5-55.8), followed by those with severe surgical poisoning (adjusted HR 18.9, 95% CI 9.69-36.8) . Patients with surgical poisoning and mechanical ventilation were 3.7 times more likely to develop AKI compared with patients without surgical poisoning (95% CI, 16.2–118.3).[81] We found that there is negative correlation of the serum potassium levels on day one of admission with respect to POP scale for severity of acute organophosphorous poisoning. Median potassium levels of 3.1 mg/dL with 95% Cl median of 3 to 3.3 on day

1 levels. However, no correlation of the serum potassium levels on day five of admission with respect to POP scale for severity of acute organophosphorous poisoning. This shows that on admission, serum potassium levels can be used to predict the severity and outcome of the patients with OP poisoning. A study by Dandekar V. in a tertiary care hospital showed that 68.4% of cases developed hypokalemia and Muscle weakness and fasciculations developed with mean serum [K+] levels dropped to 2.90 ± 0.11.[82] Another study by Bijush Difoesa in assam showed that 22 % patients who died had hypokalaemia at the time of admission and the association between serum potassium and outcome is statistically significant. [83]

Negative correlation of serum Magnesium levels on day one of admission with respect to POP scale for severity of acute organophosphorous poisoning was also observed in the study. However, no correlation of serum Magnesium levels on day five of admission with respect to POP scale for severity of acute organophosphorous poisoning. Median magnesium levels of 1.2 mg/dL with 95% Cl median of 1.1 to 1.3 on day 1 levels. On Day five Median magnesium levels of 1.6 mg/dL with 95% Cl median of 1.5 to 1.7 on day 5 levels. Similar results were obtained in a study done by Aravindan et al. that found clinical severity, length of hospital stay, coma, intermediate syndrome, cardiac arrhythmias, need for ventilators, and death were associated with lower serum magnesium concentrations (p=0.7).[84] Another report by S. Rahul et al. also showed that magnesium levels measured on day 1 but not on day 5 can be considered predictors of severity of OP poisoning.[85]

CONCLUSION :

- An increased score on the POPS scale in OP poisoning patients, is associated directly with hypokalemia and hypomagnesemia.

- Hypokalemia and hypomagnesemia are markers useful for predicting the clinical outcome in OP poisoning.

- Hypokalemia and hypomagnesemia, at time of presentation, has a detrimental effect on the clinical outcome as it predicts poor prognosis.

SUMMARY :

This study conducted with a sample size of 71 patients, were referred to our hospital for organophosphate poisoning from January 2021 to June 2022. Most of the patients were younger than 20 years old and were predominantly male. Most of them were farm workers, and 96% of patients had used poisons with a suicidal intent. Increased severity of intoxication, as measured by the POPS score, was associated with greater decreases in serum magnesium and potassium, higher doses of atropine for treatment, longer hospital stays, and poorer prognosis. Correlation of parameters was well with clinical outcome. Decrease in serum magnesium and potassium showed a linear relationship with the severity of poisoning. Low serum potassium and magnesium levels at presentation adversely affected clinical outcomes. In the study, it shows that the peradenia organophosphate poisoning scaling system along with serum magnesium, and serum potassium are helpful and effective markers for predicting clinical outcome in patients with OP poisoning.

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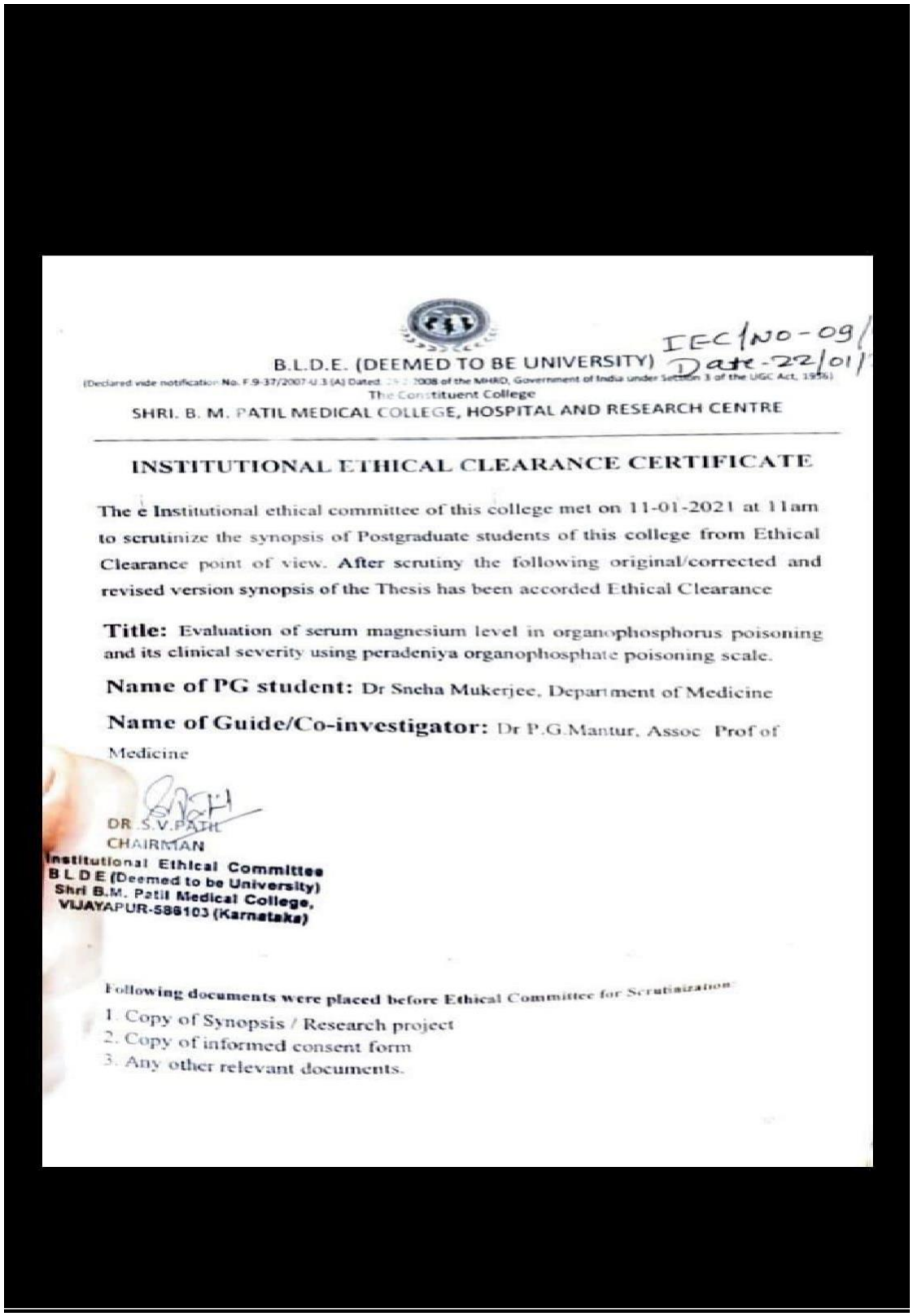
Annexures-I
Ethical Clearance Certificate



B.L.D.E. (DEEMED TO BE UNIVERSITY) IEC/NO-09/ Date-22/01/

(Declared vide notification No. F.9-37/2007-U.3 (A) Dated 29.2.2008 of the MHRD, Government of India under Section 3 of the UGC Act, 1956)

The Constituent College

SHRI. B. M. PATIL MEDICAL COLLEGE, HOSPITAL AND RESEARCH CENTRE

INSTITUTIONAL ETHICAL CLEARANCE CERTIFICATE

The e Institutional ethical committee of this college met on 11-01-2021 at 11am to scrutinize the synopsis of Postgraduate students of this college from Ethical Clearance point of view. After scrutiny the following original/corrected and revised version synopsis of the Thesis has been accorded Ethical Clearance

Title: Evaluation of serum magnesium level in organophosphorus poisoning and its clinical severity using peradeniya organophosphate poisoning scale.

Name of PG student: Dr Sneha Mukerjee, Department of Medicine

Name of Guide/Co-investigator: Dr P.G.Mantur, Assoc Prof of Medicine

DR S.V.PATIL
CHAIRMAN
Institutional Ethical Committee
B L D E (Deemed to be University)
Shri B.M. Patil Medical College,
VIJAYAPUR-586103 (Karnataka)

Following documents were placed before Ethical Committee for Scrutinization:

1. Copy of Synopsis / Research project
2. Copy of informed consent form
3. Any other relevant documents.

ANNEXURE–II

INFORMED CONSENT FORM
B.L.D.E. (DU) SHRI B.M. PATIL MEDICAL COLLEGE, HOSPITAL AND RESEARCH CENTRE, VIJAYAPURA-583106.KARNATAKA

A STUDY TO EVALUATE SERUM MAGNESIUM AND POTASSIUM LEVELS AS A PROGNOSTIC MARKER IN ORGANOPHOSPHORUS POISONING AND ITS CLINICAL SEVERITY USING PERADENIYA POISONING SCALE

PRINCIPAL INVESTIGATOR - DR SNEHA MUKERJEE
9945043041

All aspect soft his consent forma reexplained to the patient in the language understood by him/her.

I) INFORMED PART

1) PURPOSEOFRESEARCH:

I have been informed about this study. I have also been given a free choice of participation in this study.

2) PROCEDURE:

I am aware that in addition to routine care received I will be asked series of questions by the investigator. I have been asked to undergo the necessary investigations and treatment, which will help the investigator in this study.

3) RISK AND DISCOMFORTS:

I understand that I may experience some pain and discomfort during the examination or during my treatment. This is mainly the result of my condition and the procedure of this study is not expected to exaggerate these feelings that are associated with the usual course of treatment.

3) BENEFITS:

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

1) CONFIDENTIALITY:

I understand that the medical information produced by this study will become a part of Hospital records and will be subject to the confidentiality and privacy regulation. Information of a sensitive personal nature will not be a part of the medical records, but will be stored in the investigator's research file and identified only by code number. The code-key connecting name to numbers will be kept in a separate location.

If the data are used for publication in the medical literature or for teaching purpose, no name will be used and other identifiers such as photographs and audio or videotapes will be used only with my special written permission. I understand that I may see the photographs and videotapes and hear the audiotapes before giving this permission.

2) REQUEST FOR MORE INFORMATION:

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

Dr. SNEHA MUKERJEE is available to answer my questions or concerns. I understand that I will be informed of any significant new findings discovered during the course of the study, which might in fluence my continued participation.

If during the study, or later, I wish to discuss my participation in or concerns regarding this study with a person not directly involved, I am aware that the social worker of the hospital is available to talk with me. A copy of this consent form will be given to me to keep for careful reading.

2) REFUSAL OR WITHDRAWAL OF PARTICIPATION:

I understand that my participation is voluntary and that I may refuse to participate or may withdraw consent and discontinue participation in the study at any time without prejudice to my present or future care at this hospital. I also understand that Dr. SNEHA MUKERJEE may terminate my participation in the study after she has explained the reasons for doing so and has helped arrange for my continued care by my own physician or physical therapist, if thesis appropriate

3) INJURY STATEMENT:

I understand that in the unlikely event of injury to me resulting directly from my participation in this study, if such injury were reported promptly, the appropriate treatment would be available to me, but no further compensation would be provided. I understand that by my agreement to participate in this study I am not waiving any of my legal rights.

I have explained to_____the purpose of the research , the procedures required and the possible risks and benefits to the best of my ability in patient's own language.

_____ _____

DR. SNEHA MUKERJEE Date

(Investigator)

II) STUDY SUBJECT CONSENT STATEMENT:

I confirm that Dr. SNEHA MUKERJEE explained to me the purpose of research, the study procedures that I will undergo, and the possible risks and discomforts as well as benefits that I may experience in my own language. I have read and I understand this consent form. Therefore, I agree to give consent to participate as a subject in this research project.

_____ _____

Participant/Guardian Date

_____ _____

Witness to signature Date

ANNEXURE–III

OPC POISONING CASE PROFORMA

NAME:

AGE/SEX:

OCCUPATION:

ADDRESS:

RELIGION:

DATE OF ADMISSION:

I P NO:

CASE NO :

PLACE:

CHIEF COMPLAINTS :

HISTORY OF PRESENTING ILLNESS :

PAST HISTORY:

FAMILY HISTORY :

PERSONAL HISTORY :

1. DIET
2. APPETITE
3. SLEEP
4. BOWEL / BLADDER HABITS
5. HABITS

GENERAL PHYSICAL EXAMINATION :

LEVEL OF CONSCIOUSNESS:

CONSCIOUS	
ORIENTED	
DROWSY	
STUPOR	
COMATOSE	

- PUPIL SIZE - mm
- FASCICULATION -
- PALLOR - YES / NO
- ICTERUS - YES / NO
- CLUBBING - YES / NO
- LYMPHADENOPATHY - YES / NO
- CYANOSIS - YES / NO
- EDEMA - YES / NO
- WEIGHT - kg
- HEIGHT - cm
- BMI - kg/cm

VITALS :

PULSE RATE -

BLOOD PRESSURE -

SPO2 -

TEMPERATURE -

HEART RATE –

RESPIRATORY RATE -

SYSTEMIC EXAMINATION :

1. PER ABDOMEN :

2. CARDIOVASCULAR SYSTEM :

3. RESPIRATORY SYSTEM :

4. CENTRAL NERVOUS SYSTEM :

Higher Mental Functions:

Appearance and Behaviour:

Consciousness:

- (If conscious)
  - Oriented
  - Confused
  - Drowsy
  - Stupor
  - Coma
- If consciousness is diminished/ in coma

GCS SCORING:

Eye opening: SCORE:

- Open spontaneously 4
- Open only to verbal stimuli 3

- Open only to pain 2
- Never open 1

Best verbal response: SCORE:

- Oriented and converses 5
- Converses, but disoriented, confused 4
- Uses inappropriate words 3
- Makes incomprehensible sounds 2
- No verbal response 1

Best motor response: SCORE:

- Obeys commands 6
- Localizes pain 5
- Exhibits flexion withdrawal 4
- Decorticate rigidity 3
- Decerebrate rigidity 2
- No motor response 1

TOTAL GCS SCORE:

- FASCICULATION -
- PUPIL SIZE - mm

INVESTIGATIONS :

1.COMPLETE BLOOD COUNT :

TOTAL COUNT	
HAEMOGLOBIN	
PLATELET COUNT	
ESR	
RBC	

2.RANDOM BLOOD SUGAR - mg/dl

3.SERUM CHOLINESTERASE - U / mL

4.LIVER FUNCTION TEST :

TOTAL BILIRUBIN	
DIRECT BILIRUBIN	
INDIRECT BILIRUBIN	
ALBUMIN	
SGOT	
SGPT	
ALP	

5.RENAL FUNCTION TEST :

CREATININE		
UREA		
SODIUM		
POTASSIUM		
MAGNESIUM	DAY 1 : DAY 5 :	
POTASSIUM	DAY 1: DAY 5:	
ARTERIAL BLOOD GAS : BLOOD pH		
PO2		
PCO2		
HCO3		
LACTATE		

7 . PERADENIYA ORGANOPHOSPHORUS POISONING SCALE :

PARAMETER	CRITERIA	SCORE	
	>2mm	0	
PUPIL SIZE	<2mm	1	
	Pin point	2	
RESPIRATORY RATE	< 20 / min	0	
	> 20 / min	1	
	>20 /min with central cyanosis	2	
HEART RATE	>60 / min	0	
	40-60 / min	1	
	<40 / min	2	
FASCICULATION	None	0	
	Present , generalised / continuous	1	
	Both generalised and continuous	2	
LOSS OF CONSCIOUSNESS	Conscious and rationale	0	
	Impaired response to verbal commands	1	
	No response to verbal commands	2	
SEIZURES	Absent	1	
	Present	2	
	Total score		

Scoring: score 0- 3 mild poisoning,

4-7 moderate poisoning,

8-11 severe poisoning

8 . ELECTROCARDIOGRAPHY :

Standardisation:

Rate,

Rhythm:

P Wave:

PR Interval:

QRS Complex:

ST Segment:

T Wave:

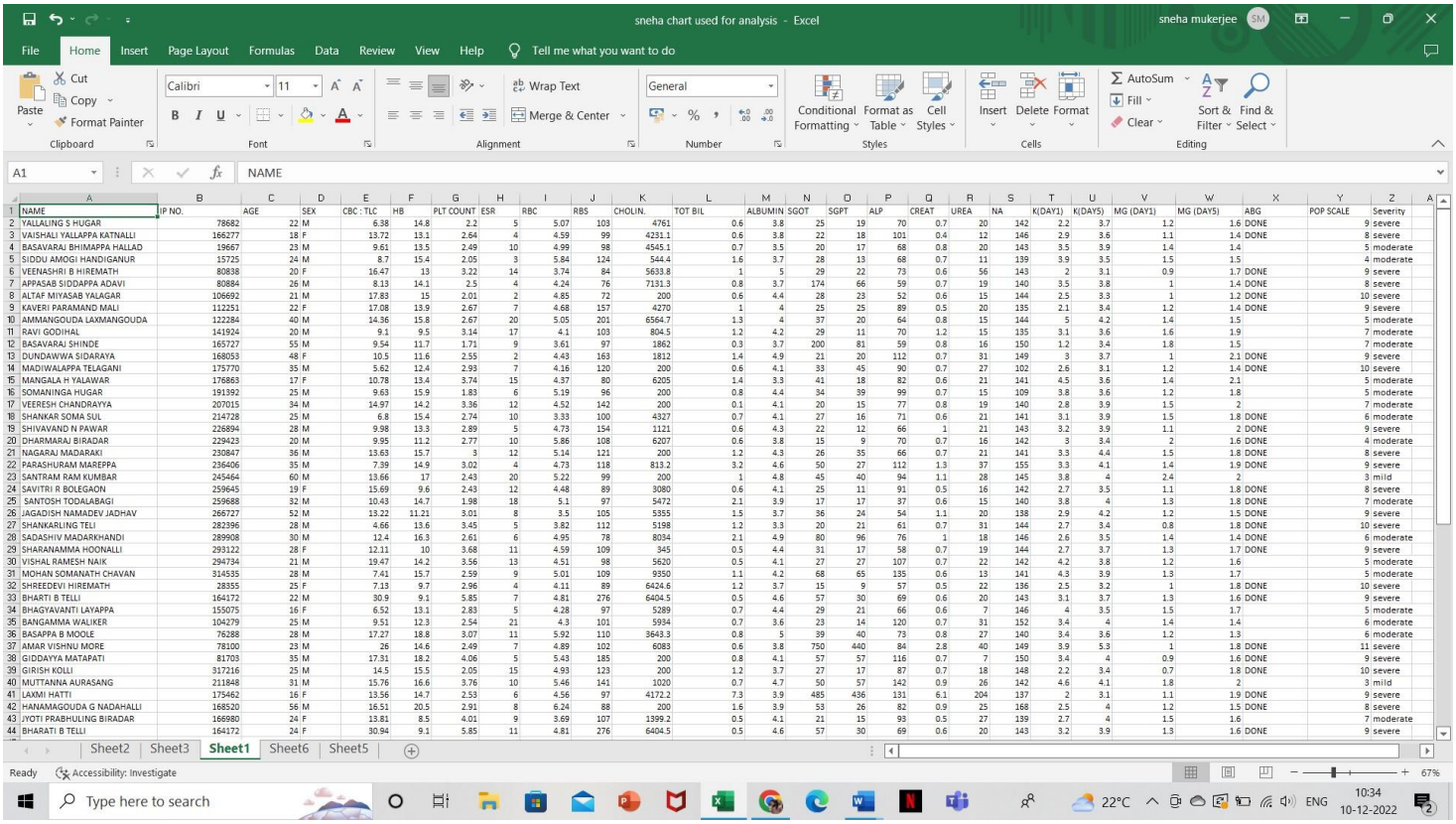
Axis:

9 . POISON DETECTION CENTRE REPORT :

FINAL DIAGNOSIS:

Annexures-IV

MASTER CHART



NAME	IP NO.	AGE	SEX	CBC : TLC	HB	PLT COUNT	ESR	RBC	RBS	CHOLIN.	TOT BIL	ALBUMIN	SGOT	SGPT	ALP	CREAT	UREA	NA	K(DAY1)	K(DAY5)	MG (DAY1)	MG (DAY5)	ABG	POP SCALE	Severity
YALLALING S HUGAR	78682	22	M	6.38	14.8	2.2	5	5.07	103	4761	0.6	3.8	25	19	70	0.7	20	142	2.2	3.7	1.2	1.6	DONE	9	severe
VAISHALI YALLAPPA KATNALLI	166277	18	F	13.72	13.1	2.64	4	4.59	99	4231.1	0.6	3.8	22	18	101	0.4	12	146	2.9	3.6	1.1	1.4	DONE	8	severe
BASAVARAJ BHIMAPPA HALLAD	19667	23	M	9.61	13.5	2.49	10	4.99	98	4545.1	0.7	3.5	20	17	68	0.8	20	143	3.5	3.9	1.4	1.4		5	moderate
SIDDU AMOGI HANDIGANUR	15725	24	M	8.7	15.4	2.05	3	5.84	124	544.4	1.6	3.7	28	13	68	0.7	11	139	3.9	3.5	1.5	1.5		4	moderate
VEENASHRI B HIREMATH	80838	20	F	16.47	13	3.22	14	3.74	84	5633.8	1	5	29	22	73	0.6	56	143	2	3.1	0.9	1.7	DONE	9	severe
APPASAB SIDDAPPA ADAVI	80884	26	M	8.13	14.1	2.5	4	4.24	76	7131.3	0.8	3.7	174	66	59	0.7	19	140	3.5	3.8	1	1.4	DONE	8	severe
ALTAF MIYASAB YALAGAR	106692	21	M	17.83	15	2.01	2	4.85	72	200	0.6	4.4	28	23	52	0.6	15	144	2.5	3.3	1	1.2	DONE	10	severe
KAVERI PARAMAND MALI	112251	22	F	17.08	13.9	2.67	7	4.68	157	4270	1	4	25	25	89	0.5	20	135	2.1	3.4	1.2	1.4	DONE	9	severe
AMMANGOUDA LAXMANGOUDA	122284	40	M	14.36	15.8	2.67	20	5.05	201	6564.7	1.3	4	37	20	64	0.8	15	144	5	4.2	1.4	1.5		5	moderate
RAVI GODIHAL	141924	20	M	9.1	9.5	3.14	17	4.1	103	804.5	1.2	4.2	29	11	70	1.2	15	135	3.1	3.6	1.6	1.9		7	moderate
BASAVARAJ SHINDE	165727	55	M	9.54	11.7	1.71	9	3.61	97	1862	0.3	3.7	200	81	59	0.8	16	150	1.2	3.4	1.8	1.5		7	moderate
DUNDAWWA SIDARAYA	168053	48	F	10.5	11.6	2.55	2	4.43	163	1812	1.4	4.9	21	20	112	0.7	31	149	3	3.7	1	2.1	DONE	9	severe
MADIWALAPPA TELAGANI	175770	35	M	5.62	12.4	2.93	7	4.16	120	200	0.6	4.1	33	45	90	0.7	27	102	2.6	3.1	1.2	1.4	DONE	10	severe
MANGALA H YALAWAR	176863	17	F	10.78	13.4	3.74	15	4.37	80	6205	1.4	3.3	41	18	82	0.6	21	141	4.5	3.6	1.4	2.1		5	moderate
SOMANINGA HUGAR	191392	25	M	9.63	15.9	1.83	6	5.19	96	200	0.8	4.4	34	39	99	0.7	15	109	3.8	3.6	1.2	1.8		5	moderate
VEERESH CHANDRAYYA	207015	34	M	14.97	14.2	3.36	12	4.52	142	200	0.1	4.1	20	15	77	0.8	19	140	2.8	3.9	1.5	2		7	moderate
SHANKAR SOMA SUL	214728	25	M	6.8	15.4	2.74	10	3.33	100	4327	0.7	4.1	27	16	71	0.6	21	141	3.1	3.9	1.5	1.8	DONE	6	moderate
SHIVAVAND N PAWAR	226894	28	M	9.98	13.3	2.89	5	4.73	154	1121	0.6	4.3	22	12	66	1	21	143	3.2	3.9	1.1	2	DONE	9	severe
DHARMARAJ BIRADAR	229423	20	M	9.95	11.2	2.77	10	5.86	108	6207	0.6	3.8	15	9	70	0.7	16	142	3	3.4	2	1.6	DONE	4	moderate
NAGARAJ MADARAKI	230847	36	M	13.63	15.7	3	12	5.14	121	200	1.2	4.3	26	35	66	0.7	21	141	3.3	4.4	1.5	1.8	DONE	8	severe
PARASHURAM MAREPPA	236406	35	M	7.39	14.9	3.02	4	4.73	118	813.2	3.2	4.6	50	27	112	1.3	37	155	3.3	4.1	1.4	1.9	DONE	9	severe
SANTRAM RAM KUMBAR	245464	60	M	13.66	17	2.43	20	5.22	99	200	1	4.8	45	40	94	1.1	28	145	3.8	4	2.4	2		3	mild
SAVITRI R BOLEGAON	259645	19	F	15.69	9.6	2.43	12	4.48	89	3080	0.6	4.1	25	11	91	0.5	16	142	2.7	3.5	1.1	1.8	DONE	8	severe
SANTOSH TODALABAGI	259688	32	M	10.43	14.7	1.98	18	5.1	97	5472	2.1	3.9	17	17	37	0.6	15	140	3.8	4	1.3	1.8	DONE	7	moderate
JAGADISH NAMADEV JADHAV	266727	52	M	13.22	11.21	3.01	8	3.5	105	5355	1.5	3.7	36	24	54	1.1	20	138	2.9	4.2	1.2	1.5	DONE	9	severe
SHANKARLING TELI	282396	28	M	4.66	13.6	3.45	5	3.82	112	5198	1.2	3.3	20	21	61	0.7	31	144	2.7	3.4	0.8	1.8	DONE	10	severe
SADASHIV MADARKHANDI	289908	30	M	12.4	16.3	2.61	6	4.95	78	8034	2.1	4.9	80	96	76	1	18	146	2.6	3.5	1.4	1.4	DONE	6	moderate
SHARANAMMA HOONALLI	293122	28	F	12.11	10	3.68	11	4.59	109	345	0.5	4.4	31	17	58	0.7	19	144	2.7	3.7	1.3	1.7	DONE	9	severe
VISHAL RAMESH NAIK	294734	21	M	19.47	14.2	3.56	13	4.51	98	5620	0.5	4.1	27	27	107	0.7	22	142	4.2	3.8	1.2	1.6		5	moderate
MOHAN SOMANATH CHAVAN	314535	28	M	7.41	15.7	2.59	9	5.01	109	9350	1.1	4.2	68	65	135	0.6	13	141	4.3	3.9	1.3	1.7		5	moderate
SHREEDEVI HIREMATH	28355	25	F	7.13	9.7	2.96	4	4.11	89	6424.6	1.2	3.7	15	9	57	0.5	22	136	2.5	3.2	1	1.8	DONE	10	severe
BHARTI B TELLI	164172	22	M	30.9	9.1	5.85	7	4.81	276	6404.5	0.5	4.6	57	30	69	0.6	20	143	3.1	3.7	1.3	1.6	DONE	9	severe
BHAGYAVANTI LAYAPPA	155075	16	F	6.52	13.1	2.83	5	4.28	97	5289	0.7	4.4	29	21	66	0.6	7	146	4	3.5	1.5	1.7		5	moderate
BANGAMMA WALIKER	104279	25	M	9.51	12.3	2.54	21	4.3	101	5934	0.7	3.6	23	14	120	0.7	31	152	3.4	4	1.4	1.4		6	moderate
BASAPPA B MOOLE	76288	28	M	17.27	18.8	3.07	11	5.92	110	3643.3	0.8	5	39	40	73	0.8	27	140	3.4	3.6	1.2	1.3		6	moderate
AMAR VISHNU MORE	78100	23	M	26	14.6	2.49	7	4.89	102	6083	0.6	3.8	750	440	84	2.8	40	149	3.9	5.3	1	1.8	DONE	11	severe
GIDDAYYA MATAPATI	81703	35	M	17.31	18.2	4.06	5	5.43	185	200	0.8	4.1	57	57	116	0.7	7	150	3.4	4	0.9	1.6	DONE	9	severe
GIRISH KOLLI	317216	25	M	14.5	15.5	2.05	15	4.93	123	200	1.2	3.7	27	17	87	0.7	18	148	2.2	3.4	0.7	1.8	DONE	10	severe
MUTTANNA AURASANG	211848	31	M	15.76	16.6	3.76	10	5.46	141	1020	0.7	4.7	50	57	142	0.9	26	142	4.6	4.1	1.8	2		3	mild
LAXMI HATTI	175462	16	F	13.56	14.7	2.53	6	4.56	97	4172.2	7.3	3.9	485	436	131	6.1	204	137	2	3.1	1.1	1.9	DONE	9	severe
HANAMAGOUDA G NADAHALLI	168520	56	M	16.51	20.5	2.91	8	6.24	88	200	1.6	3.9	53	26	82	0.9	25	168	2.5	4	1.2	1.5	DONE	8	severe
JYOTI PRABHULING BIRADAR	166980	24	F	13.81	8.5	4.01	9	3.69	107	1399.2	0.5	4.1	21	15	93	0.5	27	139	2.7	4	1.5	1.6		7	moderate
BHARATI B TELLI	164172	24	F	30.94	9.1	5.85	11	4.81	276	6404.5	0.5	4.6	57	30	69	0.6	20	143	3.2	3.9	1.3	1.6	DONE	9	severe

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DOCTOROFMEDICINE IN

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Under the guidance of

Dr. PRAKASH G.M

PROFESSOR

DEPARTMENTOFGENERAL MEDICNE

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