39

25 Batch

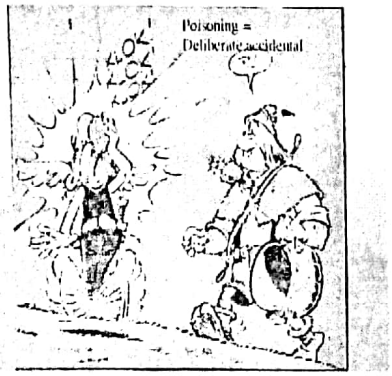
TOXICOLOGY
AGROCHEMICALS

PESTICIDE POISONING

The potent chemicals used in agriculture may harm persons by

A. accidental exposure
   1. application to crops
   2. incorrect or careless storag
B. Self administration (suicide)
C. Homicidal purposes (rare)

The main dangers from agricultural chemicals lie in the pesticides.



Common Pesticides

- Insecticides
- Weedicides
- Rodenticides
- Fungicides
- Molluscides

Insecticides

- Organochlorines
- Organophosphates
- Carbamates
- Pyrethrum & Pyrethroids
- Others

Organochlorines (chlorinated hydrocarbons)

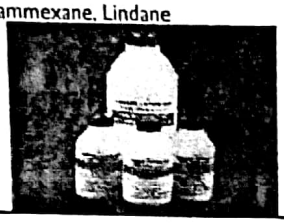
Chlorinated hydrocarbons used in agriculture and mosquito control

Eg: Gammexane, DDT (dichloro diphenyl trichloroethane)

- Organo Chlorines
(Chlorinated hydrocarbons)

Common

- Lindane derivatives – chlordaine, aldrin, dieldrin, diendrin
- Chlorobenzene derivatives
- Benzene hexachloride – Gammexane, Lindane



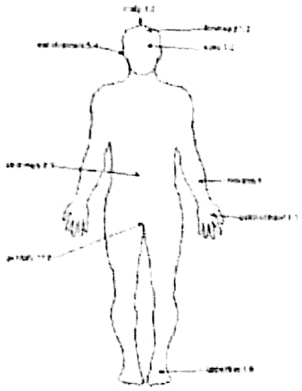
Organo chlorines

Circumstances

- Ingestion (suicidal/Accidental/Homicidal)
- Inhalation of spray or dust (Accidental)
- Absorption through skin (Accidental)

Actions- Local gastro- intestinal irritation
- Stimulation of the central nervous system

The rates of absorption relative to the forearm which is given the rating of 1



Organo chlorines

Clinical features

a. nausea, vomiting
b. Headache, dizziness & parasthesia
c. Muscle fasciculation, tremors and convulsions
d. CNS depression, coma, respiratory failure and death

Organophosphorus pesticides

These chemicals act on insects and other arthopods by inhibiiting cholinesterase and their toxic effects on man are caused by the same mechanism

Eg: Parathion (nitrostigmine), Malathion, Runbug, Sumithion, Fenthion

Organophosphorus pesticides

Parathion is extremely toxic and can be absorbed through the skin, conjunctivae, lungs and gut.

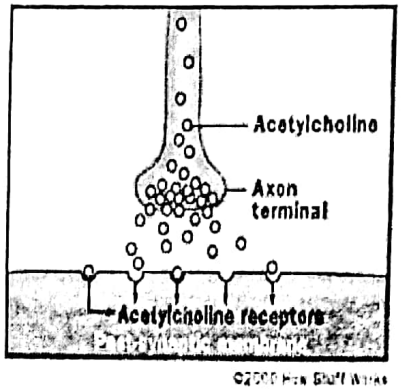
Circumstances – ingestion, inhalation and skin absorption

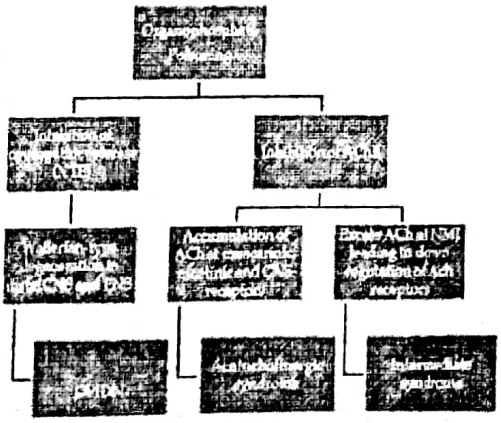
Organophosphorus pesticides

Action

Irreversible inhibition of choline esterase resulting in the increase of the acetylcholine levels at the cholinergic nerve endings

a. Neuro-muscular junction(motor end plate)
b. Postganglionic parasympathetic nerve endings (glands, smooth muscle)
c. Brain





Organophosphorus pesticides

CLINICAL FEATURES

- Muscular twitching of tongue and face
- Generalized twitching
- Muscle weakness and paralysis
- Nausea, vomiting, salivation, abdominal colic, diarrhoea, tenesmus (due to both irritation and increase in the gastro-intestinal secretions)

Organophosphorus pesticides

- Rhinorrhoea with dyspnoea due to increased secretions in the trachea and bronchi and bronchospasms followed by frothing
- Miosis, lacrimation and blurring of vision
- Headache,giddiness,confusion,convulsions, coma, paralysis of the respiratory centre and death
- Urination(enuresis), increased sweating

Organophosphorus pesticides

Clinical features- common

D- diarrhoea
U- urination
M- meiosis
B- bronchospasms
E- emesis
L- lacrimation
S- salivation and sweating

Autopsy features

There may be no specific autopsy features and the diagnosis rests upon the history, circumstances and postmortem analysis of blood urine and liver.

Carbamates

Eg: Baygon, Baycarb, Furadan

Circumstances – Ingestion, Inhalation, Skin absorption

Action- They are reversible anticholine esterase and due to the accumulation of acetylcholine the clinical features occur.

Clinical features- same as for organophosphate poisoning

Pyrethrum & Pyrethroids

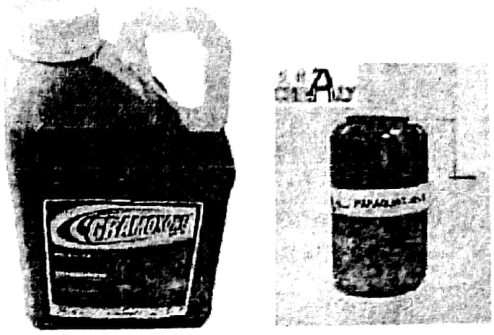
Circumstances – ingestion, inhalation and skin absorption

Action- Low toxicity. No deaths reported.

Shelltox- 2% pyrethrin and 0.1% piperonyl butoxide and kerosine base. Poisoning is due to the kerosine

WEEDICIDE (Herbicides)

- Bipyridyl : Gramoxone (20% paraquat)
- Dipyridyl : Weedol Does not cause pulmonary lesions because of its lower affinity for lung tissue



Gramoxone(Paraquat) Poisoning

- It kills all green tissue on contact and gets inactivated on contact with soil.Therefore it is an ideal weedicide
- Available as a thick greenish-blue fluid with a strong pungent odour
- Introduced to market in 1962

Circumstances of poisoning

A. Ingestion- dose of 15 ml of the liquid concentrate is fatal
B. Skin absorption- skin irritation with blister formation
C. Inhalation- epistaxis and soreness of throat
D. Parenteral

Absorption and metabolism

- Poorly absorbed from the GIT
- Only 5% is absorbed and excreted unchanged in the urine
- The unabsorbed paraquat is degraded by the intestinal bacteria
- The maximal blood level will be found up to six hours
- Next 24-48 hours the levels drop to undetectable amounts

Absorption and metabolism

- The absorbed paraquat is quickly taken to the tissues selectively and actively by the lung.
- This tissue paraquat is systematically released into the blood stream in the next 7-14 days and is excreted unchanged in the urine

Absorption and metabolism

Cellular action of paraquat

- Combines with cellular NADPH to produce NADP and oxidised paraquat or superoxide
- This acts on the polysaturated lipid cell membrane and produces lipid hyperoxides which causes tissue damage
- It also stimulates the pentose phosphate pathway, reduce the level of cellular NADPH and inhibit the synthesis of FFA

Absorption and metabolism

- Lung is sensitive because of its bioaccumulation of the higher oxygen tension
- The peroxidation converts molecular oxygen to superoxide radicals,hydroperoxide radicals and hydrogen peroxide which inturn disrupts the cell structure and function

SYMPTOMS

Early(destructive phase)

a. GIT irritation with nausea, vomiting, abdominal discomfort and diarrhoea
b. Soreness of the mouth, throat and dysphagia
c. Tremors and convulsions
d. Oliguria and anuria due to acute tubular necrosis leading to renal failure
e. Icterus due to centrilobular necrosis leading to liver failure

SYMPTOMS

f. Dyspnoea due to pulmonary haemorrhages and oedema (damaged pulmonary epithelium, interstitial and alveolar exudate of fibrin forming a eosinophilic hyaline membrane)

SYMPTOMS

Delayed (Proliferative phase) – after 7 days

a. Dyspnoea due to intra alveolar fibrosis
b. Respiratory failure and death (due to the diffuse cellular intra alveolar fibrosis of the lung)

AUTOPSY FEATURES

1. Macroscopic
- Ulceration of the lips, tongue, buccal mucosa, throat etc
- Icterus
- Irritation and ulceration of the oesophageal mucosa, gastric and intestinal mucosa

AUTOPSY FEATURES

- Enlarged fatty (yellow) liver
- Swollen kidneys with cut surface bulging, pale coretx and congested medulla
- Lungs(early) pulmonary congestion and oedema
- Tracheo- bronchial mucosal congestion with frothy blood stained mucoid secretions
- Heavy, dark (late) rubbery with congestion, oedema and areas of collapse, haemorrhage and fibrosis (honey comb appearance)
- Pleural effusion, tracheo- bronchial mucosal congestion with blood stained frothy mucoid secretions

AUTOPSY FEATURES

2. Microscopic

a. Liver- centrilobular necrosis, fatty changes, diffused scattered necrosis of hepatocytes and bile thrombi

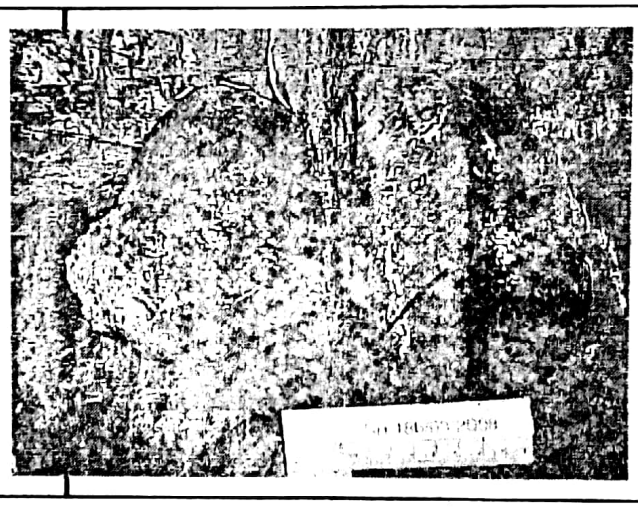
b. Kidneys- degeneration of renal tubular cells, necrosis of the proximal convoluted tubules and protein casts in the distal convoluted tubules

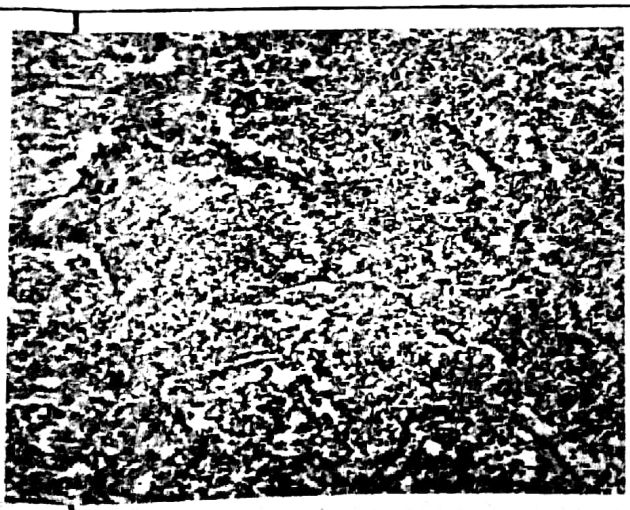
AUTOPSY FEATURES

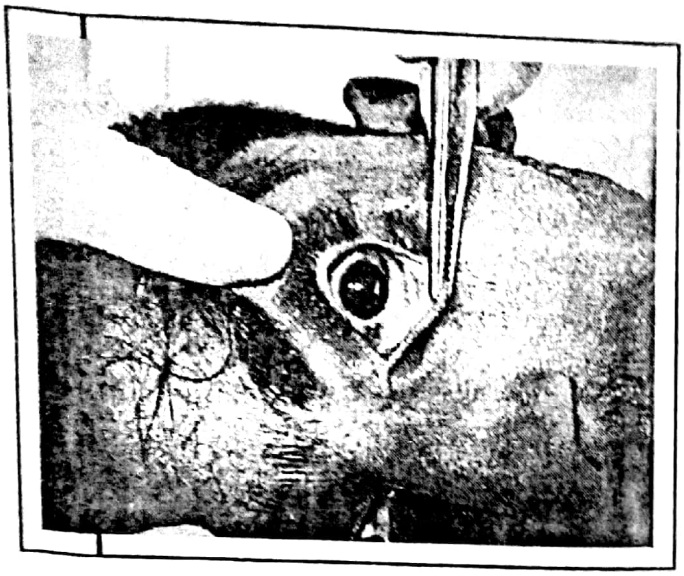
c. Lungs

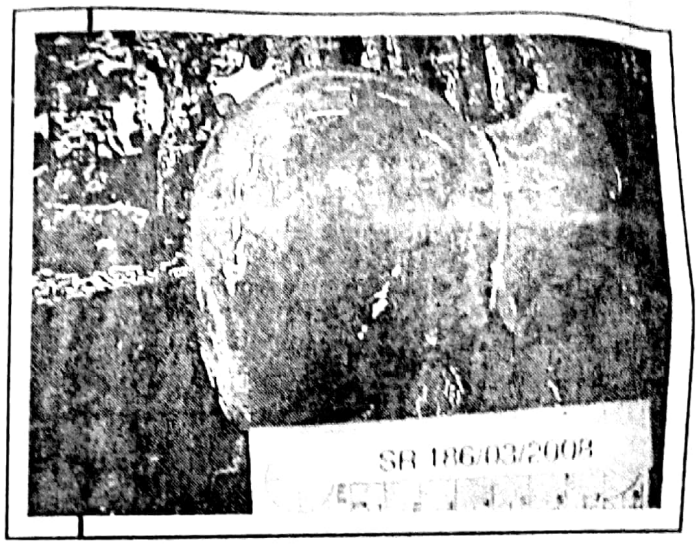
Early – Pulmonary congestion and oedema with interstitial and alveolar exudate of fibrin. The fibrin is closely attached to the bronchioles forming a eosinophilic hyaline membrane

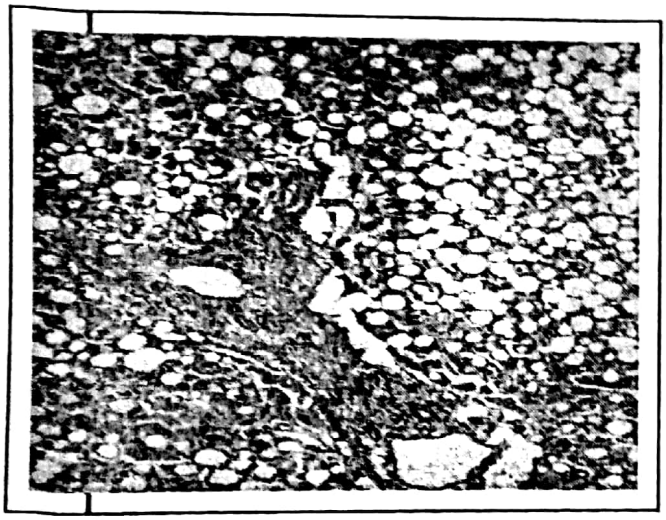
Late – Diffuse interstitial and intra alveolar fibrosis with areas of haemorrhage and collapse

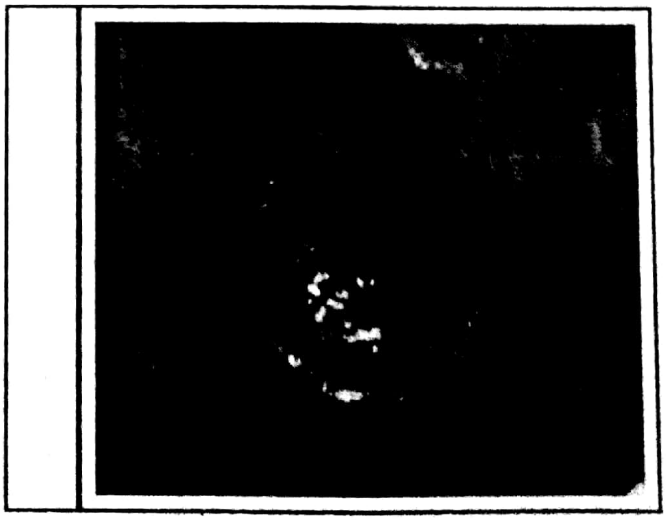


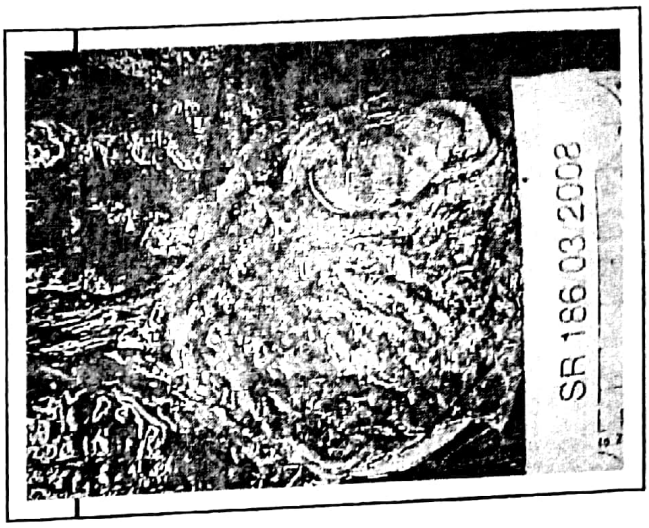












RODENTICIDES

a. Zinc phosphide: Eg: Run rat

It releases phosphine on contact with water. Rats are attracted by the rotten fish odour and readily eats the poison

Symptoms- nausea, vomiting, diarrhoea, liver toxicity, rapid pulse, irritability, fever, cyanosis

RODENTICIDES

b. Coumarins: Racumin

Safe as 1 pound is required to kill.

Symptoms- epistaxis, haeamturia, bleeding PR

c. Thallium: Zelio paste

Contains 1% Thallium sulphate. The lethal dose for human is 1 gram

Symptoms- Severe gastro intestinal irritation, tremors, polyneuritis, delirium, convulsions, encephalopathy and coma, hepato- renal failure, skin eruptions, alopecia, respiratory failure

FUNGICIDES

a. Copper compounds: Cuprasan

Acute gastro- intestinal irritation, convulsions, coma & death, hepato-renal failure

b. Organo-mercury compounds: Agrosan

Used in seed dressings

c. Dithiocarbomates : Anthrocol

Very mild toxicity

d. Chlorobenzene compounds : hexachlorobenzene cause skin irritation

e. Benzimidazole – very low toxicity

SNAIL BAIT

Metaldehyde- Metabait, Snail killer

Metaldehyde converted to acetaldehyde in the body

Symptoms – These are due to the acetaldehyde

a. nausea, vomiting, abdominal pain

b. Flushed face, pyrexia

c. Muscle rigidity, twitching and choreiform movements

d. convulsions, coma, respiratory failure and death

Reference

1. Lecture Notes by Dr L.B.L.De Alwis

2. Knight's Forensic Pathology
   3rd Edition