

PHOSPHORUS POISONING

OBJECTIVES

- ◉ Place in Classification
- ◉ Identification features
- ◉ Uses
- ◉ Mechanism of action
- ◉ Poisoning
- ◉ Fatal Dose
- ◉ Treatment
- ◉ Postmortem appearance
- ◉ Medicolegal importance

PLACE IN CLASSIFICATION

⊙ Irritant → Inorganic → Non metallic



WHITE PHOSPHORUS

- ◉ Waxy translucent pliable soft sticks
- ◉ Exposure to light changes into yellow
- ◉ Insoluble in water
- ◉ Exposure to air → oxidised
- ◉ Emits white fumes of phosphorus trioxide on oxidation
- ◉ Phosphorus trioxide
 - Luminous in dark
 - Strong garlic odour
- ◉ At 34 degree Celsius, ignites in air emitting greenish white flame
- ◉ Hence preserved in water or kerosene oil
- ◉ Taken out by forceps (body heat ignition)

RED PHOSPHORUS

- ⦿ Prepared by heating yellow phosphorus at 240 degree Celsius in an atmosphere of nitrogen and carbon dioxide
- ⦿ Not poisonous
- ⦿ Not luminous in dark
- ⦿ No odour
- ⦿ Not oxidised in air → no preservation

USES

⊙ Red phosphorus

- Preparation of safety matches
- Commercially available contains 0.6% yellow phosphorus → poisonous

⊙ Yellow phosphorus

- Vermin pastes → 1-4% yellow phosphorus with arsenic, flour, oil, sugar etc
- Fire works
- Gun powder & incendiary ammunition
- Tracer bullets
- Fertilizers and rodenticides

SAFETY MATCHES

⦿ Matchstick end

- Potassium chlorate
- Antimony sulphide

⦿ Striking surface

- Red phosphorus
- Powdered glass or coarse sand particles

ARSON

- ◉ To deliberately set fire on something
- ◉ Molotov cocktail



MECHANISM OF ACTION

- ◉ Hepatotoxic and protoplasmic poison
 - ◉ Locally irritant
 - ◉ After absorption
 - Protoplasmic poison
 - Disturbs cellular oxidation → metabolism
 - Widespread fatty degeneration and tissue destruction
 - ◉ Chronic absorption
 - Bone formation in epiphyseal cartilage and haversian and marrow canals
 - Impaired blood flow
 - Necrosis and sequestration of bones
 - Spontaneous fracture
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⦿ FATAL DOSE

- 60 to 120 mg for adult
- 10 to 25 mg for child

⦿ FATAL PERIOD

- Within 24 hours in fulminating poisoning
- 2 to 8 days

FULMINATING POISONING

- ⦿ > 1 gm ingestion
- ⦿ Thirst, nausea, vomiting and retching occur
- ⦿ Delirious and maniacal behaviour
- ⦿ Shock and cardiovascular collapse
- ⦿ Direct action on heart and blood vessels
- ⦿ Death within 12 hours

ACUTE POISONING

- First stage (8 hours to 3 days)
 - Garlic taste and smell
 - Burning pain in upper GIT
 - Intense thirst
 - Profuse and persistent vomiting
 - Vomitus luminous in dark with garlic smell
 - Stools - darks and offensive, garlic smell
- Symptoms gradually subside and passes to second stage

- Second stage (2 to 3 days)
 - Apparent improvement
 - Merges into third stage

○ Third stage (Systemic toxicity)

- N/V/D reappear with more intensity
- Vomitus and stool → blood and mucous
- Jaundice sets in and deepens
- Liver enlarged, softened and tender
- Haemorrhagic spots over body
- Epitaxis, haematemesis, malaena, haematuria, menorrhagia
- Abortion in pregnant

- ◉ Restlessness, insomnia, tinnitus, vertigo, impaired vision, delirium, priapism etc
- ◉ Hepatic and renal insufficiency → jaundice and oliguria → acidosis → fall in blood pressure and pulmonary odema → cyanosis, dyspnoea with subnormal temperature → coma and death
- ◉ SKIN BURNS by yellow phosphorus
 - Second or third degree
 - Surrounded by blister
 - Slow to heal

TREATMENT

- ◉ Gastric lavage with 0.5% KMnO_4
 - Oxidise into harmless phosphoric acid and phosphates
 - Manganese dioxide produced itself act as chemical antidote
- ◉ Copper sulphate - 250 gm solution in water orally every 5 minutes till vomiting
 - Precipitated as copper phosphide
 - Coating over phosphorus particles
- ◉ Charcoal
- ◉ Emetics

- ◉ No oils, fats or milk → promotes absorption
- ◉ Liquid paraffin → retards absorption
- ◉ Purgatives for bowel evacuation
- ◉ Glucose and alkaline drinks to protect liver
- ◉ High carbohydrate, protein diet and low fat diet
- ◉ Treatment of shock
 - i.v. 5% glucose saline with Vit C 500 mg
 - Calcium gluconate 10% 10 ml
- ◉ Inj. Vit. K i.v. Or i.m
- ◉ Skin - irrigation with 1% CuSO_4 for at least 15 minutes and remove yellow phosphorus by forceps
- ◉ Hemodialysis

POST MORTEM APPEARANCES

○ Fulminating case

- Slight icterus tings
- Mucosa inflammed
- Corrosion and ulceration sometime
- Luminous stomach content

- ◉ Death after few days
- ◉ Yellow colour skin
- ◉ Petechial haemorrhages
- ◉ Garlic odour from cavity and stomach
- ◉ Contents of stomach luminous in dark
- ◉ Altered blood and detached shreds of mucous membrane
- ◉ Petechial haemorrhagic spots over serous and submucous surfaces

LIVER

- ◉ Lemon yellow tint
- ◉ Doughy consistency
- ◉ Soft and greasy to touch
- ◉ Histology
 - Cloudy swelling
 - Fatty degeneration
 - Later necrosis
 - Fat in Kuffer's cells - earliest manifestation of necrobiosis

○ Kidney,

- Soft, greasy and yellow in colour
- Petechial spots on surface
- Tubules filled with debris, fatty casts, albumen etc

○ Heart

- Soft, flabby and dilated
- Fatty degeneration
- Subendocardial haemorrhages

○ Blood tarry or blackish in colour

○ Low coagulability

MEDICOLEGAL IMPORTANCE

- ◉ Homicide - NOT COMMON
- ◉ However, if given with alcohol and coffee
 - Delay in onset of signs and symptoms
 - Long time between ingestion and death
 - Signs and symptoms simulate hepatotoxic drugs or diseases
 - Oxidation in body if patient survives long
- ◉ Suicide - Vermin pastes, rat killers etc
- ◉ Accidental
 - Criminal abortion
 - Children eating rat poisons and fireworks
 - Projectiles with phosphorus in body
 - Inhaling hydrogen phosphide in cargo ships
 - Workers

CHRONIC POISONING

- Rare
- Inhalation of fumes for long time
- Workers
 - Match factory
 - Fireworks
 - Ammunitions
 - Inhalation of phosphorated hydrogen
 - in preparation of acetylene gas from carbide
 - Escape of gas from ferrosilicon

CLINICAL FEATURES

- ◉ After months and years
- ◉ N/V/D
- ◉ Garlic smelling eructation
- ◉ General wasting and weakness
- ◉ Joint pains, anaemia and jaundice
- ◉ Abortion
- ◉ Death from infections
- ◉ Phosphorus burns with dermatitis

PHOSSY JAW

- ◉ Tooth and gums
- ◉ Lower jaw affected
- ◉ Through decayed teeth or raw interspace between missing teeth
- ◉ Osteomyelitis and periostitis of lower jaw
- ◉ Loosening and falling of teeth
- ◉ Toothache f/b swelling of jaw, loosening of teeth, sloughing of gums, necrosis and sequestration of affected part of mandible with multiple sinuses, discharging foul smelling pus
- ◉ Differential diagnosis - Actinomyces = lumpy jaw



PROPHYLAXIS

- ◉ Cleanliness of factories
- ◉ Ventilation
- ◉ Saturation of air by turpentine in workrooms
- ◉ Better oral hygiene
- ◉ Treatment of dental problems
- ◉ Surgical intervention of jaw necrosis if already present