FORENSIC TOXICOLOGY

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Toxicology

- **The** word ‘toxicology’ is derived from the Greek word “toxicon” which means poisonous substance smeared on arrowhead to inflict maximum damage.

- **Toxicology** is defined as branch of Science which deals with the study of Poisons in reference to their source, properties, action, signs &symptoms so on and so forth

FORENSIC TOXICOLOGY

- Toxicology is the combination of chemistry and physiology that deals with drugs, poisons, and other toxic substances and how these substances affect living organisms.

Forensic Toxicology deals with the medical and legal aspects of the harmful effects of chemicals on human beings.

Poison

- Is defined as a substance which when ingested, inhaled, applied or administered is capable of acting deleteriously(harmful) on the body i.e produces ill health or death.

LAW OF POISONS:

- Drugs&Cosmetics Act 1940
- Drugs&Cosmetic Rules 1945
- Pharmacy Act 1948
- Drugs Control Act 1950
- Drugs&Magic Remedies Act 1954
- Narcotics& Psychotropic Substances Act 1985(This act repeals 3 acts. Opium Act 1857,Opium Act 1878,Dangerous Drugs Act 1930.)
- Prevention of Illicit Trafficking of Narcotic Drugs &Psychotropic Substances Act 1988

Intoxicant vs. Poison

- An intoxicant , such as alcohol or carbon monoxide, requires that you ingest /inhale a large amount to be lethal.
- Poison such as cyanide, requires only a very small amount .

It’s all in the dose

- The degree of toxicity of any substance depends on how much enters your body and over what period of time it does so.

Legal

- IF A SUBSTANCE IS GIVEN THERAPEUTICALLY TO OVERCOME A DISEASED CONDITION, IT IS LAWFULLY ACCEPTED.

- IF THE SAME SUBSTANCE IS GIVEN,ADMINISTERED OR IN OVERDOSAGE TO KILL ONESELF OR ANOTHER IS LAWFULLY PUNISHABLE

Facts

- Aspirin- in the right dose can relieve pain and symptoms associated with inflammation and protection against heart disease.

  Conversely over dosage can cause serious health problems.
- Penicillin – an important antibiotic for preventing and curing illness.

  At a given dose one individual may be cured, another will see no effect. And a third one may die of hypersensitivity.

FORENSIC TOXICOLOGY

- Drugs and toxic chemicals span a massive range from alcohol (which is socially acceptable) to heroin and crack cocaine (which are generally frowned upon)

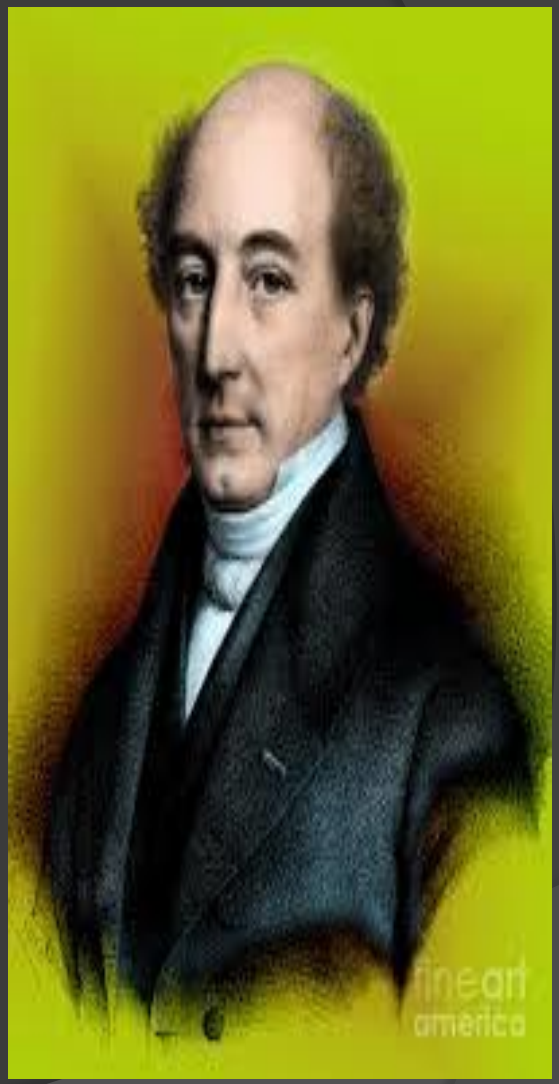
And on to killers, including arsenic and cyanide that are used only as tools of aggression or suicide.

Actions increasing risk of death by one in million.

Action	Nature of Risk
Smoking 1to 4 cigarettes	cancer , heart diseases.
Drinking 0.5 litre of wine	Cirrhosis of the liver
Spending one hour in a coal mine.	Black lung disease.
One chest X-ray taken in a good hospital	Cancer caused by radiation.
Living 5 years at site boundary of a typical nuclear reactor.	Cancer caused by radiation.

Father of Toxicology

- The Father of Toxicology was a person named Mathieu Orfila. His work was mainly centered on arsenic; the poison of choice in the early 1800's. It was readily available as rat poison and was the favorite means of murder among the poor people.



CLASSIFICATION OF POISONS

CORROSIVES
- strong acids
- strong alkalis
- metallic salts

IRRITANTS
- agricultural
- inorganic
- organic

SYSTEMIC
- cerebral
- spinal
- peripheral
- cardiovascular
- asphyxiants

MISCELLANEOUS
- food poisoning, botulism

Classification Of Poison

CORROSIVE : ACIDS AND ALKALIS,METALLIC SALTS

a) Mineral acid (HCl, H_2SO_4, HNO_3)

b) Organic acid (oxalic, salicylic, carbolic, acetic acid)

c) Vegetable acid (HCN)

d) NaOH, KOH

SULPHURIC ACID

Oil of vitriol:It is a colorless, heavy oily liquid which emits no fumes when exposed to air, mixed with water it evolves much heat

- it chars, blackens the skin, cloth and any other matter.
- fuming sulphuric acid has a formula of $H_2S_2O_7$ and is used in the manufacture of indigo dye

Fatal dose: 5-10ml

Fatal period: 12-24hrs

- Cause of death: circulatory collapse, spasm/edema of glottis, collapse due to perforation of stomach, toxemia, delayed death may occur due to hypostatic pneumonia, secondary infection, renal failure.

- Treatment: avoid gastric lavage or emetics
- Acid should be immediately neutralised in situ by giving 1/4th litre of water or milk or milk of magnesia
- Alkaline carbonates and bicarbonates which liberate CO2 should not be used as they cause gastric distension and sometimes rupture

- Give demulcent: Olive oil, milk, egg whites, starch water, mineral oil, melted butter maybe given in divided doses to prevent esophageal stricture and shock
- Circulatory shock to be corrected
- Tracheostomy(if there is edema of glottis)
- Give nothing by mouth
- Skin burns are washed with large amounts of water and paste of magnesium oxide or sodium carbonate is applied
- Eye burns are irrigated with water or sodium bicarbonate for 10-15mins.
- Treat symptomatically.
- Test: Blue litmus Red.
- Ph paper test
- Test:
- Barium Chloride and Hydrochloric acid added to a solution containing Sulphuric acid when a
- Curdy white precipitate of Barium Sulphate obtained.

VITRIOLAGE(VITRIOL THROWING)

- Throwing of Sulphuric Acid on another individual is known as Vitriolage. Jealous or disgruntled persons may throw a
- Corrosive to disfigure and harm their enemies. Burns are painless. They are penetrating burns and acid devitalises the tissues and predispose to infection. Blindness may occur if eyes are involved. Death may result from shock or toxaemia if extensive area is involved

LAKSHMI CASE

- Lakshmi Agarwal was only 15 years old and is a acid attack survivor in 2005 in New Delhi and filed for public interest litigation in Supreme Court. Her PIL sought framing of a new law or amendment to the existing criminal laws like IPC, Indian Evidence Act and Cr. PC for dealing with the offence besides asking for compensation. In 2013,Supreme Court passed rules restricting the sale of acid.

NitricAcid

Aqua Fortis, Red Spirit of Nitre: Is a clear colourless, fuming heavy liquid and has a peculiar choking odour. In concentrated form, it combines with organic matter and produces an yellow discolouration of tissue due to the production of Picric Acid(Xanthoproteic Reaction).Greater abdominal distension owing to gas formation. Inhalation of fumes causes lachrymation, photophobia, irritation of air passages and lungs, producing sneezing, coughing, dyspnoea(difficulty in breathing) and asphyxia. Colour of urine is brown. FD and FP are same as that of Sulphuric Acid.

- Test: Blue litmus Red
- Ph paper test
- Brown Ring Test: Strong Ferrous Sulphate solution and Sulphuric Acid are added to a solution containing Nitric Acid, a brown ring is formed at the junction of the two fluids.

Hydrochloric Acid:

- Muriatic Acid: Is a pungent, colourless fuming acid.It is a natural constituent of the fluid of the Stomach and bowels. It is less corrosive than Sulphuric acid .It destroys the mucous membrane.
- FD:15 to 20 ml.
- FP:18 to 36 hrs.
- Perforation of the Stomach is rare. Acute inflammation and oedema of respiratory passages and lung tissue are common.
- Test: A solution of Silver Nitrate and Nitric acid produces a heavy curdy white precipitate of Silver Chloride.

Oxalic Acid:(Salt of Sorrel)

- Occurs as colourless, transparent prismatic crystals and resembles Magnesium Sulphate and Zinc Sulphate crystals. Used as a bleach to remove stains or to clean brass or copper articles or leather and for removing writing and
- signatures illegally.
- Systemic :a)Shock: Large doses cause rapid death from shock.
- b)Hypocalcemia: It readily combines with Calcium ions in the body tissues and causes it's withdrawal from them.
- C)Renal damage: Oxalate produces Tubular nephrosis or necrosis and cause uraemia in 2 to 14 days.
- FD:15 TO 20 Gms.
- FP:1 to 2 hrs.
- Treatment: Stomach washed with Calcium Lactate or Gluconate.
- 10%of 10 ml i.v. Calcium Gluconate administered.
- Dialysis for Renal failure.
- Demulcents.
- Symptomatic.
- Test: A solution of Barium Nitrate gives a white precipitate of Barium Oxalate which is soluble in Hydrochloric Acid or Nitric Acid'
- Excretion of Oxalate crystals in urine is called as Oxal Urea.

Carbolic Acid:Phenol:

- Carbolic Acid(Phenol):C6H4 OH: Consists of short, colorless, prismatic needle shaped crystals. Has a burning sweetish taste which turn pink when exposed to air. Commercial Carbolic acid is a dark brown liquid containing several impurities, chiefly Cresol.
- Acute Poisoning is called as" Carbolism''.Greyish white discoloration of skin, pain, tingling and numbness will be felt. Pupils constricted.
- Phenol will be metabolised in the liver and the metabolites Hydroquinone and Pyrocatechol are excreted in the urine. Urine turns green in colour on exposure to air due to these metabolites and this condition is called Carboluria.

- Chronic Poisoning: Phenol Marasmus:
- Characterized by anorexia, weight loss, vertigo, dark colored urine.
- Ochronosis: The metabolites hydroquinone and pyrocatechol may cause pigmentation in the Cornea and various cartilages, a condition called Ochronosis.

Alkalies:

- Commonly encountered alkalies are hydroxides of Sodium, Potassium, Calcium and Ammonium and Carbonates of Sodium, Potassium, Calcium and Sodium Hypochlorite.
- Most of these appear as white powders or colourless solutions.
- Ammonium Hydroxide :Used in paints, dirt remover and as refrigerant.
- Sodium Hydroxide(Caustic Soda):Used as drain cleaner and oven cleaner.
- Potassium Hydroxide(Caustic Potash):Used as drain cleaners and in hearing aid batteries.
- Sodium Carbonate(Washing Soda):House hold cleaner and detergent.
- Sodium Hypochlorite: House hold bleach.
- Usual fatal dose is 10 to 15 gms;15 to 20 ml for Ammonia.
- Mode of Action: Locally alkalies produce liquefaction necrosis and saponification of fats. Ulcer formation is common. Esophagus more vulnerable than Stomach.

Treatment:

- Alkaline poisons should be neutralised with vegetable acids such as Acetic acid, Vinegar, Citric or Tartaric acid mixed with large quantity of water. These should be followed by Olive Oil, White of egg, milk, butter and acidulated demulcent drinks. Morphine may be given hypodermically to relieve pain .It may be necessary to perform oesophagostomy or gastrostomy.

Classification Of Poison

IRRITANTS: **1.**Agricultural, 2.Inorganic, 3.Organic

Inorganic:

- a) METALS: AS, Hg, Pb, Cu, Cd, Cr, Mg, Mn, Zn, Se, etc.
- b) NON METALICS: Chlorine, Bromine, Iodine, Phosphorous, Carbon Tetrachloride

- c) Mechanical poisons – Powdered glass, Diamond dust, Hair

Organic:

- a) Vegetable poison: Abrus, ergot, madar, castor oil, marking nut, Capsicum
- b)Animal: Snake venom, Insect venom, Scorpion venom, Cantharides, Ptomaine

Irritant Poisons:

Agricultural Poisons:

- 1)Insecticides of Vegetable Origin: They are Nicotine, Pyrethrins and Rotenone.
- 2)Chemical Insecticides: Inorganic: They are Phosphorous and compounds of Antimony, Arsenic, Barium, Mercury, Thallium, Zinc and Fluorides.
- 3)Synthetic Organic Chemical Insecticides: They are divided into Phosphate Esters, Carbamates, Chlorinated Hydrocarbons.

Organo Phosphorous Compounds:

They are Choline Esterase Inhibitors (Acetyl Choline-Neuro transmitters they have 3 distinct toxic actions

- 1)Muscarine like effect which potentiates postganglionic parasympathetic activity.
- 2)Nicotine like Stimulation followed by Paralysis of Post ganglionic and somatic motor nerves.
- 3)Central Nervous System stimulation followed by depression.

Treatment:

- When the poison is ingested ,stomach should be washed with1:5000 Potassium Permanganate solution. Activated Charcoal to be administered. Atropine Sulphate arrests Muscarine effects and CNS effects.
- Pupils will be constricted in OP Poisoning. Atropine should be administered till dilatation of the pupil takes place(Atropinisation). If its further administered ,it will result in death only.
- Example for OP compounds:
- Methyl Parathion, Ethyl Parathion, Malathion, Diazenon, TEPP(Tetra Ethyl Pyro Phosphate),,HETP(Hexa Ethyl Pyro Phosphate).

Organo Chlorinated Compounds

- They interfere with nerve impulse transmission. CNS is first stimulated and then depressed.
- Symptomatic Convulsions should be controlled with Diazepam.
- Example for OC compounds:
- DDT, Gammaxene, Lindane and Endosulphan.

Carbamates:

They are also Anticholinergic and inhibit Carboxylic Esterase enzymes by Carbamylation. Atropine is the specific antidote. Pralidoxime improves respiratory functions and patients well being.

Example for Carbamates:

- Aldicarb, Aminocarb,
- Aprocarb(Baygon)Carbaryl, Carbofuran(Furadon)

Cause of death: Paralysis of respiratory muscles, respiratory failure.

Metallic Poisons:

ARSENIC:

Metal is not poisonous but when volatized by heat, poisonous vapour of Arsenic Trioxide formed.

Compounds of Arsenic:

- Realgar: Yellow(As2S2)
- Orpiment: Red(As2S3)
- On heating, Arsenic sublimes to form Arsenic Trioxide, fine granular white powder known as White Arsenic.
- Copper Arsenite(Scheele's Green)
- Copper Acetoarsenite(Paris Green or Emerald Green)
- Arsine Gas(AsH3)

Types of Arsenic Poisoning:1)Fulminant: Massive doses-3 to 5 gms causes death due to shock.

- 2)Gastroenteritis Type: Constriction of the throat burning and colicky pain in oesophagus, stomach and bowel occur. Stools colorless, odorless and watery resembling rice water stools of cholera. Garlicky odour of breath and faeces.

Arsenic vapors

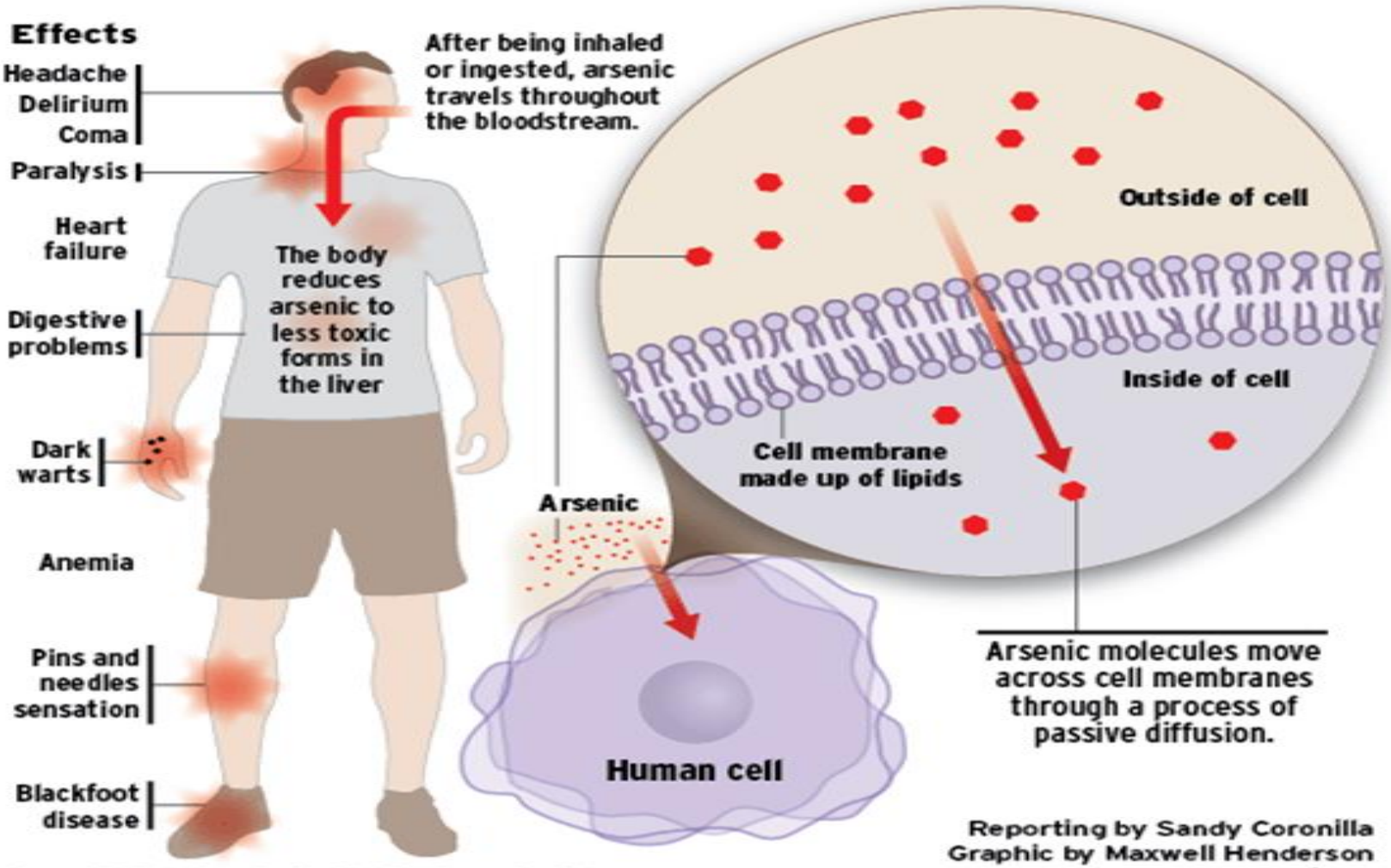
- In 1893 an Italian Biochemist named Gosio figured out that the green pigment used in many fabrics and wallpapers contained an arsenic compound that when exposed to dampness would emit arsenic vapors.

Napoleon and Arsenic

- It has been suspected for years that Napoleon's death was caused by arsenic poisoning. Arsenic loves to bind to sulfur and there is plenty of sulfur in your hair so basically your hair is a timeline .
- There is one fact…arsenic was found in Napoleon's hair.

The damaging effects of arsenic

This lethal mineral can spell disaster for almost every part of the human body.



Source: California Department of Toxic Substances Control

Reporting by Sandy Coronilla
Graphic by Maxwell Henderson
The Register

Chronic Toxicity of Arsenic:

- 2 to 4 weeks after ingestion ,Arsenic gets incorporated into hair, nails and skin.
- 4 weeks afterwards, localized in the bones.
- Garlic odour on breath, hyper brown pigmentation of the skin, the face or extremities(Rain drop pigmentation).
- Peripheral vascular disease resulting in Gangrene of feet known as “Black Foot Disease”.
- Nails become brittle with transverse whitish striations called as “Aldrich Mee’s Lines”.
- Chronic Nephritis, Cardiac failure.
- Tests:Reinsch Test
- Atomic absorption spectroscopy.
- NAA.

Treatment:

- Gastric lavage, Activated Charcoal/Magnesium sulphate, BAL, Dimercaprol, Pencillamine, DMSA(Di Mercapto Succinic Acid).
- Specific Therapy: Freshly prepared hydrated Ferric Oxide given which converts Arsenic to Ferric Arsenite.
- Sub-Acute: Pigmentation of skin and rashes convulsions, neuritis and liver with fatty degeneration resulting in jaundice, muscular weakness ending in paralysis.

Lead:

- It’s a heavy steel grey metal. The metal and all it’s salts are poisonous.
- The principal salts are :
- Lead Acetate-White crystals
- Lead Carbonate-White crystalline powder
- Lead Chromate-Bright yellow powder
- Lead Monoxide-pale brick red or pale orange mass
- Lead Tetroxide(Red Lead, Vermilion, Sindur)-Scarlet crystalline powder
- Lead Sulphide-least toxic.
- Lead is used in storage batteries, solders, paints, hair dyes, electric cable insulations, pottery, ceramic and petrol.

Action:

At cellular level it interferes with sulphydryl groups and in haem synthesis.

- FD: About 20 gms of Lead Acetate,40 gms Lead Carbonate
- FP:1 to 2 days.
- Treatment: Gastric lavage with 1%solution of Sodium or Magnesium Sulphate.
- BAL
- Penicillamine
- Peritoneal or hemo dialysis
- Symptomatic treatment.

- Chronic Lead Poisoning: called as Plumbism or Saturnism.
- Inhalation of dust, vapours leads to Lead Palsy(paralysis),
- Lead Encephalopathy:
- headache, insomnia, irritability, delirium, visual
- disturbances
- Lead Osteopathy: Deposition of Lead in the growing end of long bone
- Burtonian Line: Blue line in the gums due to deposit of Lead granules in the form of Lead Sulphide.
- Anemia
- Colic and constipation
- Nephritis

Copper:

- Copper as a metal is not poisonous. Copper compounds are powerful inhibitors of enzymes.
- Copper Sulphate –Blue Vitriol-occurs as blue crystals.
- Copper Subacetate-Verdigris-occurs in blueish green masses or powder.
- Copper is a normal constituent of the body. Copper content of the body is 150 mg.It's absorbed through lungs, mucous membrane and raw surfaces. It is excreted more by bowels than kidneys.

Copper

Acute Poisoning:

- Myalgia, abdominal pain, vomiting, diarrhea, acidosis, pancreatitis,
- Hemolysis, jaundice, renal failure, delirium, seizures and coma.
- Vomited matter will be blue in colour.

Chronic Poisoning:

Copper Sulphate spray used as insecticide causes “Vineyard Sprayer’s Lung Disease”, Characterized by histocytic granulomatous lung’. Liver damage is also common.

- Wilson’s Disease-An inherited disorder that causes too much Copper to accumulate in the organs
- Mutations link of a gene called ATP7B cause Wilson disease.These gene mutations prevent the body from removing extra Copper

Excess Copper stored in various tissues particularly in the Liver,Brain and Cornea of the eyes.

Symptoms consist of anemia ,green line on gums, peripheral Neuritis, degeneration and atrophy of muscles.

If untreated ,it may cause liver disease, CNS dysfunction and death.

- Chalcosis: Presence of Copper deposits in the tissues is called Chalcosis. Copper may be deposited in the Cornea resulting in a pigmented ring in the deeper layers.
- Chronic contact with swimming pool water containing algicidal Copper chemicals can cause green hair discolouration.
- Test: Ammonium Hydroxide gives a greenish –blue precipitate which is soluble in excess and forms a blue solution.

Treatment:

- Stomach wash using Potassium Ferro Cyanide converts Copper into Cupric Ferro Cyanide.
- Administration of egg white or milk orally helps in detoxifying Copper.
- Dimercaprol
- Hemodialysis.

PHOSPHOROUS:

Two main varieties are

- Yellow or White Phosphorous with garlicky odour. On exposure to air forms white fumes of Phosphorous Pentoxide and hence stored under water. It's highly combustible and ignites into flames at 34 degree centigrade. It's luminescence in dark is called "Phosphorescense".
- Red Phosphorous: Reddish, amorphous, odourless substance. It is insoluble and harmless.

- Uses: Red Phosphorous used in semi conductors, pyrotechnics, safety matches, smoke bombs in certain flame retardants.
- White or Yellow Phosphorous –Important ingredient in fertilisers, Vermin killers, insecticide, rodenticide, fireworks, gun powder, tracer bullets, smoke screens, air rescue flare, production of Phosphoric Acid, detergent, water treatment.
- Acute Phosphorous Poisoning:
- Mode of action: Phosphorous is a protoplasmic poison and is Hepatotoxic. Locally produces severe irritation of skin and mucosa.
- In large doses ,cause shock and cardio vascular collapse.

- Fulminate Poisoning: Massive dose of 1 to 2 gms .Peripheral vascular collapse and death occurs in 12 to 24 hours.
- Phossy Jaw or Glass Jaw: Due to long term inhalation of Phosphorous fumes ,there is necrosis and osteomylitis of the jaw (usually lower jaw) and occurs in place of an extracted caries tooth. This is called “Phossy Jaw or Glass Jaw.” Those who work in the manufacture of matches suffer from this disease.

Mercury:

- Quick Silver is a liquid metal, bright silvery appearance, volatile at room temperature. Occurs as Mercuric-intensely poisonous and Mercurous-less poisonous.
- Poisonous compounds:
- Mercuric Chloride
- Mercuric Sulphide(Cinnabar)
- Mercuric Cyanide
- Mercuric Nitrite
- Mercuric Sulphate
- Mercuric Oxide
- Mercurous Chloride(Calomel)
- Organic compounds of Mercury.

- Mercury gets absorbed by alveolar membranes rapidly converted into mercuric ions .
- CNS acts readily on the cerebellum.
- Mercury is a nephrotoxin produces tubular necrosis.
- FD: 1 to 2 gm of mercury cl .
- FP : 3 to 5 days.

Treatment:

- Milk, egg white
- Penicillamine
- BAL: – BAL and Pencillamine should not be used in combination.
- CA-EDTA should not be used as it is nephrotoxic with mercury.
- Urine must be kept alkaline;
- Haemodialysis.
- Renal dialysis.

Hydrargyrism:

Chronic poisoning of Mercury: : HydrargyrismThis occurs due to inhalation of mercury vapors.

- Chronic exposure produces gingivitis, stomatitis, salivation, tremors and neuropsychiatric changes.
- Danbury tremors: Begins in the hand, interspersed with jerky movements & is also called as “Glass blowers tremors”. These when it spreads to the lips, tongue, arms & legs called as “Hatters shake”.

- Tremors gradually become severe and interfere with all normal daily activities like shaving, holding a glass etc and the advance condition is called “Concussion mercurialis”.

- Mad hatter (Mercurial erythrism): cluster of psychiatric symptoms, depression, irritability, amnesia, delirium and hallucinations, maniac depressive psychosis.

Mercurialentis: Deposition of mercuric vapors on the anterior lens capsule of the eye.

Minimata Disease:Mercury Compound:

Mid 1950- Nervous degeneration – numbness in lip, hands and feet , victims developed slurred speech impaired vision.

Correlation of this strange and the presence of mercury in the diet of Japanese.

From 1932 to 1968 ,27 tons of mercury was dumped into Minimata bay.

Bacteria converted mercury to methyl mercury which was conc in fish.

Classification Of Poison

Systemic Poison

- 1) Cerebral
- a) CNS stimulants- eg. Amphetamine, Caffeine, Cyclic Anti Depressants
- b) CNS Depressants: Alcohols, General Anaesthetic,Opioid analgesics, Sedatives, Hypnotics.
- c) Deliriant: Datura,[8 D Rule],Atropa Belladona, Cannabis,Cocaine.

Systemic Poison

2) Spinal: Strychnus nux vomica[opisthotonos- Body arched backwards, emprosthotonus-Body arched forward, pleurosthotonus- Body arched sideways]

3) Cardio-Vascular: Oleander, Aconite, Quinine, Tobacco, Cyanide.

4) Asphyxiants: Carbon monoxide, Carbon dioxide, Hydrogen sulphide.

5) Peripheral: Curare, Conium.

Cyanide: Cardio-Vascular Poisoning:

- Hydro cyanic acid or Prussic acid is a colorless, volatile liquid possessing characteristic odour similar to that of bitter almonds. It's soluble in water, alcohol and ether. It is a powerful protoplasmic poison and prevents the tissues from utilizing oxygen of the blood by interfering with the action of an enzyme "Cytochrome".

- These contain a crystalline glycoside name as Amygdalin. With large doses, the symptoms usually appears within a few second. Face bloated, eyes glassy and prominent with dilated pupils. Finger nails are blue or purple. Respiration becomes slow and stertorous .Tonic or epileptic convulsions followed by paralysis, cyanosis, cold clammy skin, foam on mouth, relaxation of sphincters. Death occurs due to respiratory failure.

- Cyanide readily combines with haemoglobin of the blood to form cyanmethaemoglobin and the blood is bright red in colour.Most rapidly acting poison and hence used by terrorists to commit suicide
- Potassium Cyanide :Which is strongly alkaline contains Potassium Carbonate as impurity has a corrosive effect on the mouth.
- Cytochrome oxide+NaCN-Cytochrome oxidase cyanide.
- Na Nitrite+Hb-Methaemoglobin
- Methaemoglobin+NaCN-Cyan Methaemoglobin
- Cyan Methaemoglobin+Na Thiosulphate-Na Thiocyanate(Non-Toxic)

- Treatment for Cyanide poisoning:
- Amyl nitrite inhalation for 15 to 30 minutes.
- Sodium Thiosulphate 25 gms as 15% solution by slow iv over a period of 3 minutes is administered.It converts Cyanide into nontoxic Thiocyanate.
- Hydroxy Cobalamine given.
- Dicobalt EDTA acts by chelating Cyanide to form harmless compound and is excreted in urine.

- Test for Cyanide:
- Silver Nitrate Test:Forms white turbidity due to the formation of Silver Cyanide.
- Prussian Blue Test:To the distillate,add a few drops of 5% solution of NaOH followed by 5%
- solution of freshly prepared Ferrous Sulphate ,1 or 2 drops of 3% solution of
- Ferric Chloride.Shake the solution well,allow to stand for a few minutes,warm gently and acidify with dilute Hydro Chloric Acid.A precipitate of Prussian blue is formed due to the presence of Cyanide.

Asphyxiant:
Carbon Monoxide Poisoning:

- CO is a colourless, tasteless non irritative gas ,insoluble in water. It has 200 to 300 times greater affinity for haemoglobin than that of oxygen. It displaces oxygen from it's combination with haemoglobin and forms stable Carboxyhaemoglobin. It acts as a chemical asphyxiant and produces death due to anemic anoxia(absence of oxygen).It's eliminated through lungs. It's a potent cellular toxin. Effect of CO are simply those of suboxia(concentration of oxygen very low)Rapid death from respiratory arrest.

- Test: Kunkel’s Test: Tannic acid and blood, cherry red colour does not change while oxyhaemoglobin turns deep brown.
- Palladium Chloride test: COHb acts on Palladium Chloride and reduces it to white, shiny metallic Palladium.
- Spectroscopic examination show characteristic bands of Carboxy haemoglobin.

Cannabis Sativa: DeliriantPoison:

- Active principles of ganja is Cannabinol, Cannabidiol, Tetrahydro Cannabinol.
- Other names are Pot, grass, dope, weed, hash, mary jone, hasish.
- Delta 9 THC is most toxic.
- Flowering tops of the female plant is called Ganja.
- Under microscope:
- Cannabis may be identified by the presence of retort shaped,short,unicellular Cystolithic hairs.

FD: Ganja 8 gms

THC 30 mgm/ kg

FP: Several days

Treatment: Stomach wash or emesis

100 ml of 50%Glucose,2 mgm Naloxone and 100 mgm Thiamine as i.v.

5 to 10 mgm Diazepam if the patient is violent or aggressive Psycho Therapy.

- Bhang: Dried leaves and fruit shoots constitute Bhang.
- Charas or Hashish: Resin exuding from leaves and stems of the plant .Contains 25 to 40% of the active principle.
- Dark Viscous liquid obtained from hashish by repeated extraction is called Hashish Oil.
- Chronic poisoning leads to degeneration of the CNS System and insanity.

Opium: CNS Depressant:

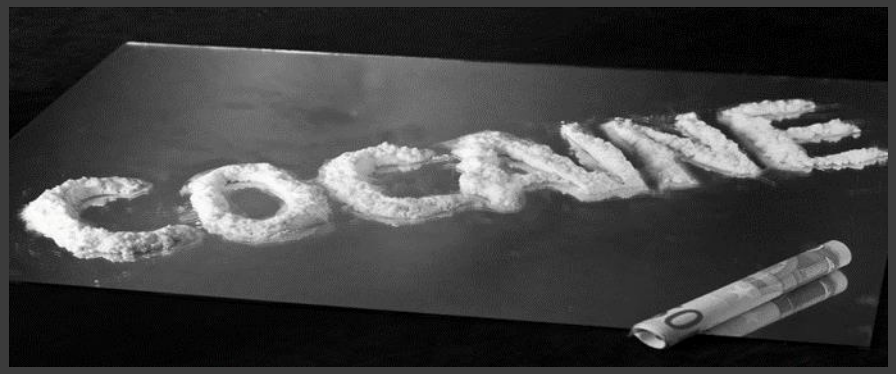
- Is a somniferous poison-induces sleep.
- Alkaloids present are
- Morphine
- Codeine
- Thebaine
- Papaverine
- Narcotine.
- Naturally occurring Opium and the derivatives are called Opiates
- Example are
- Diacetyl Morphine(Heroin)
- Buprenorphine
- Pentazocine.

- Pure synthetic analogues are called as Opioids.
- They are: Pethidine(Meperidine)
- Methadone
- Tramadol
- Loperamide
- There are 3 stages of Opium toxicity:
- Stage of excitement
- Stage of Stupor
- Stage of Narcosis

- Treatment: Airways to be cleared
- Cardio vascular support and monitoring
- Naloxone is the specific antidote for Opium derivatives
- Correct electrolytic imbalance
- Antibiotics to overcome respiratory infections
- Supportive measures
- Psychiatric Counselling
- Periodic evaluation to prevent addiction.

Cocaine:

- Cocaine: Is an Alkaloid obtained from the leaves of Erythroxylon Coca. Cocaine crystals are colourless, odourless, bitter in taste, causes numbness of the tongue and mucous membrane. It's known as Coke, snow, Cadillac or white lady. CNS Stimulant followed by depression. Tongue and teeth are black in colour.
- Magnan's Symptom or Cocaine Bugs: Is characteristic in which there is a feeling as if grains of sand are lying under the skin or some small insects are creeping on the skin giving rise to itching sensation(Tactile Hallucination, Formication) leading to irregular scratches and ulcers.
- Treatment: Gastric lavage with activated charcoal, tannic acid
- Amyl Nitrite is a antidote-given by inhalation
- Airway and Circulatory stabilization
- Thiamine 100 mg i.v.
- Naloxone Hydrochloride 2 mg i.v.
- Symptomatic Treatment.


COCAINE

Miscellanious Poisons

- WHO defines food poisoning as “diseases usually either infectious or toxic in nature, caused by agents that enter the body through the ingestion of food”

Causes: toxins, i. Poisoning due to Bacteria and toxins eg. Salmonella,Staphylococcal
ii. Poisons of vegetable origin: poisonous mushrooms, rye, oats, poisonous berries such as Atropa belladona, solanine. iii. Poisons of animal origin: poisonous fish eg. Toad fish, cat fish, lion fish, dragon fish, balloon fish, puffer fish, sun fish, shell fish, stone fish, scorpian fish , box jelly fish. 2. MUSSEL

4. Chemical: intentionally added such as flavouring agents in processed food, colouring agent, preservatives to accidentally added such as insecticides.3. Products of food processing eg. Smoking of fleshy foods.4. Radionuclides.

Eg. E. coli invade intestinal mucosa and elaborate enterotoxin.

Botulism:

CL Botulinum does not grow in body but produces neurotoxin. It is present in soil, dust, intestinal tract of animals and enters food as sperms, especially fruits and vegetables.

Virus;

Noro-virus and Rota-virus commonly cause food poisoning.

Ptomaines: Theses are alkaloidal bodies which are formed as a result of bacterial decomposition of protein. When they are formed in dead tissues they are known as Cadaveric alkaloids.

- Food poisoning: a.Lathyrus sativus(kesari dhal) causes paralysis. Active neurotoxic principle is B(N) oxalyl amino-alanine (BOAA). The continued use of L-Sativus produces Neurolathyrasm.

Depressants

- Medications that slow brain activity, which makes them useful for treating anxiety and sleep problems.

- Barbiturates
- :Phenobarbitone
- ,Amylobarbitone
- ,Secobarbitone
- ,Butabarbitone
- ,Pentabarbitone
- ,Diphenyl Hydantoin.

- Benzodiazepines:
- alprazolam ,
- chlorodiazepoxide,
- diazepam Nitrazepam,
- lorazepam , Oxazepam

- Marilyn Mandro-Actress died of

Michael Jackson

- Death in 2009- over dosage of anaesthetic Propofol
- Conrad murray –His Physician was accused of involuntary manslaughter .
- 4 year in jail- 2 years let out early for good behaviour and due to prison over crowding.

Anthony and Cleopatra

- Cleopatra Act V and scene II

Image of suicide of Cleopatra by asp (Egyptian cobra)

With thy sharp teeth this knot intrinsicate

of life at once untie; poor venous fool

Be angry and dispatch.

2010-German historian-Christoph Schaefer & toxicologist Dietrich Mebs –Cleopatra actually used a mixture of hemlock(Conium), wolfsbane(Aconitum) and opium to end her life.

ABRUS PRECATORIUS (JEQUIRITY,INDIAN LIQUORICE,GUMCHI OR RATI).

All parts of the plant are poisonous, the seeds are commonly used as poison.

The active principle is Abrin, a toxalbumin –(its actions resemble those of viperine snake bite)and Precatorin.

It is also used as Arrow poison.

Symptoms:Haemorrhagic gastritis and Cardiac manifestations.

Abrus Precatorious:

FD:60 to 120 mg

Treatment:Decontamination and supportive measures.

Accidental poisoning common in children as they are attracted towards the colour.

Sui Poison:Seeds are crushed and added with pastes of arsenic,lead,calotropis and made into injecting needles and used to kill the enemy by blowing using a bamboo stick.Also used as a cattle poison.

Strychnos Nux Vomica:Spinal Poison:

The ripe fruit contain Nux Vomica seeds which are poisonous.They are ash grey in colour,tough,having no odour but possessing a bitter taste.They yield two principal alkaloids:

Strychnine

Brucine

Besides the seeds contain to a small extent a glucoside named Loganin.

Strychnine:C21H22O:

This crystallises in colourless,inodorous,rhombic prisms having a intensely bitter taste.

- Strychnine: Is soluble in alcohol,benzene,chloroform but very sparingly soluble in water or ether.It’s used to kill stray,unclaimed dogs,rats,mice and other vermin and forms the chief ingredient of several vermin killers.
- Brucine:C23H26O4N2:This occurs in colourless,prismatic crystals with an intensely bitter taste.

- Brucine:Is slightly soluble in cold water but more in boiling water and freely in alcohol,chloroform and amyl alcohol but not in ether.It’s toxic effect is one tenth of that of Strychnine.
- Symptoms:During swallowing,bitter taste in throat,choking sensation.At first,clonic convulsions occur but eventually becomes tonic.Face cyanosed,pupils dilated.

- Opisthotonos:Body arched backward,the patient resting on his heels and occiput.
- Emprosthotonos:Spasm of the abdominal muscles may bend the body forward.
- Pleurosthotonos:Body may be flexed to the side.
- Death may occur from asphyxia or any subsequent attack or from exhaustion during intervals as a result of painful spasms.
- Strychnine poisoning has to be diagnosed from Tetanus.

- Treatment:Universal antidote
- Short acting Barbiturates or Diazepam to control convulsions
- Amyl Nitrite inhalation
- Artificial respiration

- Test for Strychnine:
- Colour Test:
- Residue in Sulphuric acid+Small particle of Potassium Dichromate drawn through the mixture with the aid of glass rod,a play of colours will follow(blue to dark violet to reddish purple,red or orange finally to yellow.)

- Physiological Test:Residue injected into dorsal lymph sac of a frog,tetanic convulsions occurs in a few minutes.

Forensic Significance:

- Homicide is common
- Accidental common in children
- Suicidal rare
- Used as an aphrodisiac
- Cattle poison
- Arrow poison.

Oleander:Nerium Odorum:White Oleander:

All parts of the plant except root are poisonous in nature.

Cardiac Glycoside:Present are Oleandroside(Oleandrin) and Nerioside(Nerin)

Symptons:Abdominal pain,vomiting,profuse frothy salivation,pupils dilated,lock-jaw,drowsiness,coma,respiratory paralysis and death occurs.

.
Teatment: rStomach wash
symptomatic.
Used mainly as suicidal poison.
Homicide rare.Cattle poison.

Cerebra Thevetia:Yellow Oleander:

All parts of the plants are poisonous in nature.
Active Principles:Thevetin,Thevetoxin,Nerifolin,Cerberin,Peruvoside,Ruvoside.All are Cardiac Glycoside.
Symptoms:Ingestion causes burning pain in the mouth,dryness of throat,tingling,vomiting,diarrhoea,dilated pupil,muscular ataxia,pulse rapid weak and irregular.Heart block,collapse and death from peripheral respiratory failure.
Treatment:Stomach wash
ECG Monitoring
IV Sodium molar solution and 5% Dextrose to combat shock.
Atropine 1 mg,Adrenaline 0.2ml and IV

Oleander:

Treatment:Stomach wash
Sodium molar Lactate transfusion with glucose and 1 mg Atropine,2 ml Adrenaline and 2 mg Noradrenaline is beneficial.
Symptomatic treatment.
Circumstances of Poisoning:Commonly used as a suicidal poison.
Also used as an abortificient and as a cattle poison.

Cleistanthus Collinus:Oduvan:

Oduvan: Cleistanthus Collinus:

Naidu and his associates have isolated a glucoside called Oduvin,$C_{22}H_{34}O_{12}$ to which the plant owes it's poisonous properties.Oduvin is a yellowish-white crystalline substance sparingly soluble in water or ether but freely soluble in alcohol and chloroform.

Symptoms:Nausea,violent vomiting,abdominal pain,diarrhoea,dilated pupils,cramps in the limbs,collapse and death.

Chemical Analysis:Oduvan:
Extraction by Stas-Otto Process.Filtrate rendered
alkaline by the addition of Sodium Carbonate and extracted with ether-chloroform mixture.Extract is evaporated to dryness.The residue contains Oduvin.
Residue+Con Sulphuric Acid:Blue colour turning to mauve.
Residue with Con Nitric Acid:Green colour becoming Brick Red.

Oduvan:

Residue when injected under the skin of frog causes paralysis and death.
Poison used for homicide and suicide purposes.
Leaves as paste and decoction :used for criminal abortion and as cattle poison.
Bark as fish poison.

SEMICARPUS ANACARDIUM (Marking Nut)

- Marking Nut – Its juice is used by dhobis
- Active principles – Semecarpol Bhilawanol
- Nut juice on the skin- vesicates – black blisters containing acrid serum which causes an eruption
- Treatment:Supportive measures.
- Juice used as an abortifacient and for producing artificial bruise,Conjunctivitis.

MADAR -CALOTROPIS FLOWERS

- There are two varieties

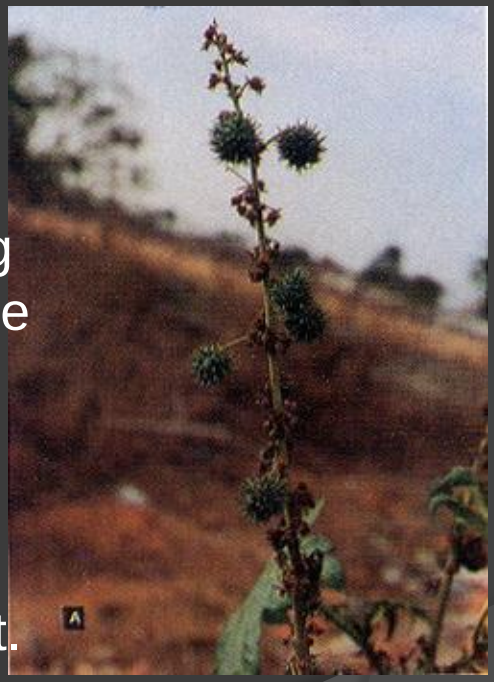
i) Calotropis gigantea – Purple flowers

ii) Calotropis procera – White flowers

- The three active principles
- i) Uscharin
- ii) Calotoxin&iii)Calactin
- Some say that it contains Calotropin,Calotoxin and Uscharin.

RICINUS COMMUNIS (CASTOR PLANT)

The raw seed produce sever toxic effects.
The Active principle called Ricin –Tox albumin or Phytotoxin is a toxic protein.
It causes agglutination and lysis of red cells.
It is antigenic in nature and is capable of producing a specific antitoxin (antibody) when injected into the body.
Symptoms:vomiting,diarrhoea,abdominal pain,hypotension,dehydration,fever with chills,hemolysis and renal failure.
Castor oil is used as a purgative and as a lubricant.
Fatal dose:1mg/kg,5 to 10 seeds.
Treatment:Gastric lavage and activated charcoal.
Correct fluid and electrolyte imbalance.
Supportive measures.



CAPSICUM (Chillies)

- Capsicum fruits are powdered and
- Universally employed In India as a
- Condiment, the condiment being known as red pepper or Lal mirch.Chilly seeds are small,yellow,rounded,smooth,pungent in odour and taste.To be differentiated from Datura seeds which are large,brown,reniform in shape.
- The active principle – Capsaicin & Capsicin
- Applied to skin causes irritation
- and vessication.
- To the eyes – burning and lachrymation.
- Thieves spray chilly powder to avoid detection by police dogs.
- Treatment:Wash with vinegar or ice cold water.
- In case of ingestion,give ice cubes to suck or sips of ice cold water.
- Supportive measures.

(iii) Deliriants:

A temporary state of mental confusion and fluctuating consciousness

e.g :Datura, Cannabis, Atropa belladonna.

Datura:

- Datura Alba,a white flowered plant and Datura Niger, a black or rather deep purple flowered plant.
- All parts of these plants are poisonous but the seeds and fruits are considered to be most toxic. They yield active principles:
- Hyoscine
- Hyoscyamine
- Traces of Atropine.
- Datura is a stupefying poison.

Deliriant Poison:Datura:

8 D Rule:

Dryness of the mouth

Dryness of the throat

Dilated pupil

Diplopia(Double Vision)

Dryness of the skin

Dyspnoea(Difficulty in breathing)

Dysphagia(Difficulty in swallowing)

Delirium.

Death occurs from paralysis of heart or respiration.

Treatment for Datura:

- Emetics and Stomach wash with a weak
- solution of Potassium Permanganate or a solution of Tannic Acid.
- Physostigmine injection 1 mg
- Subcutaneous injection of Pilocarpine Nitrate 5 mg repeated every 2 hours
- Delirium controlled with Barbiturates.

Atropa Belladona:(Deadly Night Shade)

All parts of the plant viz the leaves,berries and root are poisonous.

They contain 3 alkaloids:

Atropine

Hyoscyamine

Belladonine.

Atropine:C17H23O3N is colourless,odourless prismatic needles and has a bitter taste.Sparingly soluble in water but freely soluble in ether,chloroform and alcohol.

Symptoms for Atropine :Closely resemble that of Datura.

FD:Variable

.FP:3 to 6 hours.

Physiological Test:Residue dissolved in water containing few drops of Sulphuric acid and 1 or 2 drops instilled into cat's eye.In a few minutes ,the pupil begins to dilate.

Test:Vitali's Test

Gerrard's Test

Treatment for Atropa Belladona:Same as for Datura poisoning.
Homicidal cases are rare.
Suicide cases are common.
Atropine eliminated chiefly by kidneys in an unchanged condition.

Snake:

Snake venom is saliva of the snake.

- 1) Elapids-Neurotoxic – Fangs are 4-6mm[eg.King Cobra, Kraits, Mambas]
- 2) Vipers –Vasculotoxic – Fangs are 12-15mm
- 3) Sea Snakes- Myotoxic- Fangs 2-4 mm

Cobra venom is faint transparent yellow and is slightly viscous.

- Russels viper: Venom is white or yellow in colour.
- Snake venom are proteolytic, hemolytic, cytolytic and are neurotoxic and cardiotoxic.
- Antivenin used for treatment.

Scorpion venom:

- Is a clear colourless containing toxalbumin can be classified either as hemolytic or neurotoxic also had direct action on myocardium.
- Treatment 1% $KMnO_4$ or borax { incise the wound and use the above}
- Local anaesthesia
- 2% Novocaine or 5% Cocaine is injected to lessen the pain Antivenin is used.
- Calcium gluconate [IV] and barbiturates.
- Bees venom :contains Dopamine, Histamine, Neurotoxin and toxic peptides.
- Wasp venom: contains in addition Serotonin.
- Treatment 1. Ligature the site to tincture of iodine to be applied.
- Adrenaline injection to be given Calcium as IV.
- Ant venom :contains Alkaloids and proteins.
- Spider venom :are neurotoxic and cytotoxic.

Food Poisoning

- 1) Infection type: it is gastroenteritis due to mainly Salmonella group.(Bacteria)
- 2) Toxin type: Presence of enterotoxin (affecting intestine) formed by Staphylococcus- source tinned foods.
- 3) Botulism: Clostridium botulinum mulitiplies in food and produce exotoxin(secreted by the bacteria)

Action of Poison

Local – Localised to the site of application
(e.g acids, dilatation of pupil with Atropine)

Remote – May occur at sites farther away from the site of contact.

a) Specific- like digitalis on heart, strychnine on spinal cord.
b) Non- specific- shock with corrosives.

Action of Poison

- Local and remote action.

  Action at the local site of contact and also evokes a remote action after its absorption.

  E.g. Snake venom

- General action:

  Not restricted to some organs and there is a generalized involvement of the whole body. E.g. Arsenic, Mercury etc.

Where are the best places to collect samples?

- Where the chemical enters
- Where the chemical concentrates
- Along the route of elimination

What are the clues?

- Ingested toxins show up in the stomach, intestines or liver
- Inhaled gases are concentrated in the lungs
- Toxins that are injected intramuscularly concentrate themselves around the injection site

Best Tissues to Sample for Poisons

- Blood – most useful tool…will show chemical and its metabolites…blood levels show what was going on in the body at the time of death
- Urine – easy to obtain…high concentrations…kidneys are along the elimination route
- Stomach contents – digestion stops at the moment of death

Best Tissues to Sample for Poisons

- Liver – the toxin sponge of your body… can reflect levels of toxins that even the blood may not reveal
- Vitreous Humor – eyeball fluid…very slow to decay so will retain toxins even longer than most other organs
- Hair – chemicals take about 5 days to show up in the core of a hair shaft…natures timeline
- Insects – toxins can accumulate (bioaccumulation) in the bodies of insects that feed off of decomposed bodies.

CEREBRAL POISON: INEBRIANT POISON:

Alcohol(Ethyl Alcohol)

- The most commonly abused drug
- Blood-alcohol levels are directly proportional to the degree of intoxication

and are expressed in grams percent (# of grams of alcohol/100 ml blood)

Acts on the CNS favoring the brain

Blood carries alcohol to all cells of your body but mostly to the watery areas of your body.

Addiction to Alcohol is called Alcoholism.Chronic users will suffer from withdrawal symptoms if they stop intaking alcohol.

Alcohol Absorption

- Alcohol is absorbed through the stomach and the small intestines
- The rate of absorption depends on:
  - Total time taken to consume
  - Alcoholic content
  - Amount consumed
  - Body weight
  - Stomach contents

- Inebriant poisons produce intoxication.The term Alcohol refers to Ethyl Alcohol.It’s a transparent,colourless,volatile liquid having a spirituous odour and a burning taste.
- Absolute Alcohol contains 99.95% alcohol.
- Rectified Spirit contains 90% alcohol.
- Industrial Methylated Spirit or Denatured Alcohol is a mixture consisting of Alcohol
- 95% and 5% of Wood Naphtha.

- Ethanol is produced by the fermentation of Sugar by Yeast.
- Proof Spirit:Is one in which at 10.5`C weighs 12/13 part of an equal measure of distilled water.
- Weaker Spirits are termed “Under Proof” and Stronger Spirits “Over Proof”.
- Proof is defined as twice the percentage of the alcohol content of the drink.

- Concentration:% of alcohol by volume:
- Vodka 60 to 65%
- Rum ,Liquors:50 to 60%
- Whisky,Gin,Brandy:40 to 45%
- Port,Sherry:20%
- Wine,Champagne:10 to 15%
- Beers:4 to 8 %
- Metabolism;In the Liver,alcohol is oxidised to Acetaldehyde by Alcohol Dehydrogenase(ADH) and further oxidised to Acetic Acid and Water by Aldehyde Dehydrogenase(ALDH).
- Symptoms:
- Stage of excitement,Stage of in-coordination,Stage of coma.
- Prolonged coma may cause irreversible hypoxic brain damage and death.
- Fatal Dose:150 to 250 ml of Absolute Alcohol consumed in 1 hour.
- Fatal Period:12 to 24 hours.
- Treatment:One litre of Normal Saline in 10% Glucose,100 mg Thiamine and 15 units of Insulin are useful.If coma deepens,nerve stimulants should be used.
- Artificial respiration
- Hemo dialysis or Peritoneal dialysis.

Alcohol Elimination

- 2 mechanisms for elimination:
- Oxidation
- Takes place in the liver
- Acetaldehyde
- Acetic acid

(goes all over body)

- CO 2 + H 2 O

Excretion

Breath

Urine

Perspiration

Physiological effects of alcohol:

Blood alcohol concentration	Effects
0 to 50 mg %	No significant effect or mild euphoria.
50 to 100 mg %	Decreased inhibitions, increased self-confidence, decreased attention span, slurring of speech, mild incoordination, alteration of judgement, nystagmus.(Rapid involuntary movements of the eyes).
100 to 150 mg %	Some mental confusion, emotional instability, loss of critical judgement, ataxia(loss of control of bodily movements), impaired memory, sleepiness, slowed reaction time.
150 to 300 mg %	Loss of muscular coordination, staggering gait, marked mental confusion, drowsiness, exaggeration of emotions, dizziness, decreased pain response, disorientation; thickened speech.
300 to 400 mg %	Stupor, marked incoordination, marked decrease in responses to stimuli, possibly coma.
400 mg % & above	Anaesthesia, depression of responses, respiratory failure, deep coma, death.

- Kozelka and Hine test for Blood Alcohol determination
- Widmark formula used to measure alcohol intoxication
- Breath Analyser:Is based on Henry's Law.Concentration of alcohol in 1 ml of blood is equal to the concentration of alcohol in 2100 ml of alveolar blood.
- For medico legal purposes,the most desirable is Gas Chromatography in which specificity is ascertained.
- Test: 1 ml of sample+1 ml Acetic Acid+1 drop of Sulphuric Acid
- and heat gently for 1 minute.Strong fruity odour is positive.

- Wernick Encephalopathy:Brain damage caused by lack of Vitamin B1.Confusion,ataxia and ocular abnormalities seen.

- Korsakoff's Psychosis:Memory deficits,confusion and behavioral changes observed.

- Gastritis,pancreatitis,fatty degeration of Liver,Cirrhosis are complications of alcoholism.

Treatment for Alcohol Poisoning

- Disulfiram 250mg single daily dose. It inhibits alcohol dehydrogenase.
- Antabuse: {Tetraethythiuram disulphide} inhibits the bio-transformation of ethanol beyond Acetaldehyde.
- Citrate Calcium Carbimide 50mg once day.
- Chlorpromazine: 25 to 50mg, every 4 to 6 hours is useful.

Methanol Poisoning:

- Wood Alcohol: It is a colourless volatile liquid with a burning taste.
- Symptoms: Nausea, vomiting, abdominal cramps, head ache, neck stiffness, depressed cardiac action, photophobia
- Blurred or misty vision, complete blindness due to Optic Neuritis.
- Methanol is oxidized to Formaldehyde in the Liver which is 33 times more toxic than Methanol.
- Formaldehyde is further oxidized to Formic Acid which is responsible for metabolic Acidosis.

Treatment:

- Ethanol as antidote:10% solution in 500 ml infusion.
- Intra muscular Paraldehyde given for convulsions.
- Morphine to combat pain
- IV Saline-Glucose given
- Gastric Lavage using 5% bicarbonate solution to combat acidosis
- Eyes kept covered to protect from light.

VISCERA BOTTLES PACKED & SEALED

Poisons –Constriction of pupil

- Opium
- Organo phosphorous compounds
- Tobacco
- Carbolic acid
- Curare
- Anesthetic
- Alcohol(stage of coma)

Poisons –Dilatation of pupil

- Cyanide
- Datura
- Corrosives except carbolic acid
- Alcohol (initial stages)
- Digitalis
- Cannabis
- Atropa Belladona
- Strychnine.

Poisons with characteristic smell

Cyanide- Bitter almond

hPosphorus-Garlicky.

- Phenol- Phenolic.
- Alcohol, Nitrites, Chloroform-sweet or fruity
- Opium – Raw flesh.
- OP, Phosphorous, Arsenic- garlicky.
- Hydrogen Sulphide, Mercaptans, Disulfiram-rotten egg smell.
- Zinc Phosphide-fishy or musty odour.

Poisons leading to characteristic manifestation in Stomach.

- Sulphuric Acid – Black perforation
- Nitric acid – Yellow.
- Phenol – Leathery.
- Copper Sulphate – bluish green contents.
- Oxalic acid-cloudy deposition of calcium oxalate.
- Iodine- mucous membrane brown-contents blue.

Poisons used as arrow poison

- Abrus precatorius.
- Aconite.
- Strychnine.
- Croton.
- Snake venom.
- Scorpion venom.
- Curare.
- Calotropis.

Poisons causing convulsion

- Cyanide
- Strychnine.
- OP
- Arsenic.
- Aconite.
- Cobra snake.
- Opium.
- Lead.

Poisons causing blisters.

- Barbiturates.
- CO.
- Arsenic.
- Iodine.
- Viper snake.
- Croton oil.
- Marking nut juice.
- Tri cyclic antidepressants.

Poisons causing excessive salivation.

- OP
- Anesthetics.
- Tobacco.
- Arsenic.
- Copper.
- Mineral Acids.

Types of antidotes.

- Physical or Mechanical.
- Chemical.
- Pharmacological or Physiological.
- Universal.

Physical or Mechanical

- Physically hinder the absorption of the poison.

a) Demulcent: these substance form an oily layer on the gastric membrane.

e.g oil, butter, ghee, milk, white of egg.

b) Bulky foods: these substances engulf the poison and make it non available for causing effects.

e.g. banana, flour suspension boiled rice or mashed potato.

Physical or Mechanical

- (c) Activated charcoal- it adsorbs the poison .

e.g. Metals, alkaloids, glycosides and thereby makes it non-available for absorption.

Chemical antidotes.

- These substances chemically react with the poison and thereby alter its chemical nature.
- (a) certain substances react with poison and render it inert.

  e.g. calcium oxide or magnesium oxide for acid poisoning

- (b) Tannin –forms a complex with metals alkaloids and glycosides.
- (c) KMno4 (1 in 1000)- oxidizes the poison.

Pharmacological or Physiological

- (i)Have a pharmacological opposite action as compared to poison.
- e.g., atropine for OP.
- (ii) Chelating agents (Greek –chele =crab or claw)

used in metal poisoning.

e.g. BAL- arsenic poisoning.

EDTA-ethylene diamine tetra acetic acid, used against lead poisoning.

Universal Antidote.

- It can be used in all cases of poisoning especially when the nature of poison is not known.[ATM]

Activated Charcoal	2 parts	Adsorbs poison
Magnesium oxide	1 part	Neutralises acids
Tanin	1 part	Ppt metals ,alkaloids and glucosides

Techniques

- Specimen extracted
- Identification of substance

Screening procedures

- Gas chromatography
- Thin layer chromatography

- Confirmation :
  - Gas chromatography
  - UV Spectrophotometry
  - IR Spectroscopy
  - Mass spectroscopy
  - GC-MS
  - Ion Detector
  - AASP
  - FTIR

- Medico legal aspects of Poisons: Important
- Sections:176,177,193,201,202,284,299,300,304A,309,320,324,
- 326 & 328 IPC & sections 39,40 &175 Cr.P.C deals with offences
- relating to administration of poisonous substances, section 270 & 278 IPC deal with adulterated food & drugs.

INTERESTING CASES:

- Case history Hanging:
- A 20 year woman was found hanging at her residence by her husband. On visceral analysis, phenobarbitone was detected. IO was informed. On interrogation, it was found that the husband suspected the character of his wife & administered phenobarbitone. When she was unconscious he hung her.

- Food Poisoning:
- A male aged about 30 was having a concubine .So the wife tried to kill him by administering gammaxine in curd rice. After eating the curd rice, husband vomited and became unconscious and hospitalised. His vomit, gastric aspirate and curd rice were sent for chemical analyses. Gammaxine was detected.

Interesting Cases:

- Unknown poison:
- A businessman from Andhra was travelling to Chennai by bus, was offered Frooti- sealed pack by his friendly co-passenger. After everyone got down from the bus, the conductor found him unconscious and he was hospitalised. When the frooti contents were analysed, Diazepam was detected. By using a fine needle the accused had injected Diazepam from the side which was invisible.
- The businessman had lost nearly 10 sovereigns of gold jewels.

- Train Travel:
- Four passengers travelling by train were offered food by 2 co-passengers who were husband and wife. After eating, they became unconscious. Money, jewellery were taken away. Datura, a stupefying poison detected during analysis.

- Unknown Poison:

Green paste like substance was found in the stomach of a woman. Oduvan detected.

- Illegal abortion:

Unknown death of a female during illegal abortion along with viscera, a stick used for abortion was also received at the lab. Oleander was detected.

- Anaesthetic death:

A young lady who was admitted for delivery died on the operation table itself. Viscera and blood were analysed and detected Ketamine by TLC and instrumentation method.

- LTTE Case:

Several ampules seized from LTTE militants were sent for chemical analyses. Detected potassium cyanide in all the ampules received. Ampules contained about 1.5 gms of KCN.

- T.I. CYCLES Case:

Cyanide, which should have been dumped 500 kms inside sea level, was dumped in a pond. The water was consumed by 10 cows in the morning and they died immediately. Viscera was analysed. Detected cyanide.

Case Study

- THE STAFF NURSE ADMINISTERED THE MEDICINE AND SOON AFTER THE LADY DEVELOPED CONVULSIONS AND DIED. THE DOCTOR INFERRED THE DEATH DUE TO TETANUS. YASODHA'S PARENTS SUSPECTED THE DEATH

- AND THE CASE WAS UNDER INVESTIGATION. THE CHEMICAL ANALYSIS PROVED THE PRESENCE OF STRYCHNINE. FURTHER INVESTIGATION PROVED THE HUSBAND TO BE GUILTY OF THE MURDER.

Thank you