POISON

- A poison is any substance that is harmful or destructive to a biological (living) system.
- Poisons may be defined as "Any substance which when ingested, inhaled or absorbed or when applied to, injected into, developed within the body by its chemical action, may cause damage to structure or disturbance of function".
- A poison derived from a biological source is conventionally called as a toxin.
- Forms solid, liquid or gas which when introduced into the living body results in ill effects or death.
- Include corrosive substances, mutagens, carcinogens, teratogens (birth defects or congenital disorders) and harmful pollutants etc.
- A poison is a small dose is medicine and medicine in a large dose is a poison (Taylor, 1859).





The ideal poison characteristics:

The ideal poison characteristics include it as

- ➤ Colourless,
- ➤ Tasteless,
- Soluble,
- Exotic,
- ➤ Undetectable,
- Low Dose Lethality,
- Easily Obtained,
- ➤ Delayed Onset Of Action And Decompose After Death,
- Chemically Stable And Found In The Burial Environment

Classification of Poisons - Based on source

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Natural

Plants, animals



Synthetic (Chemical)





Plants – phytotoxins, they are present in leaves, flower (alkaloids, terpenes, and especially phenolics,).





Animals – Zootoxins - poisonous animals like snakes, insects, amphibians some fish like puffer fish etc.- self-defense when

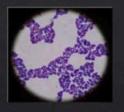


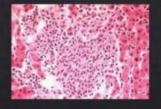




MICROBIAL SOURCES OF POISONS OR TOXINS

 Bacteria (Staphylococcus aureus, Salmonella, Clostridium perfringens, Campylobacter, Listeria monocytogenes, Vibrio parahaemolyticus, Bacillus cereus).







Blue green algae (Anabaena and Microcystis), dinoflagellates (Shellfish poisoning - paralytic, neurotoxic
and amnesic shellfish poisoning), golden brown algae (Azaspiracid toxins).







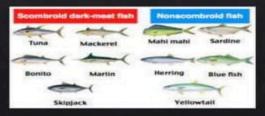
Fungi (Aspergillus) etc.

Four main types of poisoning

Ciguatera fish poisoning (Ciguatera poisoning is a form of food poisoning caused by eating warm water ocean fish that have ciguatera poison (toxin). The toxin is produced by a small organism called a dinoflagellate, which attaches to algae in warm ocean water reef areas. Ex. Gymnodinium and ceratium)



Scombroid fish poisoning (histamine poisoning) - Scombridae family - includes tuna, mackerel (If fish are caught in warm areas and are not refrigerated properly, a chemical called histidine, that exists naturally in man fish, can break down to histamine which causes symptoms within a few hours of eating the fish.)



Shellfish poisoning (Some organisms present in seawater and ingested by shellfish may produce a toxin. algal blooms or 'red tides').

Paralytic Shellfish poisoning (saxitoxin)



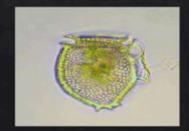
Amnesic shellfish poisoning (caused by consumption of shellfish that contain the marine biotoxin called domoic acid.)



Neurotoxic Shellfish poisoning (brevetoxins)



Diarrhetic shellfish poisoning (Dinophysis)



Rudderfish (Centrolophus spp.) poisoing/Escolar diarrhea (diarrhoea)

(This is caused by eating fish belonging to the escolar and oil fish groups. These fish have a high wax ester (oil) content. In humans, these wax esters cannot be digested and may accumulate in the bowel causing oily diarrhea).



Mineral source includes various metals and non-metal elements and their salts and compounds etc.

- Heavy metals such as mercury (Hg), Manganese (Mn), Lead (Pb),
 Cadmium (Cd), Nickel (Ni) and Arsenic (As) and their compounds are harmful to fish.
- The heavy metals and non-metals damage the vital organ by interacting with various enzymes and accumulated in the muscle of fish which are transferred to higher fish eating animals.

Classification of Poisons- Mode of action

1) Corrosives

- Inorganic acids (hydrochloric acid, sulfuric acid)
- Organic acids (oxalic acid, carbolic acid, acetic acid, salicylic acid),
- Vegetable oils (hydrocyanic)
- Alkalies (carbamates of sodium and potassium, caustic soda, caustic potash)

II) Irritants

Inorganic having metallic (arsenic, antimony, copper, lead, mercury, zinc etc.)
 or non- metallic (phosphorous, chlorine, iodine, boron etc.

III) Neurotoxin

- Poison- have a cerebral or spinal effect
- Pesticides, plant extracts or some other chemicals that affect the brain

IV) Cardiovascular

Poison - Affect blood, heart, blood vessels. Eg. Anticoagulants, Cardiotoxic and Asphyxiant poison like Oleander, Nicotine etc.

V) Respiratory depressants

Which comprise of poisonous gases like carbon monooxide (CO), coal gas, excess carbon dioxide (CO2), ammonia, hydrogen sulfide in water etc.

VI) Miscellaneous

Poison go into the water bodies by surface runoff and these poison include drugs and antibiotics used in higher animals as well as in fishes- at high concentrations Further on the basis of mode of action, the poison are divide into the ones having Local effect: Poison that affects the local tissue or organ on which it contacts like irritation of the skin by corrosives or by other chemicals on eyes

Systemic effect: Poison that affects one or more organ system by circulating through the blood. Eg. Different chemicals affect the circulatory system, nervous system of fish etc.

Combined effect: Poison have both local and systemic effects Eg. Carbolic and Oxalic acids, Phosphorous etc.

Based on the relative toxicity of poison:

The poison can be classified into

- Extremely toxic, which can be fatal to animals at a very low dosage (in microorganism),
- Highly toxic (produce toxicity at 1 mg to 50 mg)
- · Moderately toxic (toxic at 50-500mg) and
- Non-toxic (produce toxicity at very high toxic dose(more than 15 g/kg) Radiation from different sources are also defined as poisons
- The relations can be from manmade or natural sources and upon contact with the living organisms, they changed the DNA base paring which results in the faulty protein, cancer and ultimately death
- Common examples of radiations are X rays, cosmic rays, radioisotopes etc.

CLASSIFICATION OF POISON-Based on their toxic effects in the body as:

- ▶Poisons which cause death by anoxia
- ➤Poisons which make haemoglobin incapable of transporting oxygen
 - e.g. Carbon monoxide, nitrites
- ➤ Poisons which desroy haemopoitic organs
 - e.g. Radioactive substances
- Poisons which damage protoplasm or parenchyma. These poisons produce local irritation and after absorption cause damage to the cells and Capillaries
 - e.g. Phosphorus and carbon tetrachloride
- ➤ Poisons which affect the nerve cells and fibres
 - e.g. Hypnotics, Narcotics, Anesthetics, Alcohol, some Alkaloids and Glycosides

Based on their chemical and physical nature as

- Organic poisons
- Inorganic poisons
- Gaseous poisons
- Nitrogenous
- · Non-nitrogenous organic poisons etc.

Based on their behaviour during separation procedures as

- Volatile poisons
- Non-volatile organic poisons isolated by solvent extraction
- Metallic poisons and
- Miscellaneous poisons.

GUIDELINES FOR THE CLASSIFICATION OF POISONS BASED ON THE DOSE

Extremely toxic	<1mg/kg
Highly toxic	1-50 mg/kg
Moderately toxic	50-500 mg/kg
Slightly toxic	0.5-5 g/kg
Practically non toxic	5-15 g/kg
Relatively harmless	> 15 g/kg

The following is a list of types of poison by intended use:

- Avicide substance which can be used to kill birds
- Biocide a chemical substance capable of killing living organisms, usually in a selective way
- Fungicide a chemical compound or biological organism used to kill or inhibit fungi or fungal spores
- Microbicide any compound or substance whose purpose is to reduce the infectivity of microbes
- Germicide a disinfectant
 - Bactericide a substance that kills bacteria
 - Viricide a chemical agent which "kills" viruses outside the body
- Herbicide a substance used to kill unwanted plants
- Parasiticide any substance used to kill parasites
- · Pesticide a substance or mixture of substances used to kill a pest
- Acaricide pesticides that kill mites
- · Insecticide a pesticide used against insects
- Molluscicide pesticides against molluses
- Nematocide a type of chemical pesticide used to kill parasitic nematodes (roundworms)
- Rodenticide a category of pest control chemicals intended to kill rodents

Factor affecting the toxicity of poison

Biotic factors

- Taxonomic group of which an animal belongs.
- The aquatic bioassays indicate that arthropods are more sensitive to poisons than fish and later are more sensitive than amphibians to toxicants.
- Algae, macrophytes are less sensitive than other aquatic animals.
- Age and body size of fish
- Larval stage of fish are is considered to be the sensitive than the adult stage
- The egg stage considered to be most resistant due to the membrane coverings that protect it from reacting to the available poison in the environment
- The small organism are more sensitive to the toxoids because of having more surface area:
 volume ratio, which leads to fast chemical uptake per unit weight

Abiotic factors

The most common abiotic factors that affect the toxicity of poison are

- Temperature
- pH
- Alkalinity
- Salinity
- Hardness.

Temperature: Increase the metabolism which in turn reflects

- The respiratory rate
- Chemical absorption
- Detoxification
- Excretory rate and all of which may affect the toxicity of a chemical or poison.
- Cytochrome P450 an enzyme used for the metabolism of toxic substances is greatly influenced by environmental temperature.
- It was shown that Oryzias latipes exposed to diethynitrosamine developed a few liver tumour at cold temperatures than at higher temperatures.

pH and Alkalinity:

pH promptly influence the toxic effects of different chemicals or other poisons on aquatic organism.

- Hydrogen ions very acidic conditions -increasesthe permeability of the gill epithelium thereby causing the loss of important electrolytes and ultimately affect the osmoregulation.
- Toxicity of trace metals are highly influenced by pH, it affects the chemical separations in water or competes with metals for sites on biological membranes.

TYPES OF POISONING

Acute

- Acute poisoning is associated with exposure to a relatively large, often single, dose of a toxic agent, this being followed by rapid manifestation of more severe clinical signs of intoxication.
- It is also defined as sudden violent syndrome caused by a single large dose of poison.



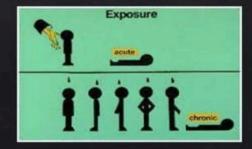
Sub-Acute

- In sub-acute poisoning the exposure level is lower and the survival time longer, than in acute poisoning, but the period between exposure and manifestation of signs of poisoning and possible death is again relatively short.
- · Symptoms of toxicity develop gradually.
- Low doses of poisons are administered for a period of 90 days.
- No Observed Effect Level or No Observed Adverse Effect Level and to identify
 the specific organ(s) affected by the test compound after repeated
 administration.

Chronic

- Chronic poisoning is usually caused by multiple exposures to the poison, while individual quantities are not sufficiently large to produce clinical intoxication.
- It is also defined as persistent lingering condition brought about by small repeated doses.
- A relatively long delay is observed between the first exposure to the toxic agent and the eventual development of signs of poisoning.
- In the chronic toxicity studies, the exposure time is six months to two years for rodents and one year for non-rodents.





Thank You!

PRINCIPLES OF FORENSIC TOXICOLOGY

BY ANDREW A. MAGEMBE MANAGER,

FORENSIC SCIENCE SERVICES

Estimation of Time Since Death



TEJASVI BHATIA

ASPHYXIAL DEATHS

Dr. M. Hammad

Department Of Forensic Medicine

Asphyxia

- Commonly means "Lack of Oxygen".
- In Greek meaning applying "Pulselessness/absence of pulsations
- It is defined as interference with the process of oxygenation in the lungs.

In Forensic context Asphyxia: Air is physically prevented to enter the air passages at any part from nose and mouth to the alveolar membranes.

Classification of Gordon

- 1. Anoxic anoxia
- 2. Anaemic anoxia
- 3. Histotoxic anoxia
- 4. Stagnant anoxia
- Anoxic anoxia
 - O 1. By obstruction to air passages
 - × Suffocation, Smothering,
 - 2. By obstruction to the air passage down to the respiratory tract
 - Drowning, Choking, throttling, hanging and strangulation
 - O 3. Excessive compression of the chest and abdominal wall
 - 4. Primary cessation of respiratory movements causing respiratory failure as in narcotic poisoning, electrical injury
 - O 5. Inhalation of irrespirable gases
 - CO2 and CO
- Anaemic anoxia

Reduced oxygen carrying capacity of the blood.

Histotoxic anoxia

Depression of the oxidative process in the tissues.

POISON and its TREATMENT

1 - INTRODUCTION TO TOXICOLOGY

By: RAGHU KHIMANI