

TOXICOLOGY

UNIT 5

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poison



Accumulate in body cells



Damage cell structure, functioning



symptoms and toxic signs developed



Toxicity severer death may occur

POISONS:-

- **poison, in biochemistry, a substance, natural or synthetic, that causes damage to living tissues and has an injurious or fatal effect on the body, whether it is ingested, inhaled, or absorbed or injected through the skin.**
- **Poisoning involves four elements: the poison, the poisoned organism, the injury to the cells, and the symptoms and signs or death. These four elements represent the cause, subject, effect, and consequence of poisoning.**

- **To initiate the poisoning, the organism is exposed to the toxic chemical. When a toxic level of the chemical is accumulated in the cells of the target tissue or organ, the resultant injury to the cells disrupts their normal structure or function. Symptoms and toxic signs then develop, and, if the toxicity is severe enough, death may result.**

Classification based on origin

- Poisons are of microbial, plant, animal, or synthetic origin.

Microbial poisons

- Microbial poisons are produced by microscopic organisms such as bacteria and fungi.
- Microbial toxins promote infection and disease by directly damaging host tissues and by disabling the immune system.
- Botulinus toxin, for example, is produced by the bacterium Clostridium botulinum and is capable of inducing weakness and paralysis when present in under processed, nonacidic canned foods or in other foods containing the spores.

Plant toxins

- Plant poisons are naturally occurring phytochemicals or **secondary metabolites** formed by plants to protect themselves against various threats like bacteria, fungi, insects, and predators.
- Toxins can be present in commonly consumed human foods like fruits and vegetable.
- Consumption of these toxins can be poisonous and seriously harm the liver.
- An example of a plant toxin is the **belladonna** alkaloid hyoscyamine, which is found in belladonna (*Atropa belladonna*) and jimsonweed (*Datura stramonium*).



belladonna



jimsonweed (*Datura stramonium*).

- **Animal poisons** are usually transferred through the bites and stings of venomous **terrestrial** or marine animals.
- Includes poisonous snakes, scorpions, spiders, and ants, and the latter group including sea snakes, stingrays, and jellyfish.
- poisoning by toxins from animals poses an important health hazard in the tropics. Animal toxins are complex mixtures of proteins, peptides, enzymes and chemicals.



SEA SNAKES

JELLY FISH





STINGRAY

- **Synthetic toxins** are responsible for most poisonings.
- “Synthetic” refers to chemicals manufactured by chemists, such as drugs and pesticides, as well as chemicals purified from natural sources, such as metals from ores and solvents from petroleum.
- Synthetic toxins include pesticides, household cleaners, cosmetics, pharmaceuticals, and hydrocarbons.

ARSENIC

- ***Arsenic* is a harmful toxic metallic compound that is found in the soil, air, and water**
- **Arsenic Poisoning is a fatal medical condition that is caused due to accumulation of high levels of arsenic in the body.**
- **Affects various internal parts of the human body drastically, such as the liver and kidneys, leading to severe or death conditions**

Signs and Symptoms of Arsenic Poisoning

The symptoms of arsenic poisoning are seen post in taking such compounds after 1 hour of indigestion.

some significant symptoms

- Person suffers from painful throat movements.
- The vomiting components include bile, mucus, and significant blood traces.
- Stool comes in the form of rice water.
- The phenomenon of vomiting is accompanied by purging.

- **Weight loss, fatigue, malnutrition, and loss of appetite are seen in the patients suffering from arsenic poisoning.**
- **Conjunctivitis is also seen in the case of arsenic poisoning.**
- **Whitish lines (Mee lines) are seen across the nails and fingers**

Conjunctivitis



MEE LINES



Medico-Legal Importance of Arsenic

As per the researchers, arsenic is asserted as a specific kind of homicidal poison used in suicidal cases

- It's because arsenic is available with ease at a very cheap rate.**
- Shopkeepers also supply it while mixing it with other substances.**
- The symptoms of arsenic poisoning tend to be similar to cholera.**

- **Suicidal cases rarely take place because intake of arsenic causes severe pain.**
- **Chronic poisoning is caused due to consumption of water containing arsenic traits.**
- **It's sometimes use to perform procure abortion.**
- **Also used as cattle poisons.**
- **Accidental poisoning is caused due to inappropriate medicinal usage of arsenic or by mistake with food substances.**

Barbiturate



- **Barbiturate is one of the important sedatives or analgesics drugs that are tremendously being used as drugs of addiction.**
- **These have depressant effects upon the body and make it insensitive to pain or depression.**
- **All barbiturates are derivatives of *barbituric acid*.**
- **They are also known as barbitones or barbitals.**
- **These substances are increasingly being used by drug addicts as they are comparatively more easily available, less costly, and are considered less dangerous.**

Fatal Dose of Barbiturates

Fatal dose is comparatively large though it varies with the compound. For example-

For *Short-acting Barbiturates* → 1 to 2 g.

For *Medium-acting Barbiturates* → 2 to 3 g.

For *Long-acting Barbiturates* → 3 to 5 g.

For *Ultra short Barbiturates* → 6-10 gm

Sign and Symptoms of Barbiturate Poisoning

If they are taken in excess amount leads to several problems in the body and also affects the human body in different ways. However, the effect varies with individuals. Some reported Signs and symptoms of barbiturates are mentioned below-

For Acute Poisoning symptoms include-

- Drowsiness – Desire to sleep
- A short period of confusion
- Excitement
- Hallucinations
- Vertigo
- slurred speech
- Headache

For Chronic Poisoning, symptoms are as follows-

- **Poor judgement**
- **Loss of memory**
- **Skin eruption (cutaneous bullae)- skin rash**
- **Constipation- difficult bowel movement**
- **Irritability- frustration**
- **Ataxic gait- failure of muscle coordination, irregular foot placement**
- **Stammering- problems with normal fluency of speech.**
- **Cramps and orthostatic hypotens- bp drop when standing up, seating up or sleeping.**

Medico-legal Importance of Barbiturates

Many cases of suicide are reported by using short-acting barbiturates.

Thiopental is used as truth serum to extract the truth from the criminals during interrogation by inducing a state of hypnosis in Narcoanalysis process.

Accidental poisoning and Homicidal poisoning cases are also reported.

Cyanide



- **Cyanides are among those fast-acting poisons which are lethal and cause painless death.**
- **Naturally, it is produced by certain bacteria, fungi algae.**
- **It is also found in cigarette smoke, in-vehicle exhaust and in food such as spinach, bamboo shoot almonds, etc.**
- **Cyanide occurs in all the three forms ie in the gaseous, liquid and solid-state.**
- **It occurs in a gaseous state as hydrogen Cyanide(HCN), in a liquid state as hydrocyanic acid or prussic acid and as salts of Cyanide in the solid-state as sodium Cyanide or potassium Cyanide.**

Signs and symptoms

- **Slow heart-beat**
- **General weakness**
- **Fast breathing**
- **Confusion**
- **Skin turning pink**
- **Bizarre behaviour- odd, strange or unexpected**
- **Seizures**
- **Excessive sleepiness**
- **Abdominal pain**
- **Coma**
- **Vomiting**
- **Shortness of breath**
- **Dizziness**

Medico legal importance

Generally after consuming cyanide death of the victim takes place. As cited above the death due to consumption of Cyanide can be homicidal or accidental or suicidal and hence all three have slightly different medico legal effects.

1. Homicidal death-

- Homicidal deaths the type of deaths that are caused to others by the person like killing or commission of murder etc.**
- it is the well-established notion that Cyanide is the best weapon for causing a homicidal type of death.**
- But the actual fact is that it has been very rarely used**
- Cyanide is rarely used for homicidal poisoning because of its peculiar smell and taste. .**

Suicidal death-

- Suicidal kind of deaths are the kind of death was the person intentionally administers himself Cyanide in any form so as to end his life.
- Cyanide is a very popular reason for suicidal deaths. This is because it causes instantaneous death.
- But as it is restricted chemical its employment is rare.
- The liberation tiger of tamil eelam (a terrorist organization of Srilanka) was known to encourage its members to wear a Cyanide capsule around there necks all the time. So that in the event of capture they could consume it and die and thus avoid being interrogated.

Accidental deaths-

- **Accidental deaths are those kinds of deaths that are caused by some mistake or some misunderstanding.**
- **In the case of Cyanide, accidental exposure to cyanide may occur. This is frequently among the workers in industries handling Cyanide during their occupations.**
- **There are cases where the chemists and the laboratory assistants sometimes come in contact with hydrocyanic acid**

Alcohol



- **Alcohol poisoning is a serious — and sometimes deadly — consequence of drinking large amounts of alcohol in a short period of time.**
- **Drinking too much too quickly can affect your breathing, heart rate, body temperature and gag reflex and potentially lead to a coma and death.**
- **Alcohol poisoning can also occur when adults or children accidentally or intentionally drink household products that contain alcohol.**
- **A person with alcohol poisoning needs immediate medical attention.**

Signs and symptoms

Confusion

Vomiting

Seizures

Slow breathing

Irregular breathing

Blue tinged skin or pale skin

Low body temp

Passing out (unconscious) and cant be awakened

Medicolegal importance

1. As per Sec 85 of IPC, a person is not held responsible for his criminal act if at the time of doing the act the person happens to be intoxicated and provided that the alcohol or intoxication was given to him without his knowledge or against his will. According to this section, voluntarily drunkenness is no excuse for commission of crime.

As per Sec 86 of IPC, an act done is not an offence unless done with a particular knowledge or intent, a person who does the act in a state of intoxication is liable to be dealt with as if he had the same knowledge as he would have had if he had not been intoxicated unless the thing which intoxicated him was administered to him without his knowledge or against his will.

According to Sec 510 of IPC — misconduct by a drunken person in public place is punishable with imprisonment up to 24 hours.

Many homicides are triggered by the aggressive behaviour engendered by alcohol

Sec 65 and 66 (1) of the Bombay Prohibition Act 1949 provides penalty for illegal import, export, manufacture, sale, purchase or transport of an intoxicant without proper license, permit or authorization.

Datura



INTRODUCTION

Datura is a Deliriant poison or cerebral poison. These type of poisons acting on the brain and inducing altered consciousness with confusion, delusions, hallucination. It exists in many varieties such as *D. fastuosa* and *D. stramonium*. It grows in the wild. All Parts of dathura are poisonous but seeds and fruits are more poisonous.

- Datura is a wild small coarse shrub up to 3 to 5 feet and grows at waste places and has handsome foliage of dark green ovate, pointed leaves, and large tubular (trumpet-shaped) flowers. There are 2 varieties of *Datura fastuosa* are found in India as follow-

1. *Datura alba* – They are white color flowers.

2. *Datura niger* – They are deep purple color flowers.

- These plant bears fruits which are spherical in shape, green in colour and have multiple spikes or thorn is called as "thorn apple. The fruit contains brownish or yellowish-brown kidney shaped seeds. The fruits contains more than 100 seeds resembling chilly seeds.

- These plants have unpleasant smell.

- These plants grow all over India and are offered to Lord Shiva in Puja.

SIGNS AND SYMPTOMS OF DATURA POISONING

Dryness of mouth

Bitter taste

Excessive thirst

Difficulty in talking

Dilated pupils

Difficulty in vision

Hyperpyrexia- high body temp

Increased cardiac and respiratory activity

Elevate blood pressure

Temperature elevation

Convulsions

hallucinations

- **Urine retention- difficulty urinating completely empty bladder**
- **Anxiety**
- **Deficit of recent memory**
- **Coma**
- **Death**

Fatal period:-

About 24 hours through Datura poisoning is rarely fatal

MEDICOLEGAL IMPORTANCE

Accidental: Accidental poisoning may result from any one of the following ways:

- Sometimes people taken dhatura seeds by mistaken because its seeds resembles like capsicum seeds. They fails to identify.
- Foraging children in the countryside chewing on the seeds (or other parts of the plant) out of curiosity.
- Therapeutic misadventures.

Suicidal: It is easily assessable and available. Datura is not infrequently reported in suicidal ingestions, especially in rural parts of India.

Homicidal: There have been rare instances of murder being accomplished with one or the other belladonna alkaloids.

- Datura seeds are abused. The seeds are mixed with cigarette and belladonna and smoked as hallucinogen.
- Datura seed resist putrefaction of body.
- **Criminal responsibility:** Datura produces temporary insanity. Usually, the poison is administered without the victim's knowledge. Hence the individual is not held responsible for his acts under the influence of Datura.
- Scopolamine is used as truth serum in Narcoanalysis test.

Opium



- **Opium (afim) is the dried juice of the poppy (Papaver somniferum) which is cultivated in India and other Eastern countries, only under a licence.**
- **The plant grows up to one metre in height.**
- **Each plant bears 5 to 8 capsules.**
- **Flowers are white.**
- **The unripe capsule is incised and the white juice which exudes is collected and allowed to evaporate to obtain opium.**
- **Ripe and dry poppy capsules contain a trace of opium and are used for their sedative and narcotic action.**

- **Poppy seeds (khaskhas) are white, harmless and nutritive and are used as food.**
- **The oil from the seeds is used for cooking purposes.**
- **Opium occurs in rounded, irregularly formed or flattened masses and has a strong characteristic odour and bitter taste**

Signs and Symptoms:

- **The contact of morphine with the skin of sensitive persons may cause erythema, urticaria and itching dermatitis.**
- **When opium is taken by mouth, symptoms begin within half hour.**
- **If the drug is injected, its action is noted within 3 or 4 minutes.**
- **It first stimulates, then depresses and finally paralyses the nerve centres.**

Stage of Excitement:

- **This stage is of short duration, and may be absent if a large dose is taken.**
- **There is an increased sense of well-being, increased mental activity, freedom from anxiety, talkativeness.**

Stage of Stupor:

- **The symptoms are headache, nausea, vomiting, a sense of weight in the limbs, giddiness and drowsiness**

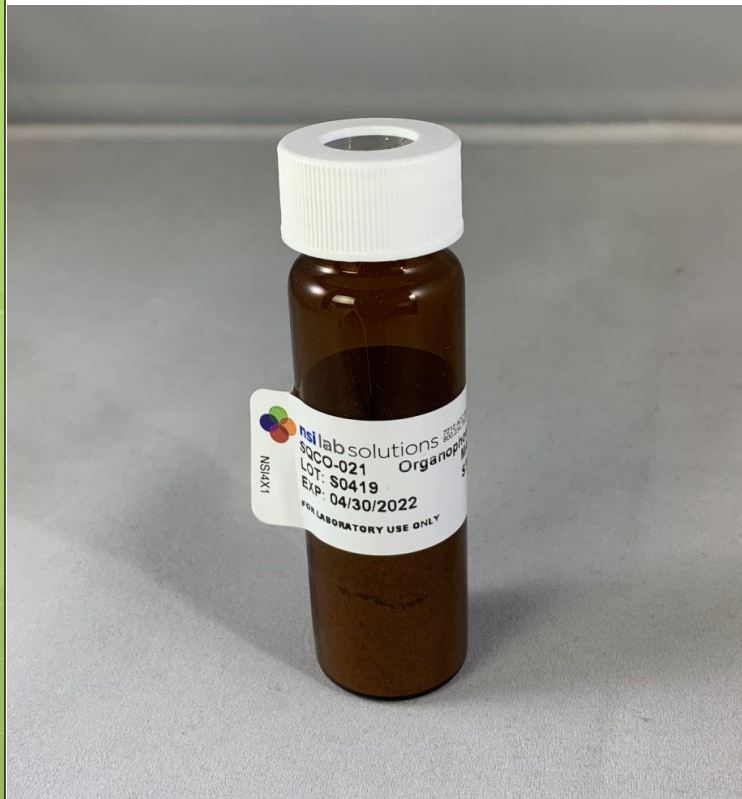
Stage of Coma:

The patient passes into deep coma from which he cannot be roused. The muscles become flaccid and relaxed and all reflexes are abolished. The face is pale, and conjunctivae congested.

MEDICO LEGAL ASPECTS

- **Suicidal**
- **Accidental**
- **Homicidal (rare) but used for infanticide**
- **Cattle poisoning**
- **Drug addiction**

Organophosphorus poisons



- **Organophosphate poisoning is the most common poisoning in India followed by aluminium phosphide.**
- **Organophosphorus compounds are available as dust powder or liquid.**
- **Organophosphorus compounds are classified as**
- **1. Alkyl compounds — such as tetraethyl pyrophosphate (TEPP), hexa ethyl tetraphosphate (HETP), octa methyl pyrophosphate (OMPA), malathion etc.**
- **2. Aryl compounds — such as parathion, chlorothion, diazinon (Tik-20), paraoxon etc.**

Signs and symptoms

Acute Poisoning

A. Muscarinic effects

Due to muscarinic like action, following clinical features are observed

1. **Bronchial tree — cough, increased secretions, bronchoconstriction, wheezing, dyspnea, pulmonary edema.**
2. **Gastrointestinal — nausea, vomiting, abdominal cramp, diarrhea.**
3. **Sweat glands — increased sweating.**
4. **Salivary glands — increased salivation.**

Eyes — miosis, blurring of vision or dimness of vision.

Heart — slow pulse, hypotension.

Nicotinic effects

The nicotinic effects are as follows:

- 1. Striated muscles — easy fatigue, weakness, muscular twitching, cramps**
- 2. Sympathetic ganglia — occasional elevation of blood pressure (hypertension), tachycardia**
- 3. Increased adrenal medulla activity**

C. CNS effects

The CNS effects are:

- 1. Irritability**
- 2. Restlessness**
- 3. Convulsions**
- 4. Mental confusion progressing to stupor to coma**
- 5. Depression of respiratory and circulatory centers**

Medicolegal Importance

- 1. Accidental poisoning may occur in farmers while spraying in the fields or opening the lid of the containers.**
- 2. Suicidal poisoning is common with this insecticide.**
- 3. Homicidal is rare as it is difficult to mask the smell of insecticide**