CLINICAL TOXICITY

Toxicity is the degree to which a chemical substance or a particular mixture of substances can damage an organism.

The degree to which a substance (a toxin or poison) can harm humans or animals will lead to the following cases.

- Acute toxicity involves harmful effects in an organism through a single or short-term exposure.
- Subchronic toxicity is the ability of a toxic substance to cause effects for more than one year but less than the lifetime of the exposed organism.
- Chronic toxicity is the ability of a substance or mixture of substances to cause harmful effects over an extended period, usually upon repeated or continuous exposure, sometimes lasting for the entire life of the exposed organism.

Types of toxic materials

There are generally four types of toxic entities;

- Chemical,
- Biological,
- Physical and
- Radiation.

Chemical toxicants include inorganic substances such as, lead, mercury, hydrofluoric acid, and chlorine gas, and organic compounds such as methyl alcohol, most medications, and toxins.

General treatment of poisoning

- Removal of unabsorbed poison
- Use of Antidote
- Elimination of absorbed poison
- Treatment of general symptoms
- Maintenance of patient general condition

Antidotes

An antidote is a drug, chelating substance, or a chemical that counteracts (neutralizes) the effects of another drug or a poison.

There are dozens of different antidotes; however, some may only counteract one particular drug, whereas others (such as charcoal) may help reduce the toxicity of numerous drugs. Most antidotes are not 100% effective, and fatalities may still occur even when an antidote has been given. Some examples of antidotes include:

- Acetylcysteine for acetaminophen poisoning
- Activated charcoal for most poisons
- Atropine for organophosphates and carbamates
- Digoxin immune fab for digoxin toxicity
- Dimercaprol for arsenic, gold, or inorganic mercury poisoning
- Flumazenil for benzodiazepine overdose
- Methylene blue for drug-induced methemoglobinemia
- Naloxone for opioid overdose
- Pralidoxime for poisoning by anti-cholinesterase nerve agents.

Insecticide poisoning

Stronger insecticides, which a commercial greenhouse might use or someone might store in their garage, contain many dangerous substances. These include:

- Carbamates
- Organophosphates
- Paradichlorobenzenes (mothballs)

Symptoms of insecticide poisoning

Organophosphates and carbamates cause,

- eye tearing,
- blurred vision,
- salivation,
- sweating,
- coughing,
- vomiting,
- frequent bowel movements and
- urination.
- Blood pressure can decrease.
- Heart rate can decrease
- seizures can occur.
- Breathing may become difficult, and
- muscles twitch and become weak.

Pyrethrins can cause,

- eye tearing,
- coughing,
- breathing difficulty.

Treatment of insecticide poisoning

- Removal of contaminated clothing and washing of skin
- Treatments to support breathing and heart function
- **Atropine** given by vein

Heavy metal poisoning

The heavy metals most commonly associated with poisoning of humans are lead, mercury, arsenic and cadmium. Heavy metal poisoning may occur as a result of industrial exposure, air or water pollution, foods, medicines, improperly coated food containers, or the ingestion of lead-based paints.

Arsenic poisoning, or arsenicosis, occurs after the ingestion or inhalation of high levels of arsenic. Arsenic is a type of carcinogen that's gray, silver, or white in color. Arsenic is extremely poisonous to humans. What makes arsenic especially dangerous is that it doesn't have a taste or odor, so you can be exposed to it without knowing it.

Symptoms of arsenic poisoning

- red or swollen skin
- skin changes, such as new warts or lesions
- abdominal pain
- nausea and vomiting
- diarrhea
- abnormal heart rhythm
- muscle cramps
- tingling of fingers and toes

Treatment for arsenic poisoning

- There's no specific method used to treat arsenic poisoning.

- The best way to treat the condition is to eliminate arsenic exposure.
- Full recovery may not happen for weeks or months.
- **Vitamin E and selenium supplements** have been used as alternative remedies to limit the effects of arsenic exposure.

Barbiturate poisoning

Barbiturate overdose is poisoning due to excessive doses of barbiturates. Barbiturate overdose may occur by accident or purposefully in an attempt to cause death.

Symptoms of barbiturate poisoning

Symptoms typically include,

- difficulty thinking,
- poor coordination,
- decreased level of consciousness, and
- decreased effort to breathe (respiratory depression).

Treatment for barbiturate poisoning

- Treatment involves supporting a person's breathing and blood pressure.
- While there is no antidote, **activated charcoal** may be useful.
- Multiple doses of charcoal may be required.
- **Hemodialysis** may occasionally be considered.
- **Urine alkalinisation** has not been found to be useful.
- If a person is drowsy but awake and can swallow and breathe without difficulty, the treatment can be as simple as monitoring the person closely.
- If the person is not breathing, it may involve **mechanical ventilation** until the drug has worn off.
- **Psychiatric consult** is generally recommended.

Narcotic /Opoid drug poisoning

Opioids are medications used to treat severe pain. These drugs bind to receptors in the brain and other areas to release dopamine. Opioid intoxication, also known as overdose, occurs when someone takes too much of an opioid drug.The level depends on how much of the drug is taken.

Opioid drugs that are commonly prescribed include:

- codeine
- fentanyl
- hydromorphone
- methadone
- morphine
- oxycodone
- oxymorphone

Symptoms of opoid poisoning

- small or constricted pupils
- slowed or absent breathing
- extreme fatigue
- changes in heart rate
- loss of alertness

Treatment for opioid poisoning

An opioid overdose requires emergency medical treatment. A nurse at the hospital or emergency room will first measure:

- breathing rate
- blood pressure

- heart rate
- temperature
- In the meantime, they may use a drug known as **naloxone** (Narcan, Evzio). This medication prevents the opioid from further affecting the central nervous system.
- The doctor may also use oxygen support if breathing is affected.

Role of a pharmacist in clinical toxicity

Clinical pharmacists practice in all health care settings and utilize in-depth knowledge of medications and disease states to manage medication therapy as part of a multiprofessional team. Clinical pharmacists are responsible and accountable for medication therapy and patient outcomes.