

UNIT – 5

Principles of Toxicology

a. Definition and Basic Knowledge of Acute, Subacute, and Chronic Toxicity:

1. Acute Toxicity:

- **Definition:** Adverse effects occurring shortly after exposure to a toxic substance.
- **Time Frame:** Usually within 24 hours.
- **Examples:** Acute poisoning, overdose.

2. Subacute Toxicity:

- **Definition:** Adverse effects occurring within 1 to 30 days of exposure.
- **Time Frame:** Intermediate between acute and chronic toxicity.
- **Examples:** Repeated exposure to toxins over a few weeks.

3. Chronic Toxicity:

- **Definition:** Adverse effects resulting from long-term exposure to a toxic substance.
- **Time Frame:** Extends beyond 90 days.
- **Examples:** Long-term exposure to environmental toxins, occupational hazards.

b. Definition and Basic Knowledge of Genotoxicity, Carcinogenicity, Teratogenicity, and Mutagenicity:

1. Genotoxicity:

- **Definition:** Ability to cause damage to genetic information within a cell.
- **Assessment:** Determined through genotoxicity assays.
- **Examples:** DNA damage leading to mutations.

2. Carcinogenicity:

- **Definition:** Capability to induce cancer.
- **Assessment:** Determined through long-term studies.
- **Examples:** Benzene, asbestos.

3. Teratogenicity:

- **Definition:** Ability to cause birth defects in the developing fetus.
- **Timing:** Critical periods during pregnancy.
- **Examples:** Thalidomide, alcohol.

4. Mutagenicity:

- **Definition:** Ability to induce changes in the genetic material of a cell.

- **Assessment:** Evaluated through mutagenicity assays.
- **Examples:** Exposure to certain chemicals, radiation.

c. General Principles of Treatment of Poisoning:

1. Decontamination:

- **Removal of Toxin:** Activated charcoal, gastric lavage.
- **Prevention of Absorption:** Emesis, cathartics.

2. Enhancement of Elimination:

- **Urinary Alkalinization:** Increases excretion of weak acids.
- **Hemodialysis or Hemoperfusion:** Removes toxins from the blood.

3. Antidotes:

- **Naloxone:** Opioid overdose.
- **Atropine:** Organophosphate poisoning.
- **N-acetylcysteine:** Acetaminophen overdose.

4. Supportive Care:

- **Airway Management:** Ensure adequate ventilation.
- **Fluids and Electrolytes:** Correct imbalances.
- **Symptomatic Treatment:** Address specific symptoms.

d. Clinical Symptoms and Management of Barbiturates, Morphine, Organophosphorus Compounds, and Lead, Mercury, and Arsenic Poisoning:

1. Barbiturates:

- **Clinical Symptoms:** Respiratory depression, CNS depression.
- **Management:** Supportive care, activated charcoal, mechanical ventilation if needed.

2. Morphine:

- **Clinical Symptoms:** Respiratory depression, pinpoint pupils.
- **Management:** Naloxone administration, respiratory support.

3. Organophosphorus Compounds:

- **Clinical Symptoms:** Excessive salivation, muscle twitching, respiratory failure.
- **Management:** Atropine, pralidoxime, decontamination.

4. Lead, Mercury, and Arsenic Poisoning:

- **Clinical Symptoms:** Neurological symptoms, gastrointestinal disturbances.
- **Management:** Chelation therapy (e.g., EDTA for lead poisoning), supportive care.

6. Chronopharmacology

a. Definition of Rhythm and Cycles:

1. Rhythm:

- **Definition:** Regularly occurring pattern of change.
- **Examples:** Circadian rhythm (daily), ultradian rhythm (more than once a day), infradian rhythm (less than once a day).

b. Biological Clock and Their Significance Leading to Chronotherapy:

1. Biological Clock:

- **Definition:** Internal timing mechanism in living organisms.
- **Examples:** Circadian rhythm regulated by the suprachiasmatic nucleus in the brain.

2. Chronotherapy:

- **Definition:** Administration of medications based on the body's natural rhythms.
- **Significance:** Optimizes drug efficacy, minimizes side effects.
- **Examples:** Timed release formulations, scheduling drugs to coincide with peak disease activity.

In conclusion, understanding the principles of toxicology involves recognizing different types of toxicity (acute, subacute, chronic) and the various aspects of genetic and carcinogenic effects. Treatment of poisoning involves decontamination, enhancing elimination, using specific antidotes, and providing supportive care. Additionally, chronopharmacology considers the influence of biological rhythms and cycles on drug effects, leading to optimized therapeutic strategies.