

## **INTRODUCTORY TOXICOLOGY; SOURCES AND TYPES OF POISON, ANTIDOTAL THERAPY**

### **Definitions:**

- Toxicology: It is the science or study of poisons on biologic systems, including their properties, actions and effects. Also their detection and identification, the treatment and prevention of the conditions produced by them.
- Toxicant: Any poisonous agent
- Toxins/Biotoxins: Poisons produced by biologic sources e.g venom, plant toxins.
- Toxicosis/ Poisoning/ Intoxication: Any disease produced by a toxicant
- Acute toxicosis: Effects during the first 24 hours
- Chronic toxicosis: Effects produced by prolonged exposure (> 3months)
- Toxicity: Refers to the amount of a toxicant necessary to produce a detrimental effect.
- Hazard: Describes the likelihood of poisoning under conditions of use.
- Toxicant accumulation/ biomagnifications: Occurs when absorption exceeds the ability of the body to destroy or excrete a xenobiotic compound.
- Ecotoxicology: The study of the relationship of potentially toxic chemicals in living organisms and their environment.
- Tolerance: The ability of an organism to show less response to a specific dose of a chemical than it demonstrated on a previous exposure; refers to acquired and not innate resistance.
- LD<sub>50</sub>: The dose that is lethal to 50% of a test sample or population. Expression of toxicant concentrations are in ppb or ppm in feedstuff, water, air, tissue etc. Other expressions of dose are maximum nontoxic dose, maximum tolerated dose, approximate lethal dose.

### **Toxicology as a discipline**

- It is a multifaceted science
- It contributes to, and draws from fields such as chemistry, pharmacology, pathology, psychology, clinical medicine, botany etc.

- *Is toxicology a chemical or biological science?*

### **Who are toxicologists?**

- Toxicologists are persons trained in the knowledge of poisons.
- They may have been trained solely in this specialty or more often than not, they were trained as veterinarians, physicians, chemists, physiologists, pharmacologists, entomologists, botanists, agronomists and some other specialties.
- The common factor is an interest in learning more about the undesirable effects of substances and energies on living organisms and their environment.

### **Veterinary Toxicologist**

- A person having special knowledge of the poisons affecting the animals and birds in which man is interested for his economic gain or pleasure, and of those substances which, when present in animal products, could injure the health of the people consuming them.
- He is also concerned with the determination of the safety of drugs, chemicals and energies intended for direct use by people (the best qualified to evaluate the results of animal experiment action which usually precede human usage).

### **Environmental Toxicology**

- Chemicals released into the environment abound there to elicit their deleterious effects on the ecology where man, animals and other organisms interact.
- The delicate interactions is altered by these chemicals with devastating effects on man and animals.

### **Factors affecting the activity of poisons**

Exposure-related, biologic or chemical factors regulate absorption, metabolism and elimination and accordingly, influence the clinical consequences.

Factors related to exposure:

- Dose
- Duration and frequency of exposure
- Route of exposure
- Time of exposure
- Environmental factors e.g temperature, humidity etc

Biologic factors:

- Species of animal
- Age and size of animal
- Sex and hormonal factor of animal
- Nutritional and dietary factor
- Health status

Chemical factors:

- Chemical nature of the toxicant
- Vehicle/Carrier

### **Diagnosis**

- History
- Clinical signs
- P/M lesions
- Laboratory examinations
- Bioassay/ Animal inoculation

### **Treatment of Poisoning**

General Considerations:

- Each clinical case of poisoning presents individual problems
- More often than not, approach to treatment is determined by
  - i. Nature of poison involved
  - ii. Condition of the patient

Principles of therapy:

1. Prevention of further absorption

2. Supportive or symptomatic treatment
3. Specific antidote

Prevention of further absorption:

- Remove the source of poison or remove the animals from the area in which the poison exist.
- Limit the absorption of material already in or on the animal for topical chemicals.

Wash the animal or remove contaminated hair or wool.

- For ingested toxicants:

- Induce vomiting eg apomorphine
- Gastric lavage is useful in smaller animals
- Rumenotomy in ruminants
- Purgation when slow-acting poisons are involved.
- Activated charcoal serves to adsorb poison in the stomach

Supportive Therapy:

- Control of seizures
- Maintenance of respiration
- Treatment for shock
- Correction of electrolyte and fluid balance
- Control of cardiac function
- Alleviation of pain

Specific Treatment (Antidotal therapy):

- This is application of drugs to reverse or neutralize the effect of the poison.
- Specific antidotes for the treatment of poisoning are highly desirable but rather rare.
- Some antidotes form complexes with the toxicant (e.g the oximes bind with organophosphates), others block or compete for receptor sites e.g vitamin K competes with the receptor for coumarin anticoagulants such as warfarin and a few affect metabolism of the toxicant e.g ferric to ferrous reduction with methylene blue in nitrate poisoning.

**Other Examples:**

- i. Chloral hydrate or barbiturates for treatment of convulsions due to strychnine and other chlorinated hydrocarbons.
- ii. Atropine sulphate is the antidote for organic phosphorus and carbonates poisoning.
- iii. BAL or dimercaprol is an antidote for lead, arsenic or mercury poisoning.
- iv. CaEDTA (Ca ethylenediamine tetra acetate) is used as a chelating agent in lead poisoning.
- v. Sodium nitrate is used for cyanide poisoning.
- vi. Tannic acid will precipitate heavy metals.

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