

The logo of Galgotias University, featuring a stylized 'G' composed of three curved, overlapping bands in shades of yellow, blue, and red, set against a light grey circular background.

Unit 5

Principles of Toxicology

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All the content material provided here is only for teaching purpose.

The logo of Galgotias University is a circular emblem with a stylized 'G' shape inside. The 'G' is composed of several overlapping, curved segments in shades of yellow, orange, and blue. The background of the emblem is a light, warm tone.

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Introduction:

Poison:

Substance which when administered inhaled or ingested, is capable of acting deleteriously on human body

- Thus, Almost anything is a poison
- Medicine in a toxic dose= Poison
- Poison in a small dose=Medicine

General Principles of Poisoning

1. Stabilization

2. Evaluation

3. Decontamination

4. Poison elimination

5. Antidote administration



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Stabilization

- Initial survey should always be directed at assessment & correction of life threatening problems , if present.
- Attention must be paid to the airway, breathing, circulation, and depression of the CNS (the **ABCD** of resuscitation)

- Airway & Breathing
- Symptoms of airway obstruction:
- Dyspnoea, air hunger, & hoarseness
- Signs : stridor, intercostal & substernal retractions, cyanosis, sweating, and tachypnoea
- Increasing metabolic acidosis in the presence of a normal PaO₂ suggests a toxin or condition that either Decreases oxygen carrying capacity (e.g. carbon monoxide) **OR** Reduces tissue oxygen (e.g. cyanide)

Evaluation

- In all those poisoned patients where there appears to be no immediate crisis, a detailed & thorough clinical examination should be made with special reference to the detection & treatment of any of the following abnormalities :
 - Hypothermia
 - Hyperthermia
 - Acid-base disorders
 - Convulsions
 - Electrolyte disturbances

Decontamination

- This is with reference to skin/eye decontamination, gut evacuation and administration of activated charcoal.
- EYE
- Irrigate copiously for at least 15 to 20 minutes with normal saline or water. Do not use acid or alkaline solutions.
- Skin
Cutaneous absorption is a common occurrence especially with reference to industrial and agricultural substances such as phenol, hydrocyanic acid, aniline, organic metallic compounds, phosphorus, & most of the pesticides

Emesis

The only recommended method of inducing a poisoned patient to vomit is administration of **syrup of ipecac**. In recent years owing to doubts being raised as to its actual efficacy and safety. **The current consensus is that syrup of ipecac must NOT be used, except in justifiable circumstances**

Gastric lavage

- Gastric lavage should **not be employed routinely in the** management of poisoned patients. There is no certain evidence that its use improves outcome, while the fact that it can cause significant morbidity is indisputable.
- Lavage should be considered **only if a patient has** ingested a life-threatening amount of a poison and presents to the hospital within 1 to 2 hours of ingestion.

Catharsis

- It means purification
- Achieved by purging the gastrointestinal tract (particularly the bowel)
- Recommended saline cathartics are Magnesium citrate, Magnesium sulfate, Sodium sulfate
- In saccharides, Sorbitol (D-glucitol) is the cathartic of choice in adults because of better efficacy than saline cathartics

Activated charcoal

- A number of studies have documented clearly the efficacy of activated charcoal as the sole decontamination measure in ingested poisoning
- Decreases the absorption of various poisons by adsorbing them on to its surface
- **Contraindications**— Absent bowel sounds or proven ileus

Elimination

- The various methods of eliminating absorbed poisons from the body include the following:
- Forced Diuresis
- Extracorporeal techniques
 - Haemodialysis
 - Haemoperfusion
 - Peritoneal dialysis
 - Haemofiltration
 - Plasmapheresis
 - Plasma perfusion
 - Gene

Antidote administration

- In majority of cases of acute poisoning, all that is required is intensive supportive therapy
- Specific antidotes are rarely necessary, besides the fact that only a few genuine antidotes exist in actual practice, though there is no denying to the results that can be achieved with some of them in appropriate circumstances

Barbiturates Poisoning:

- Poisoning is mostly suicidal, rarely accidental
- Characterized by respiratory failure, cardiovascular collapse, coma & renal failure
- Treatment: Gastric lavage, artificial respiration & forced alkaline diuresis with mannitol & sodium bicarbonate

Morphine Poisoning:

- It may be accidental, suicidal or seen in drug abusers. The human lethal dose is estimated to be about 250 mg.
- Stupor or coma, flaccidity, shallow & occasional breathing, cyanosis, pinpoint pupil, fall in BP & shock; convulsions may be seen in few, pulmonary edema occurs at terminal stages, death is due to respiratory failure

Treatment:

- Consists of respiratory support & maintenance of BP (i.v.fluids, vasoconstrictors)
- Gastric lavage should be done with pot. Permanganate to remove unabsorbed drug
- Specific antidote: Naloxone 0.4–0.8 mg i.v. repeated every 2–3 min till respiration picks up, is the specific antagonist of choice
- Due to short duration of action, naloxone should be repeated every 1–4 hours, according to the response.

Atropine Poisoning:

- Belladonna poisoning may occur due to drug overdose or consumption of seeds & berries of belladonna/datura plant
- Dry mouth, difficulty in swallowing & talking Dilated pupil, photophobia, blurring of near vision, palpitation, psychotic behaviour, ataxia, delirium, visual hallucinations, Hypotension, weak & rapid pulse, cardiovascular collapse with respiratory depression
- Convulsions & coma occur only in severe poisoning

Treatment:

- If poison has been ingested, gastric lavage should be done with tannic acid
- The patient should be kept in a dark quiet room. Cold sponging or ice bags are applied to reduce body temperature. Physostigmine 1–3 mg s.c. or i.v. antagonises both central & peripheral effects

Heavy metals Poisoning:

- Heavy metals are dangerous because they tend to bio-accumulate. Bio-accumulation means an increase in the concentration of a chemical in a biological organism over time, compared to the chemical's concentration in the environment. Compounds accumulate in living things any time they are taken up and stored faster than they are broken down (metabolized) or excreted.
- Heavy metal contamination may occur due to factors including irrigation with contaminated water, the addition of fertilizers and metal based pesticides, industrial emissions, transportation, harvesting process, storage and/or sale.
- Examples: Lead, Cadmium, Arsenic, Mercury etc

Heavy metal antagonists:

- Heavy metal antagonists (Chelating agents) are designed specifically to compete with these groups for the metals and prevent or reverse toxic effects and enhance the excretion of metals.
- Chelate- complex formed b/w a metal and a compound that contains two or more potential ligands.

Lead Poisoning:

- Four chelators are employed
 1. Edetate calcium disodium (CaNa_2EDTA)
 2. Dimercaprol
 3. D-penicillamine
 4. Succimer (2,3-dimercaptosuccinic acid)

Arsenic Poisoning:

Mechanism of action- Arsenate (pentavalent) is a well known uncoupler of mitochondrial oxidative phosphorylation.

Chelating therapy: Dimercaprol- 3-4mg/kg i.m every 4-12hrs
Penicillamine- in 4 divided doses to a maximum of 2 g per day

Mercury Poisoning:

Treatment:

Stomach should be washed out with 250 ml of a 5 percent solution of sodium formaldehyde sulfoxylate.

This substance reduces the Mercury (II) perchlorate (more soluble) to Mercury (I) chloride (less soluble).

Egg Albumin may be administered, which forms mercury albuminate (which is insoluble).

Medicinal Charcoal – Mercury adsorbs with charcoal's surface, and hence gets removed without being absorbed by enterocytes.

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