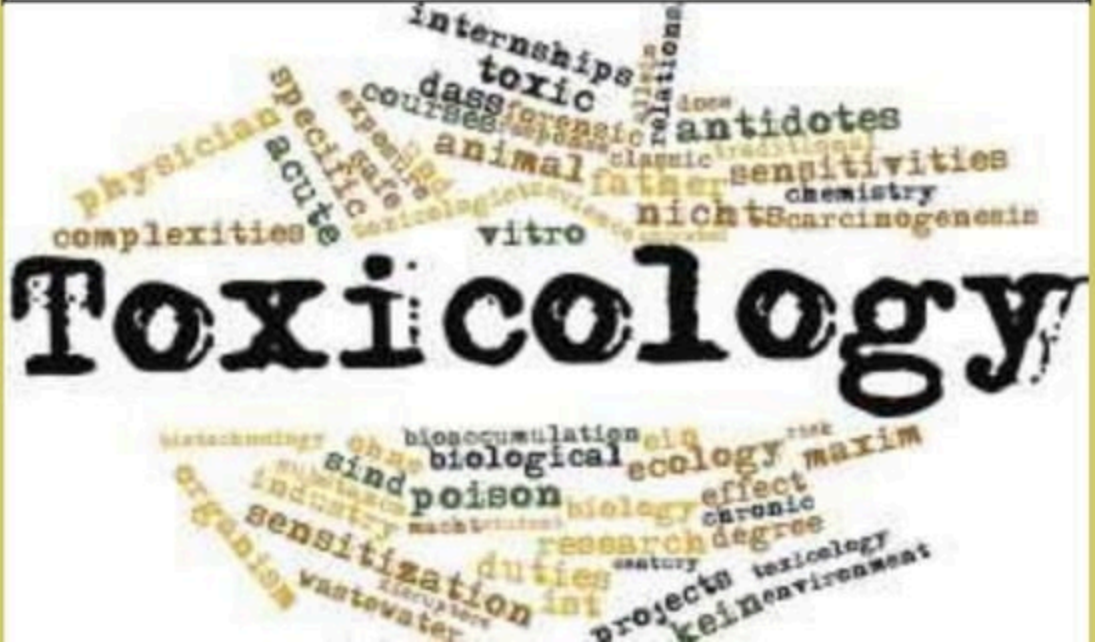
General Toxicology



What is a ***Poison***?:

A poison is any substance of microbial (bacteria) , plants or animals, or synthetic that is harmful to the body.

NOTE: Xeno-biotic: Any substance, harmful or not, that is foreign to the body.

DIAGNOSIS OF POISONING

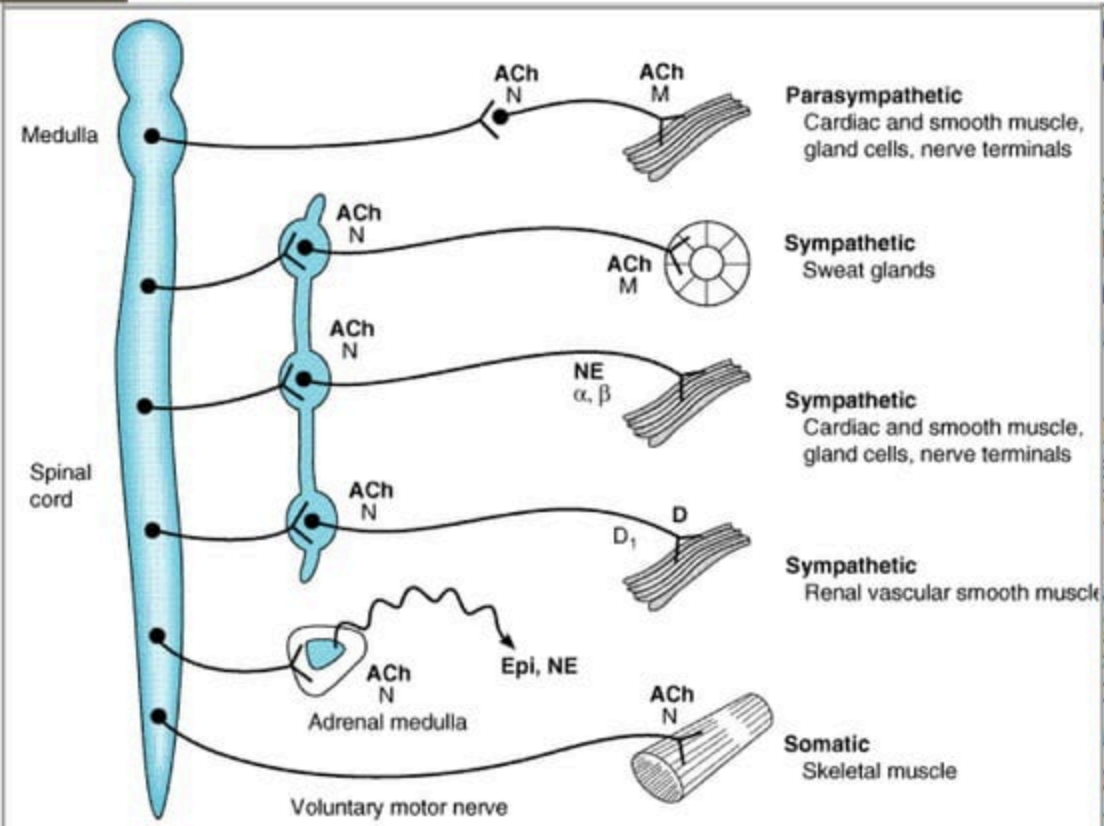
1) Circumstantial evidences: e.g.,

- Sudden illness of previously healthy person or persons after ingestion of food or drink or exposure to some chemical, gas, insect or snake bite.

2) Clinical picture:

- Vital signs (B.P, pulse, respiration, temperature).
- Neurological examination + pupil's state.
- Chest and abdomen examination.
- Skin and smell of breath.

TOXIDROMES: They are the groups of signs and symptoms that consistently result from particular toxins. EXAMPLES:



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c agents

aine,
hetamines
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histamine

cl.
depress.,
parkinson
ts,
nothiazine
ropine &

Ant				seizures (rare)	scopolamine

Toxi-drome	Mental status	Pupils	Vital signs	Other manifest-ations	Examples of toxic agents
Opioid	CNS depression, coma	Miosis	Hypothermia,bradycardia, hypotension, hypopnea, bradypnea	Hyporeflexia, pulmonary edema, needle marks	Opiates (eg. heroin, morphine, methadone), diphenoxylate

In a case of suicide by a drug, the victim shows rapid pulse, dilated reactive pupils, fever, convulsions and diaphoresis. The poison may be:

a. Morphine. **b. Tricyclic antidepressant.**

c. Amphetamine. **d. Antiparkinson drug.**

3. **Investigations: e.g., laboratory:**

   I. **Clinical laboratory e.g., serum electrolytes, blood glucose, liver and renal function tests and anion gap**

   II. **Toxicological screening**

      i. **Initial or preliminary tests e.g.,** Color tests

      ii. **Confirmatory tests e.g., GC/MS [a combination of two technologies: mass spectrometry and gas chromatography]**

EXAMPLE: MARQUIS TEST:

- Turns *purple* in the presence of *Heroin, opium and morphine.*

- Turns *red orange* in the presence of *Amphetamines.*

4) Postmortem picture:

I- External Examination:-

1.Characteristic smell; cyanide, phenol, opium & organo-phosphates.

2.Characteristic eschars; corrosives; black in sulphuric acid, yellow in nitric acid & brown in phenol.

3.Postmortem changes:

A. Hypostasis (deep blue in asphyxia e.g. barbiturates and organophosphorus insecticides, brown in nitrates and red in carbon monoxide and cyanide).
B. Rigor Mortis (earlier in convulsants e.g. strychnine)
C. Putrefaction (delayed in dehydration as in arsenic poisoning)

II- Internal examination:- e.g.,

A.Characteristic poisonous seeds, tablets or mass in stomach.

B.Hyperemia & superficial ulcers in gastric mucosa; metallic poisons.

MANAGEMENT OF POISONING

I Supportive therapy
II Gastro-intestinal (GIT) Decontamination
III Elimination of the poison from the blood
IV Antidotes

I- Supportive therapy = [Treat the patient not the poison]
= [Support the ABCs]

* Air

More than 90% of cases of drug overdoses will survive if you do NOTHING beside the supportive care … while less than 10% needs specific therapy and antidotes.

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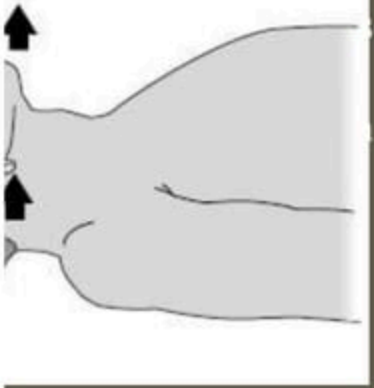
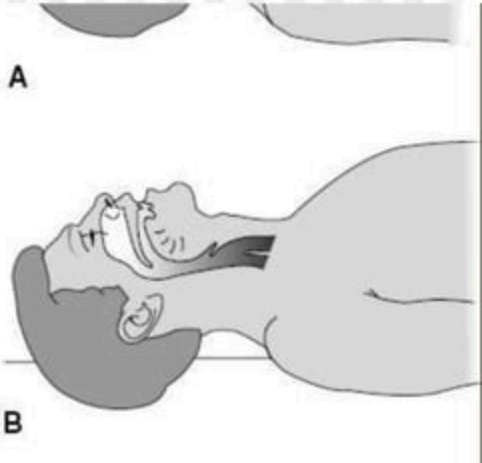
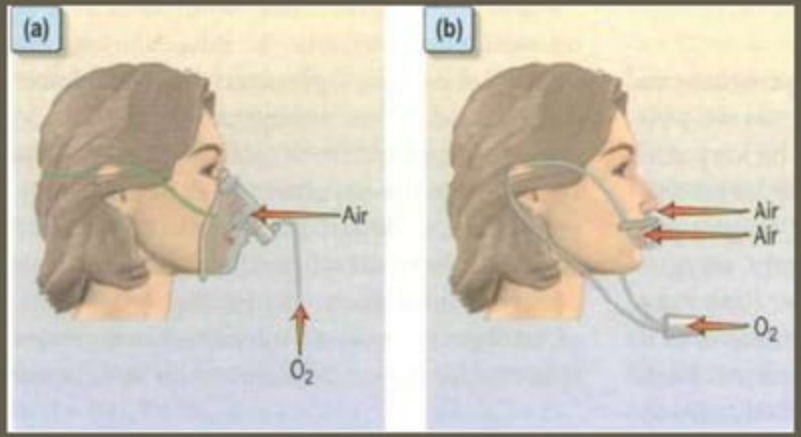




*Breathing [O2 therapy] by

- Simple face mask
- or
- Nasal cannula
- or
- Mechanical ventilation



***Circulation:**

1. Check blood pressure and pulse rate and rhythm.
2. Begin continuous electrocardiographic (ECG) monitoring. Arrhythmia must be treated by antiarrhythmic drugs (lidocaine, phenytoin, etc.).
3. Secure venous access.
4. Begin intravenous infusion of normal saline.

***C.N.S : [coma or convulsions]**

A] **Coma:**

*C.N.S : [coma or convulsions]

A] Coma:

Treatment of coma :

Coma cocktail could be used :

I- Dextrose: All comatose patients should receive concentrated dextrose unless hypoglycemia is excluded by an immediate bedside test.

II- Thiamine: 100mg I.V. for possible Wernicke's encephalopathy in alcoholics. **It is not given routinely to children.**

III- Naloxone (Narcan): All patients with respiratory depression should receive naloxone.

And add oxygen

*C.N.S : [coma or convulsions]:

Seizures are treated with diazepam 0.2 mg/kg slowly IV (over 1-2 minutes) followed by Phenobarbital 15 mg/kg slowly IV if no response to diazepam

Caution: Anticonvulsants can cause hypotension, cardiac arrest, or respiratory arrest if administered too rapidly.

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II. Gastrointestinal decontamination:

1. Emesis.
2. Gastric lavage.
3. *Activated charcoal: the most effective.*
4. Cathartics.
5. *Whole bowel irrigation.*

ACTIVATED CHARCOAL (A.C.)

This is considered the most useful agent for the prevention of absorption of toxicants.

Source:

It is manufactured by pyrolysis of wood and then activation by passing hot steam to increase the pores. The final product (activated charcoal) has a large surface area of 950- 2000 m^2/g.

Action:
The charcoal particles have many
(binds) poisons in GIT and hence

Dose:
1 –1.5 g/kg in adults [orally, mixed

WHOLE BOWEL IRRIGATION [WBI]

Definition :

Irrigation of the entire GIT with **non absorbable** isotonic electrolyte solution containing **Polyethylene Glycol** through nasogasrtic tube until the bowel has been cleansed rapidly of the poison.

Indications : Poorly adsorbed drugs by Activated Charcoal [e.g., iron and lithium]

(1)Preparations which are slow release e.g **Salicylates.**

(2)Packets of illicit drugs (e.g. **Cocaine** or **Heroin**] – in case of body packers (smugglers who swallow tightly sealed packets of illicit drugs) or body stuffers (drug sellers who swallow the evidence [i.e. just prior to detection]

(E) WHOLE BOWEL IRRIGATION

Definition :

Indication:

The rate:

2 L / h. in adults or 0.5 L / h. in children.

The end point:

when the rectal effluent is clear OR ideally when radiography reveals no tablets or opacities previously visualized.

MANAGEMENT OF POISONING

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III- ELIMINATION OF THE POISON FROM THE BLOOD AFTER ABSORPTION , BY:

- **Forced diuresis and alteration of the urine pH (ion trapping),**
- **Extracorporial methods which include:**
  1. **Dialysis: Hemo [artificial kidney] or peritoneal**
  2. **Haemoperfusion**
  3. **Plasmapheresis**

Alteration of the urine pH (ion trapping)

- **Definition:**

Changing PH of urine → "ion trapping" [i.e. poison can't b… as ionized dru… increase E…

N.B.: Acid diuresis is no longer used because → metabolic acidosis

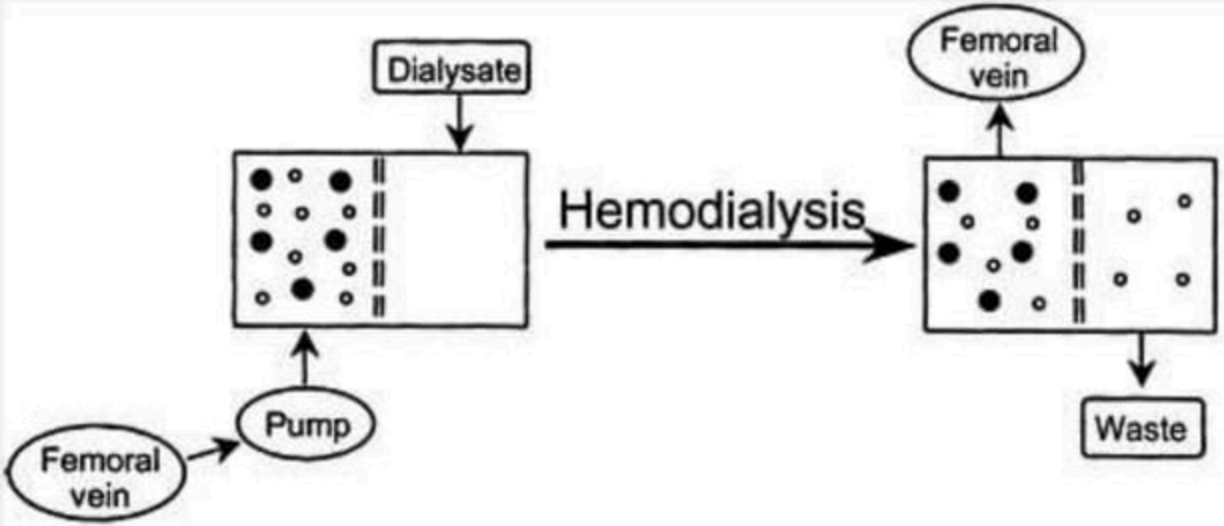
- **Principles of ion trapping:**

Type	Toxin	Solution
(1) Alkalinization of urine	**Acidic** ▪ Salicylates ▪ Barbiturates	**Alkalies** [$NaHCo_3$]
(2) Acidification of urine	**Alkaline** ▪ Amphetamine	**Acids** [NH4cl]

III- ELIMINATION OF THE POISON FROM THE BLOOD AFTER ABSORPTION (ENHANCED ELIMINATION), BY:

- **Forced diuresis and alteration of the urine pH (ion trapping),**
- **Extracorporial methods which include:**
  1. **Dialysis: Hemo [artificial kidney] or peritoneal**
  2. **Haemoperfusion**
  3. **Plasmapheresis**

Hemodialysis	Peritoneal dialysis	Hemoperfusion	Plasma pheresis
Mechamism of action:			



In hemodialysis, blood is taken from a large vein (usually a femoral vein) with a double-lumen catheter and is pumped through the hemodialysis system. The patient must be anticoagulated to prevent clotting of blood in the dialyzer. Drugs and toxins flow passively across the semipermeable membrane down a concentration gradient into a dialysate solution.

Hemodialysis	Peritoneal dialysis	Hemoperfusion	Plasma pheresis
Mechamism of action:			
Removal of poisons from the **blood** to the **dialysis fluid** according to **concentration gradiant** (from higher to lower) through semi permeable membrane which is Cellophane peritoneum			

Hemodialysis	Peritoneal dialysis	Hemoperfusion	Plasma pheresis
Mechamism of action:			
		a) The technique is similar to hemodialysis except there is no dialysis membrane or dialysis fluid involved in the procedure.	

Hemodialysis	Peritoneal dialysis	Hemoperfusion	Plasma pheresis
Mechamism of action:			
			*A volume of blood is removed, and all **blood components** except the **plasma** are returned to the circulation * The plasma is replaced with a **crystalloid** solution **or fresh frozen plasma from another donor.**

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Physiological [systemic] antidotes CAC

1) Chemical inactivators
2) Antagonistic antidotes
3) Competitive antidotes

1) Chemical inactivators:

a) Hydroxycobalamine combines to cyanide to form non toxic cyanocobalamine (vit B12).
b) Calcium unites with oxalic acid to form non toxic calcium oxalate.

2) Antagonistic antidotes:

Antagonise the pharmacological effect of physiological mechanism e.g.,:

- Naloxon in opioid and narcotic poisoning

Physiological [systemic] antidotes

1) Chemical inactivators
2) Antagonistic antidotes
3) Competitive antidotes

3) Competitive antidotes:

A.Compete with the poison for the receptor e.g.,: **Nalorphine** in morphine poisoning

B.Compete with the receptor for the poison e.g.,: the chelating agents for metallic poisoning

THANKS

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