POISONING

A poison is a substance which, by its direct action on body tissues or its action after absorption into the circulation, injuriously affects health or destroys life.

A poison may get into the body through ingestion, inhalation (gas, vapours, dust, fumes, smoke, spray), skin contact (pesticides), or injection (bites and stings, drug injection)

Human poisoning can be classified into two broad divisions:

1. **ACUTE POISONING:** It may be self or accidental poisoning. Symptoms appear suddenly soon after the consumption of poison. These symptoms increase in severity, and may cause death if not attended in time.
2. **CHRONIC POISONING:** Chronic poisoning results from a drug build up over time because these poisons accumulate in the body tissues and gets metabolized and eliminated very slowly. Symptoms does not appear immediately. However, symptoms start disappearing on removal of the patient from further exposure.

POISON COLOUR CODES & SYMBOLS:

WHO colour codes for Poison (pesticides)

RED LABEL	Extremely toxic
YELLOW LABEL	Highly toxic
BLUE LABEL	Moderately toxic
GREEN LABEL	Slightly toxic

Other symbols

Toxic

CLASSIFICATION OF POISONS: (according to their mode of action)

1. **CORROSIVES:** These rapidly destroy or decompose body tissues at the point of contact.
   Examples:
   - **Mineral acids:** HCl, H_2SO_4, HNO_3
   - **Organic acids:** Acetic acid, Carbolic acid
   - **Strong alkalis:** NaOH, KOH
   - **Metallic salts:** Mercuric Chloride, KCN

2. **IRRITANTS:** These produce pain at the site and also cause abdominal pain, vomiting and purging.
   Examples:
   - **Inorganic**
     Nonmetallic: Phosphorus, Iodine, Chlorine, Bromine
     Metallic: Arsenic, Antimony, Lead, Copper, Zinc
     Mechanical: Glass, Diamond dust, Hair
   - **Organic**
     Animal: Snake venom, Scorpion venom, Poisonous insects, Cantharides
     Vegetable: Castor seed, Croton oil, Calotropis

3. **NEUROTICS:** These poisons primarily act on the Nervous system. The chief signs and symptoms include headache, drowsiness, giddiness, stupor, coma, convulsions or paralysis.
   TYPES:
   - **Cerebral :** Opium, Alcohols, Datura, Cannabis
   - **Spinal:** Strychnine (*Nux vomica*)
   - **Peripheral:** Curare [d-tubocurarine toxin][*Chondrodendron tomentosum*], Conium [Poison hemlock][*Conium maculatum*] (*Act on peripheral nerves)*

4. **CARDIAC POISONS:** Digitalis, Aconite
5. **ASPHYXIANTS:** CO_2, CO, SO_2, NH_3 gas. These poisons are present in the gaseous state and if inhaled destroy the capability of blood as a carrier of Oxygen and irritate or destroy the lung tissue and bronchi.
6. **MISCELANEOUS:** Salicylate, Hypnotics,

CURARE NOTES:

These poisons are not actually true toxins, rather they are potent muscle relaxers. Curare is an alkaloid, and acts as a neuromuscular blocking agent to produce paralysis in muscles. It first affects the muscles of the toes, ears, and eyes, then those of the neck, arms and legs, and finally, those involved in breathing. Death from curare poison is caused by asphyxia (respiratory arrest) because the muscles become so relaxed that the muscles operating the diaphragm and lungs stop functioning.
Curare must get into the blood system for it to work. It does not hurt to eat something killed by a poisoned curare arrow because the poison is not absorbed in the stomach.

POISONING MANAGEMENT APPROACH:

Patient presenting with history of poisoning or suspicious poisoning first their vitals has to be stabilized like protecting the -

- ✓ **A**irway (oropahryngeal or nasopharyngeal airway)
- ✓ **B**reathing (nasal prong or face mask with venture or intubation and mechanical ventilation)
- ✓ **C**irculation (inotropes)
- ✓ Collect available evidence about time of consumption, Quantity, compound, its form, colour, use and symptoms (tablets, agrochemical, household chemical, plant)
- ✓ Perform focused examination on clues and to identify toxidrome, appropriate lab tests (atropine challenge test, cholinesterase test, blood or urine drug assays, electrolytes, Arterial Blood Gas test, ECG, chest X-ray etc.,)

- ✓ If specific compound is identified initiate specific management
  - ABC
  - Decontamination
  - Antidote
  - Elimination

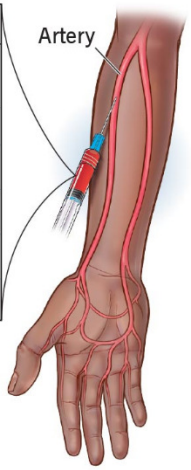
- ✓ If compound is unknown
  - Perform gastric lavage preferably within 6 hours of ingestion and administer activated charcoal if there is no contraindication
  - Continue to monitor for early symptoms and signs of intoxication and provide supportive management

NOTES ON INOTROPES: Inotropes are drugs that modulates heart muscles to beat or contract with more power or less power, depending on whether it's a positive or negative inotrope.

POSITIVE INOTROPES	NEGATIVE INOTROPES
Adrenaline	Amiodarone
Dobutamine	Amlodipine
Dopamine	Carvedilol
Isoprenaline	Metoprolol
Levosimendan	Nicorandil
Milrinone	Propranolol
Noradrenaline	Ramipril
	Telmisartan
	Valsartan

Arterial Blood Gas (ABG)

ABG	Normal range
O_2CT	15-23% per 100 mL of blood
pH	7.35-7.45
$PaCO_2$	35-45 mmHg
PaO_2	80-100 mmHg
HCO_3	22-26 mEq/L
O_2Sat	95-100%



POISONING MANAGEMENT DECONTAMINATION:

Skin should be washed thoroughly with soap and water including genital area and clothes changed, if skin contamination is present

Gastric lavage

1. Life-threatening poisoning and unconscious presentation within 1 hour with precautions to prevent aspiration
2. For Pesticide poisoning – gastric lavage is useful within 6 hours and can be extended even after 6 hours if clinical condition warrants.
3. Tablet poisoning with anticholinergic effects presentation within 4 hours.
4. Sustained release preparation, salicylates, heavy metals within 12 hours
5. Iron or lithium poisoning

Contraindications:
1. Corrosive
2. Comatose patients (secure airway before gastric lavage)

Activated charcoal

1 g/kg as a *single dose* for poisoning with significant toxicity, if ingestion less than 1-2 hours.

Multiple dose activated charcoal 1 g/kg every 4 hours

(Both can be given orally or through Ryle's tube diluted in 150ml of water)

Indication: oleander poisoning, c a r b a m a z e p i n e, d a p s o n e, phenobarbital, quinine and theophylline.

Contradindications: Ileus, vomiting, corrosive poisoning, kerosene poisoning

(*Ileus is a condition where there is persistent abdominal bloating and pain due to build up of gases and liquids. Other symptoms of Illeus are nausea, vomiting, abdominal cramps, severe constipation, loss of appetite*)

Polyethylene glycol (PEG)

Indications: poisonings where activated charcoal alone is not satisfactory.

1.Iron and lithium
2.Sustained release preparations (e.g. theophylline and verapamil)
3.Toxins that form pharmacobezoars (e.g. salicylates)

Procedure:
PEG Given either orally or through nasogastric tube at 2 litres per hour for 2-6 hours.

(A bezoar is a stiff, solid, and recurrent foreign body that is located in the gastrointestinal tract. They are classified depending on the material of origin. A pharmacobezoar is ***foreign material that is formed by drugs)***

POISONING MANAGEMENT ELIMINATION:

Alkaline diuresis

Mechanism: Alkalinisation of the urine increases urinary excretion of weak acids (e.g. salicylates, phenobarbitone).

Indications: Copper sulphate, Salicylates, chlorpropamide, phenobarbitone and possibly the chlorphenoxy herbicides.

Method: Each cycle consists of 500 ml of 0.9 % over 1 hour followed by 400 ml of 5% dextrose with 100 ml Soda bicarbonate over 1 hour and then followed by 500 ml 0.9% NS with 10 mEq of kcl over 1 hour.

- If urine output less than 100ml/hr- then inj. Frusemide IV stat to be given, if urine output not increasing give another dose inj. frusemide IV stat is given and even after that if it is less than 100 ml/hr stop FAD and plan hemoldialysis
- If urine out put more than 100 ml/hr then continue FAD (Patient may be catheritized for monitoring urine output)
- Look for Lungs signs to rule out Pulmonary edema during FAD cycle

(*FAD – Forced alkaline diuresis*)

Contraindication:
Congestive heart failure, Renal failure, Cerebral edema

Haemodialysis

Hemodialysis can be used for poisons which are water soluble, low molecular weight and have low volume of distribution.

Indications: Ethanol, toxic alcohols (Methanol, Ethylene glycol, Isopropyl alcohol), Lithium, Salicylates, theophylline and phenobarbitone

Charcoal hemoperfusion

Mechanism: Blood is pumped through a charcoal cartridge. Charcoal adsorbs the poison compound. Compounds that are removed must have affinity for charcoal.
Indications: Carbamazepine, Theophylline and Paraquat (first 2-3 hours only)
Adverse effects: Thrombocytopenia, consumptive coagulopathy and hypotension

9. Organophosphorous Poisoning

Symptoms	Treatments	Dose/Reason
1. Smooth muscles and glands are first affected and then brain centres are affected.	• Artificial respiration • Atropine	To block peripheral actions to counter, i.e. act muscarinic effects
2. Headache, constriction of chest with pin-point pupils	• Oxime compounds, e.g. pralidoxime	To control convulsions
3. Nausea, vomiting, diarrhoea, abdominal cramps, sweating, salivation, muscular switching.	• Antibiotics	To treat respiratory infections
4. Pulmonary edema, coma, convulsions, excessive bronchial secretions, bradycardia, respiratory failure.	• Mercurial diuretics	To avoid oedema.

12. Arsenic Poisoning

Symptoms	Treatments	Dose/Reason
a. Acute: Capillary damage, epigastric and abdominal pains, vomiting, diarrhoea, jaundice, muscle cramps, pale face, dilated pupil, rapid pulse, convulsion, coma, death	• Artificial respiration • Ferric oxide	To ppt. arsenic to harmless ferric arsenic
	• Sodium thiosulphate	By IV after every 46 hr
	• Dimercaprol (BAL)	Till the symptoms of arsenic disappear
	• Morphine	To reduce the pain.
b. Chronic: Peripheral neuritis, diarrhoea, pigmentation of skin, liver damage, conjunctivitis oedema, carcinoma	• Fresh air	Place the victim in fresh air
	• Sodium thiosulphate	By IV 1 gm in 10 ml water 2 to 3 times/ week for many weeks
1. Anorexia diarrhoea, occasional vomiting, fatigue	• Dimercaprol (BAL)	Till the control over arsenic symptoms
2. Conjunctivitis, eye and nose are affected, sense of fullness of head	• Anticonvulsants	To control convulsion
	• Antidiarrhoeals	To control diarrhoea.
3. Skin rash, brittle nails, falling of hairs		

Universal antidote:

When the nature of ingested poison is unknown, the universal antidote is used to –

- Neutralize the acids
- Absorb the alkaloidal poisons
- Precipitate or chelate the metals, certain glycosides and alkaloids

Composition:

1. Magnesium : 1part
2. Activated Charcoal: 2 part
3. Tannic acid: 1part

The mixture (1tablespoon in 200 ml water) should be given orally or through ryles tube once or twice depending on the condition

Table 1.1 List of antidotes

S. NO	NAME	ANTIDOTE
1	Acetaminophen	N-Acetylcystein
2	Anticholinergics agent	Physostigma
3	Benzodiazepine	Flumazenil
4	Carbom monoxide	Oxygen, hyperbaric oxygen
5	Cyanamide	Amyl Nitrate, Sodium Nitrate, SodiumThiosulfate, Hydroxycobalamin.
6	Digitalis	Digoxin immune feb
7	Methanol Ethylene glycol	Femepizol
8	Heparin	Protamin sulfate
9	Lead	Dimercapto-succinic acid
10	Mercury arsenic gold	Dimercaprol
11	Methemoglobinemia	Methylene blue
12	Opiates	Naloxone, nalmefene or naltrexone
13	Organophosphomates, carbamates, cholinergics	Atropine, pralidoxime
14	Toxic Alcohols	Ethanol Drip, Dialysis Experimental trials underway on Enzyme Inhibitors.
15	Tricyclic Antidepressants	Sodium Bicarbonate
16	Barbiturates	Activated charcoal
17	Phenothaizine	Benztropine, procyclidine
18	Kerosene	Oxygen, antibiotics, steroids
19	Oleander seeds	Atropine,dopamine,epinephrine,isoprenaline
20	Isoniazid	Pyridoxine (vitamin B6)
21	Radioactive iodine	Potassium iodide
22	Snake, coral	Micrurusfulvius antivenin
23	Snakes (rattlesnakes, cotton-mouth, copperhead)	Crotalidae polyvalent antivenin Crotalidae polyvalent immune fab
24	Thallium	Prussian blue

Table 1.2 Newer Antidotes

Sr. No.	POISON	ANTIDOTES
1	Cardiac glycoside	Fab antibodies
2	Sympathomimetic drugs	Esmolol hydrochloride
3	Hypoglycemic agent (sulphonylurea)	Octreotide
4	Arcenic, lead, mercury	Succimer
5	Methanol, ethylene glycol	Fomepizole (4-methylpyrazole)
6	Cyanide	Hydroxycobalamine