

PRINCIPLES IN MANAGEMENT OF TOXICITY CASE

Practical Toxicology : Lab 1

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CLINICAL STRATEGY FOR TREATMENT OF THE POISONED PATIENT

The treatment of the poisoned patients in the emergency department include the following:

1. Stabilization of the patient.
2. Clinical evaluation (history, physical, laboratory, radiology).
3. Prevention of further toxin absorption.
4. Enhancement of toxin elimination.
5. Administration of antidote.
6. Supportive care and clinical follow-up.

CLINICAL HISTORY IN THE POISONED PATIENT

HISTORICAL DATA INCLUDE:

1. Type of toxin.
2. Time of exposure (acute vs chronic), amount taken.
3. Rout of administration
4. **The timing of ingestion** (e.g toxic fungus ingestion, emesis less than 6hrs. is good, no risk of liver failure).
5. Previous suicide attempts or psychiatric history.

SUPPORTIVE ASSESSMENTS

A

- Airway
- Signs of obstruction (dysphonia, cyanosis, apnea)

B

- Breathing
- Chest movement, respiratory rate.

C

- Circulation
- Skin color, temperature, pulse (rate & rhythm)

D

- Disability
- Assess level of consciousness

GENERAL NON-SPECIFIC ASSESSMENT



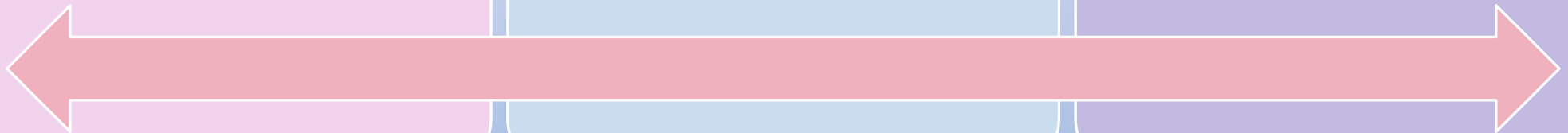
Support breathing
Administration of
oxygen



Cardiovascular
stabilize B.P and
normalize H.R



CNS
consciousness
control
convulsions



MAJOR APPROACHES FOR TOXICITY MANAGEMENT

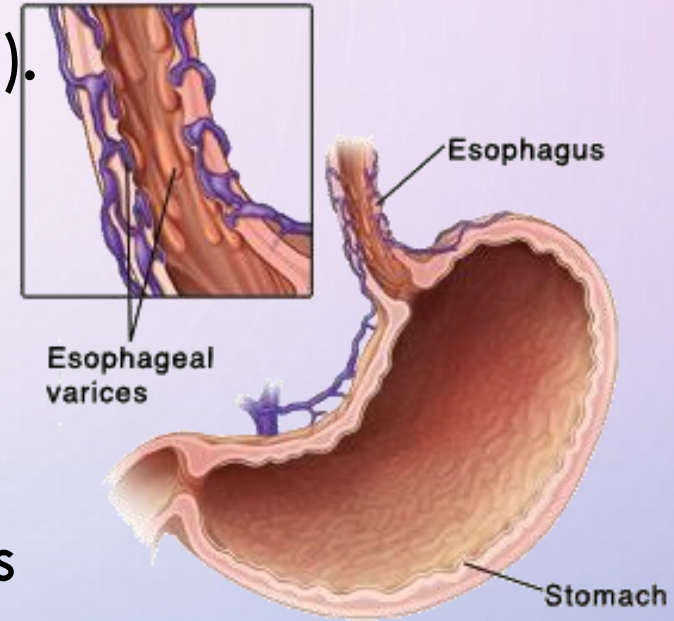
- **FIRST PREVENTION OF GIT ABSORPTION OF TOXIN**
- **GASTRIC EMPTYING:** (Dilution, emesis, gastric lavage, Activated charcoal, cathartics, WBI)

Indications

1. Recent ingestions, less than 1-2 hr., especially for slow release drugs.
2. Ineffective or nonexistent antidotes e.g colchicine.
3. EC or SR tablets e.g: aspirin , verapamil, theophylline.

- **CONTRAINDICATIONS**

1. Caustic acid/alkali ingestions.
2. Hydrocarbon ingestion? Why (**aspiration**).
3. Bleeding diathesis, coagulopathies.
4. Esophageal varices.
5. significant vomiting.



Dilution: 1-2 capfuls for child, 2-3 for adults

Advantages: reduce gastric irritation, add bulk to stomach to enhance emesis.

Disadvantages: excessive water may distend stomach causing evacuation to duodenum, **unconscious patient?, solid ingestion?**

• EMESIS BY IPECAC SYRUP

• INDICATIONS

1. Ingestion at home (home use).
2. Ingestion by infants older than six months.

Contraindications

1. Compromised airway protective reflex.
2. Seizures, loss of consciousness.
3. Caustic acid/alkali ingestion.
4. Prior significant vomiting or hematemesis.
5. AC will adsorb ipecac syrup.



• DOSE OF IPECAC SYRUP

- Adults and children over 6 years: 30ml once.
- Children 1-5 yr. 15ml.
- Infants 6-12 months: 10ml


• IPECAC SYRUP INDUCE VOMITING BY 2 PHASES

1-early: within 30 min (direct stimulation of GIT, irritation of gastric mucosa).

2-late: after 30 min (stimulation of CRTZ)



- **COMPLICATIONS**

1. Aspiration pneumonitis.
 2. Delaying administration of activated charcoal
 3. Electrolyte abnormalities
 4. Persistent vomiting.
 5. Ipecac has been used by individuals with bulimia nervosa as a means to achieve weight loss through induced defensive vomiting.
 6. Arrhythmias with chronic abuse
 7. Convulsions, skeletal muscle weakness.
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- **APOMORPHINE**

- Is a morphine derivative

- Produce rapid emesis 3-5 min (direct stimulation of CRTZ)


- Can be used along with AC.

- Given by injection

- Disadvantage: It may produce prolonged CNS depression.



- GASTRIC LAVAGE

- Usefulness depend on time (10-20%) of gastric content removed after one hour of ingestion
 - DOSE: 10 ml/kg/lavage of 0.9% saline up to 400ml in adult
 - Lavage solution: Lavage fluids administered in 20-30ml aliquots, each followed by removal of the stomach contents.
 - After lavage specific antidote administered if available, otherwise, a slurry of activated charcoal is administered.
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- **GASTRIC LAVAGE**

- **INDICATIONS**

1. Ingestion of drug or toxin that still in stomach (less than 1hr).
2. Ingestion of drug or toxin that delay gastric emptying or EC, SR preparations.

- **Contraindications**

1. Compromised airway
2. Caustic acid or alkali ingestion
3. Bleeding diathesis
4. Prior significant emesis

• **COMPLICATIONS**

- Inadvertent tracheal intubation or airway trauma
- Esophageal /gastric perforation **or** hemorrhage, aspiration pneumonitis.
- **Multidose Activated Charcoal:** Method of enhanced elimination that uses multiple doses of activated charcoal.
- Dosing:0.5-1.0 g/kg every 1 to 4 hours

• WBI (WHOLE BOWEL IRRIGATION)

- Cleanses the bowel by enteral administration of large amounts of PEG-Electrolyte Solution which induce a liquid stool.
- Use nasogastric tube
- Dose: adult 2L/hr. Less than 5years 40ml/kg/hr.

Indications

1. SR,EC drugs e.g theophylline, verapamil.
2. drugs not absorbed by AC (heavy metals, iron , lithium).
3. Cocaine and heroin.

• CONTRAINDICATIONS

1. Paralytic ileus or small bowel obstruction.
2. Rapidly absorbed drugs or toxins like alcohol.
3. Parenteral administration.

Complications

1. Vomiting
2. Bloating
3. Decreased efficiency of activated charcoal.

ENHANCING ELIMINATION OF THE TOXIN

- **INDICATIONS**

1. Toxins with small volume of distribution (remain in blood compartment).
2. Toxins with Low renal clearance (alcohol, beta blockers, lithium, phenytoin, theophylline, salicylates).
3. Toxins that are not lipid soluble or highly protein-bound.

METHODS OF INCREASE ELIMINATION OF TOXIC AGENTS

1. Forced diuresis
2. Ion trapping
3. Extracorporeal methods
 - Dialysis
 - Peritoneal dialysis
 - Hemodialysis
 - Hemoperfusion

- **FORCED DIURESIS**

To produce diuresis by volume expansion with Na-containing solutions, normal saline, often combined with diuretics.

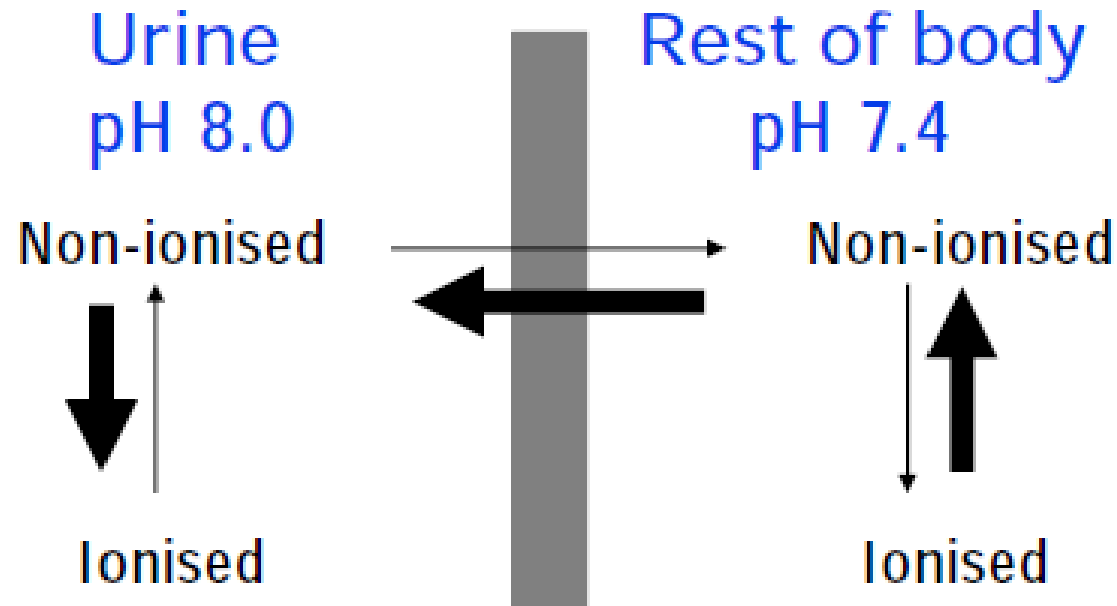
Indication not recommended.

Complications: fluid overload, and electrolyte disturbance

• **ION TRAPPING**

- Alteration of urine PH to prevent renal reabsorption
- Urine alkalization (PH=7.5-8) NaHCO_3 .
- Urine acidification (PH=4.5-6) NH_4Cl , ascorbic acid, HCL.
- Urine alkalization considered for all weak acids such as salicylate , phenobarbital.
- While urinary acidification is not recommended may cause metabolic acidosis .

Urine pH varies (4.5 - 8.0). Sodium bicarbonate may be given to make the urine alkaline



Barbiturate moves into urine - eliminated from body.

- **Extracorporeal methods**

- **Dialysis: For dialyzable toxin**

- Patient not responding or deteriorating in spite of good medical care (Volume of distribution less than 1 L/kg, protein binding less than 50%, water soluble, LM.Wt. Less than 500 da, long elimination $t_{1/2}$)

- **Peritoneal dialysis**

- Enhance elimination of water soluble ,LM.Wt, poorly protein bound substance with low volumes of distribution, too slow to be useful , not recommended

Peritonea,
Cavity →

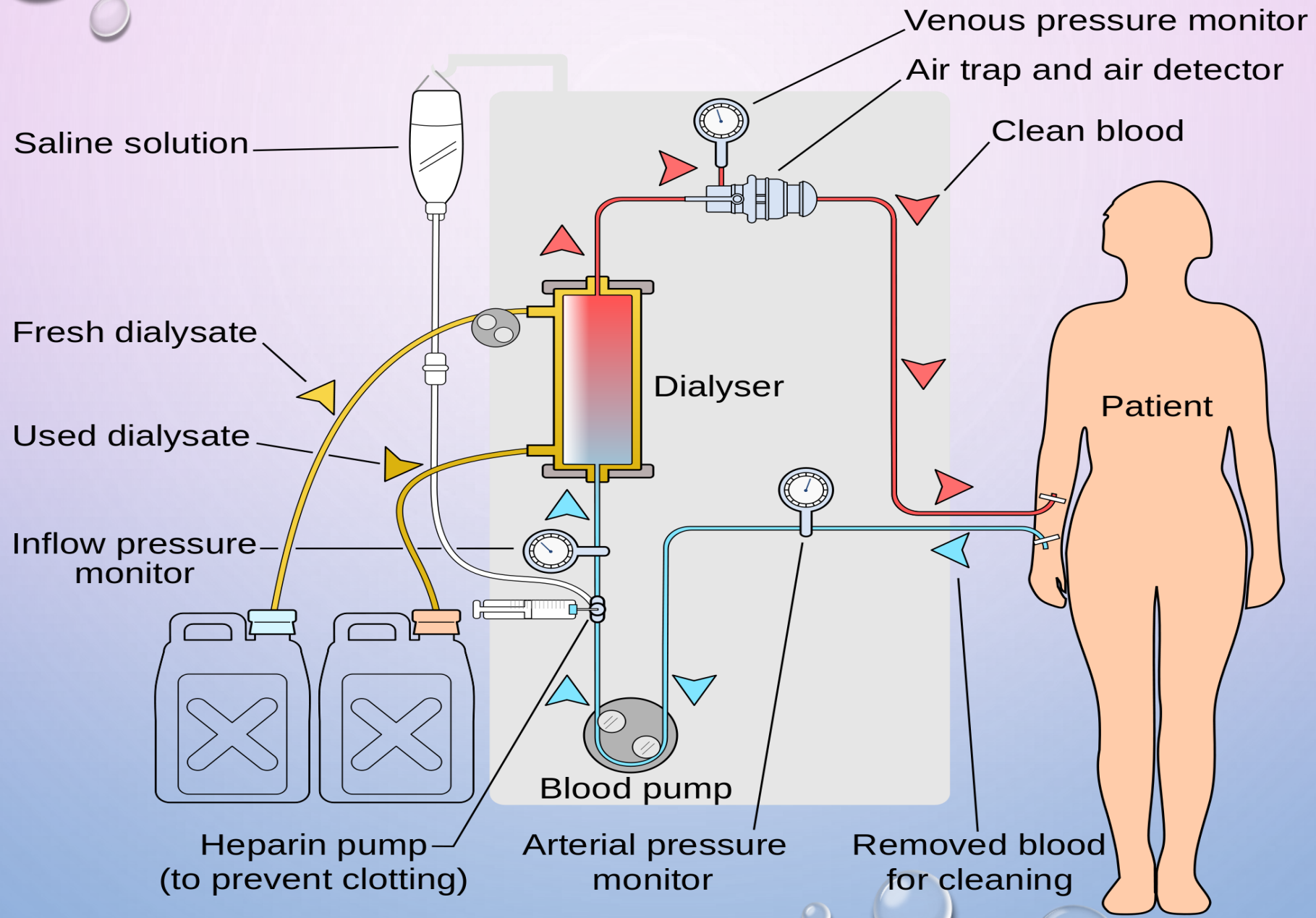


HEMODIALYSIS

- Blood is circulated past a semipermeable membrane, enhance elimination of water soluble, very LM. Wt less than 500 Dalton, non-protein bound substance, with low volumes of distribution less than 1 liter per Kg, low renal clearance rate less than 4ml/kg/min.
- Indications: lithium, bromide, potassium, salicylate, alcohols and chloral hydrate.
- Complications: bleeding, air embolism, nosocomial infections

• HEMOPERFUSION

- Same as hemodialysis but differ in that blood pass through an adsorbent (**charcoal or resin**). Enhance elimination of lipid soluble compounds through adsorption by charcoal, can be used in series with hemodialysis.
- Indications: carbamazepine, phenobarbital, phenytoin, theophylline, (thallium is the only heavy metal adsorbed to AC).



Saline solution

Venous pressure monitor

Air trap and air detector

Clean blood

Fresh dialysate

Dialyser

Patient

Used dialysate

Inflow pressure monitor

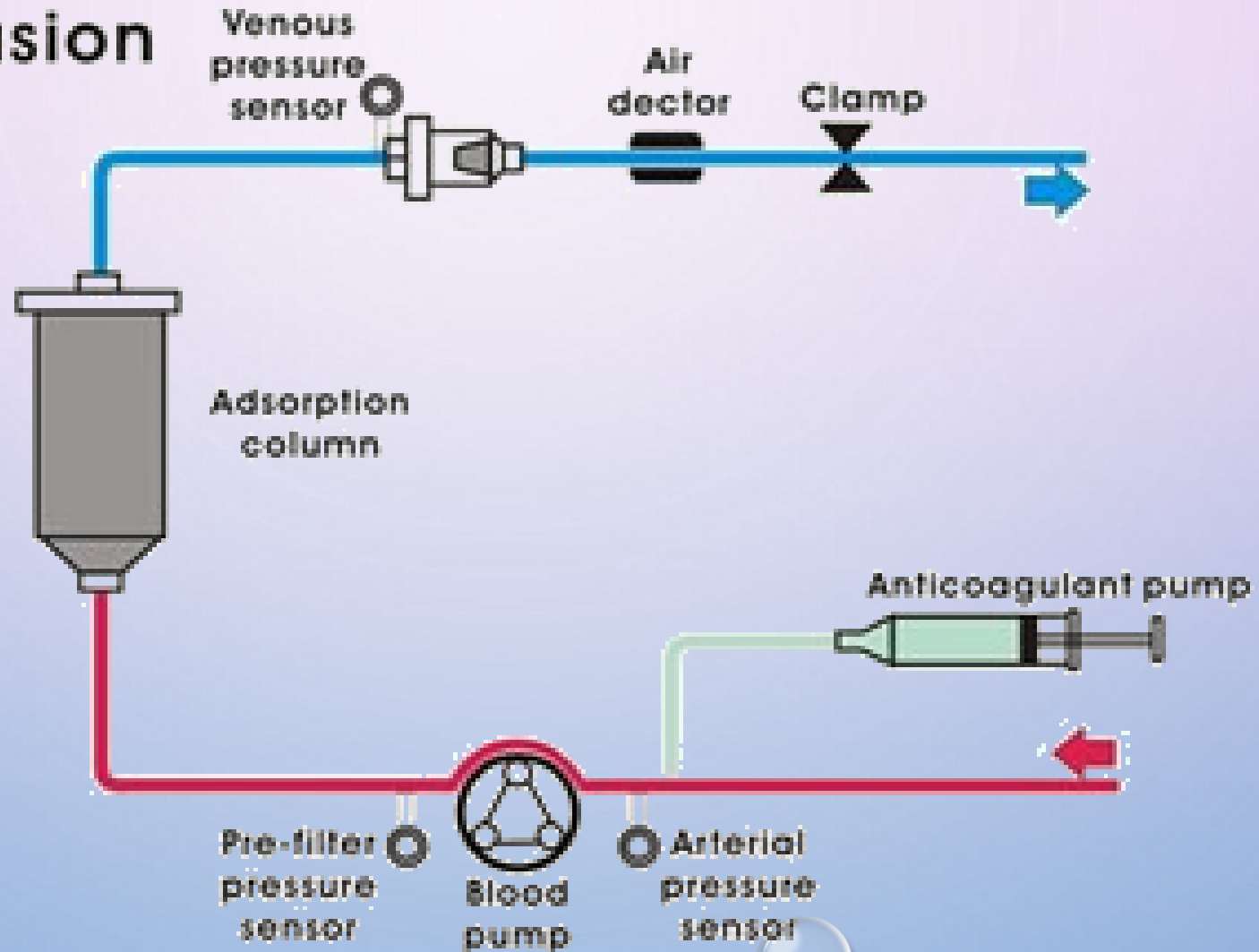
Blood pump

Arterial pressure monitor

Removed blood for cleaning

Heparin pump (to prevent clotting)

Hemoperfusion






- **HEMOFILTRATION**

- Enhance the elimination of very HMWT(10.000-40.000 Dalton) compounds using patient arterial blood Pressure or a blood pump to continuously perfuse a large pore size dialysis membrane by convection and diffusion.

Indication to clear large molecules such as methotrexate, heparin, protamine, insulin, myoglobin.

Complications: same as hemodialysis and secondary to anticoagulation, removal of beneficial therapeutic drugs (antibiotics, antidotes, & vitamins).



- **PLASMAPHERESIS**

- Enhance elimination of large M.WT compounds (greater than 15.000 Dalton) that are not dialyzable and have high protein binding removed to treat and then return blood stream, FFP (fresh frozen plasma) and albumin are used to replace removed plasma.
- Indications : to remove large protein bound molecules Ag/Ab complexes especially digoxin-Fab complexes.
- Complications: transfusion related anaphylaxis or allergic manifestations

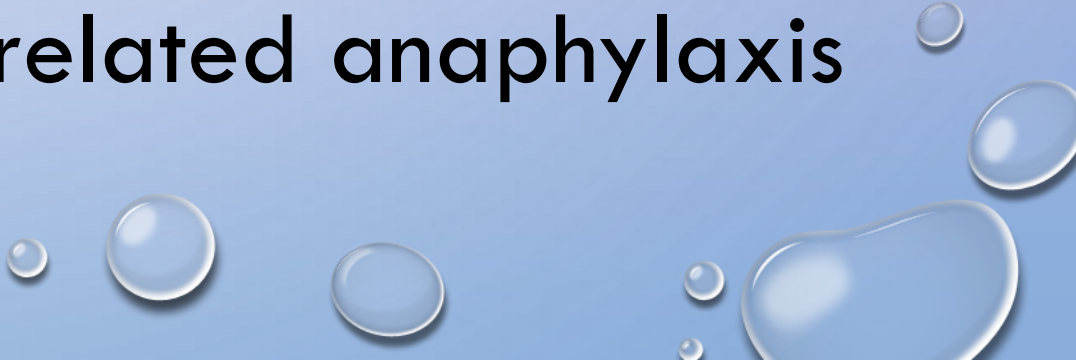


- **EXCHANGE TRANSFUSION**

- Same as plasmapheresis, but the replacement of removed blood is with packed red blood cells or platelets.

- Usually reserved for hemolytic disease of neonates.

- Complications: transfusion related anaphylaxis or allergic manifestations



ANTIDOTES

- An antidote is a substance which can counteract a form of poisoning
- The antidotes for some particular toxins are manufactured by injecting the toxin into an animal in small dose and extracting the resulting antibodies from the host animals blood. This results in **antivenom** that can be used to counteract poison produced by certain species of snakes , spiders, and others.