CLINICAL MANAGEMENT OF TOXICOLOGIC EMERGENCIES

Clinical management of a patient presenting with apparent poisoning involves a stepwise approach to securing effective treatment of the suspected toxicologic emergency.

Whether the perceived emergency is in the hospital emergency room or in the field, such as at home or on the street, it is important to begin management of the situation in a systematic manner

This includes:

(1) stabilization of the patient;

(2) clinical evaluation (including, if possible, history of the events leading to the emergency), physical examination, and laboratory and/or radiological tests;

(3) prevention of further absorption, exposure, or distribution;

(4) enhancement of elimination of the suspected toxin;

(5) administration of an antidote; and

(6) supportive care and follow-up.

1. Stabilization of the patient

involves a general assessment of the situation and the environment, overall appearance of the patient, and maintenance of vital signs. Removal of the victim from the obvious source of contamination, such as from fumes, gas, or spilled liquid, is of primary concern. This is followed by maintenance of the ***ABCs of clinical management; that is, maintain airway, breathing, and circulation, which are crucial to survival..***

This includes monitoring of blood pressure and heart rate, ensuring that respirations are adequate, checking the status of the pupils, determination of skin temperature, color. There may be wide variability in the initial signs and symptoms, especially in the first few minutes post exposure. Stabilization includes not only the return of vital signs to normal but also normal rhythm

Clinical evaluation

includes documentation of the history of the events leading to the emergency. This is accomplished more easily in the emergency room, or on phone intake, by a witness or the patient who is conscious and able to respond. Determination of the substance ingested can also be obtained by inspection of the area adjacent to the victim and questioning of any potential witnesses..

Time of exposure is critical and can influence the course of treatment and prognosis. If time permits, calls to a local pharmacy or physician's office may contribute some valuable information as to the etiologic agent. Location of the victim, neighborhood, and activity in the vicinity, may also divulge some hints as to the nature of the ingested agent

Physical examination involves identification of a constellation of clinical signs and symptoms that, together, are likely associated with exposure from certain classes of toxic agents. Also known as the identification of the toxic syndrome or “toxidrome,” this compilation of observations allows for the initiation of treatment and progress toward follow-up care and support.

Common Toxidromes and Their Clinical Features

Anticholinergic Dry mucous membranes, flushed skin, urinary retention, decreased bowel sounds, altered mental status, dilated pupils,

Sympathomimetic Psychomotor and physical agitation, hypertension, tachycardia, hyperpyrexia, diaphoresis, dilated pupils, tremors; seizures (if severe)

Cholinergic SLUDGE (sialorrhea, lacrimation, urination, diaphoresis, gastric emptying), BBB (bradycardia, bronchorrhea, brochospasms); muscle weakness, seizures

Opioid CNS depression, miosis, respiratory depression, bradycardia, hypotension, coma

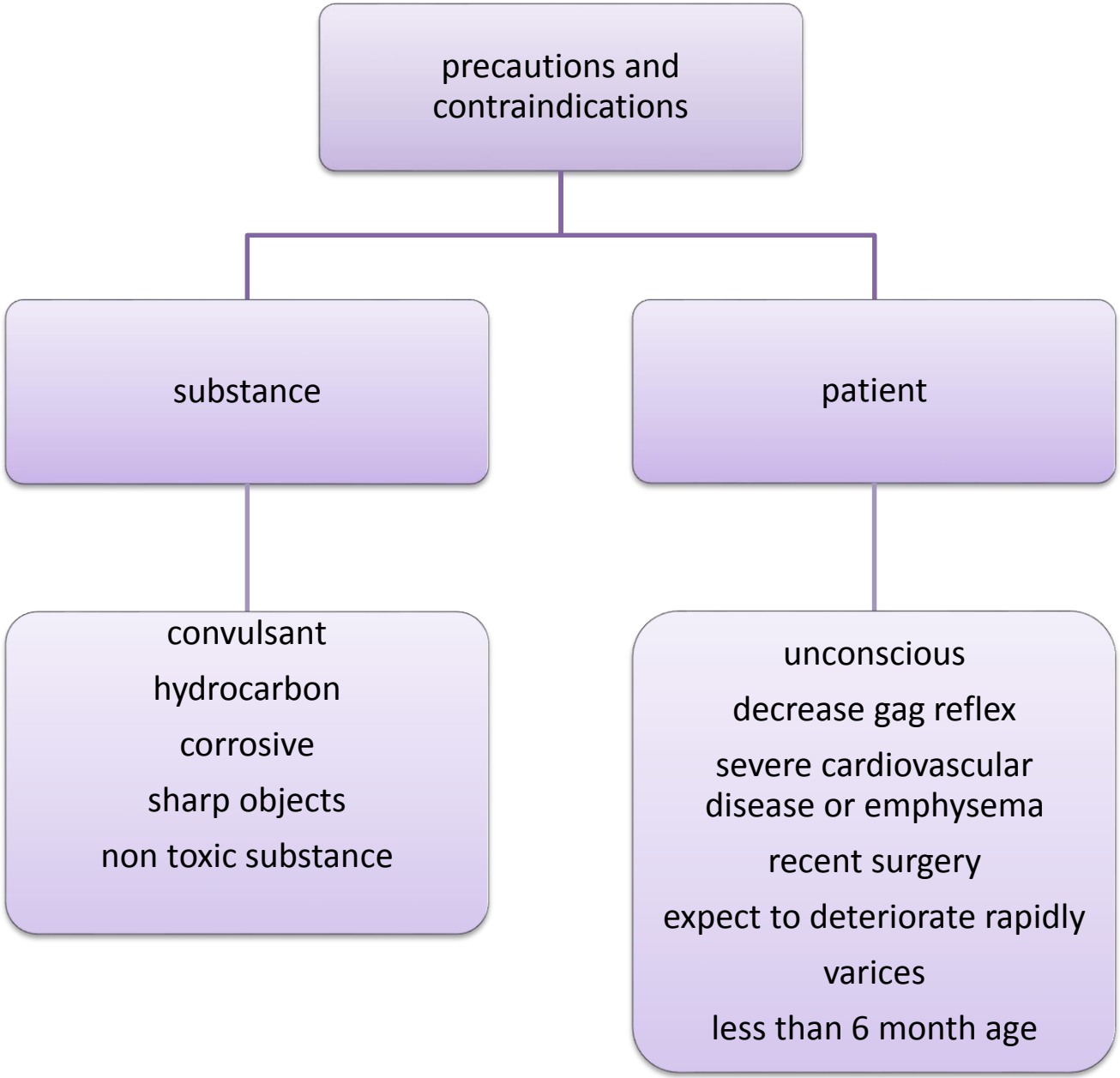
Benzodiazepine Mild sedation, unresponsive or comatose with stable vital signs; transient hypotension, respiratory depression

3. prevention of further absorption, exposure, or distribution;

or exposure to a toxic agent initially involves removing the patient from the environment, especially in the presence of gaseous fumes or corrosive liquids. In the event of dermal exposure to a liquid, removal of the contaminated clothes and thorough rinsing with water are important steps. Rinsing the exposed area with soap and water are of great benefit for acid and phenol burns

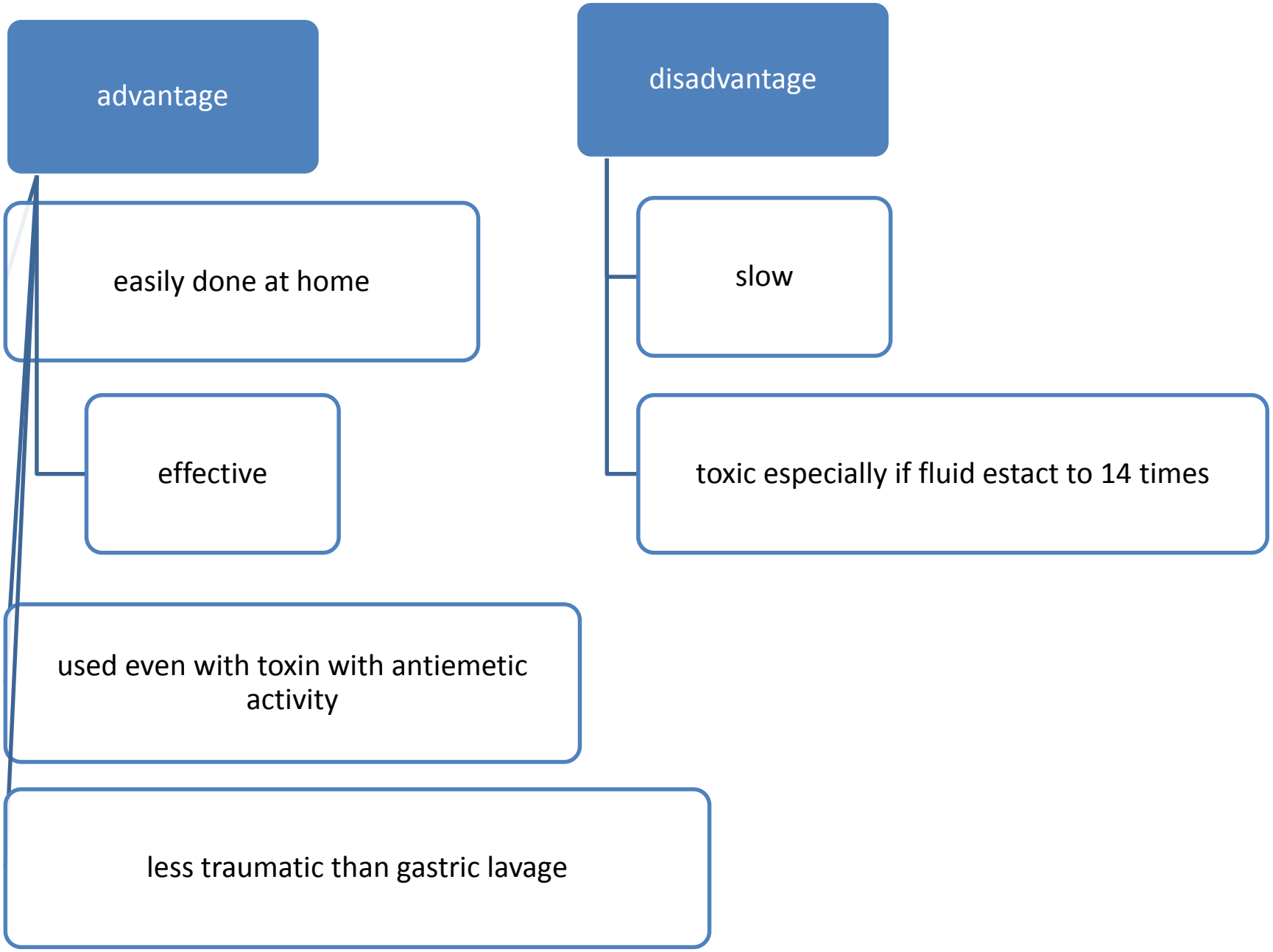
Limiting exposure of oral intoxication of an agent should be pursued immediately after a known ingestion. In the home or ED, several methods can be employed to limit intestinal absorption, enhance bowel evacuation, or promote emesis. Activated charcoal is the best method to diminish intestinal absorption.

- Emesis
- For many years emesis has been a mainstay for treating the ingestion of toxic agents as the first line procedure because it can be easily done at home.


precautions and contraindications
substance
patient
convulsant
hydrocarbon
corrosive
sharp objects
non toxic substance
unconscious
decrease gag reflex
severe cardiovascular disease or emphysema
recent surgery
expect to deteriorate rapidly
varices
less than 6 month age

- Vomiting should be induced only if there is sufficient bulk (fluid) in the stomach to serve as a carrier for the ingested poison.
- If the patient vomits only a portion of the ingested toxin before absorption this could be sufficient to change prognosis

- Syrup Ipecac:
- Ipecac is derived from the root of Cephaelis ipecacuanha or C.acuminata .
- Emetine and cephaeline are the alkaloids that cause emesis through early and late phases.
- The early phase occurs within 30 minutes by direct action on GI tract , this phase is slow .
- The late phase occurs by effect on chemoreceptor trigger zone that activates the vomiting centers in reticular formation
- Vomiting does not occur in 15 to 20 minutes because effectuate coordinated somatic and visceral motor activity.


advantage
easily done at home
effective
used even with toxin with antiemetic activity
less traumatic than gastric lavage
disadvantage
slow
toxic especially if fluid estact to 14 times

Dose of Ipecac:

6-12 months	• 5-10 ml
1-12 years	• 15 ml
adult	• 30 ml

Second dose may be given within 20 to 30 minutes.

- Adverse effects:
- Include protracted vomiting , diarrhea , lethargy , diaphoresis and fever .
- Emetine is cardiotoxin in chronic use in patients with anorexia nervosa or bulimia which results in peripheral myopathies and sometimes fatal cardiomyopathies.

- Apomorphine:
- Is a morphine derivative that produce rapid emesis within 3-5 minutes through direct stimulation of the chemoreceptor trigger zone…… it is no longer recommended.

- Soap solution:
- If ipecac is not available , one alternative is dish washing liquid detergent which produce emesis by direct stivulation of the GI mucosa .
- Two to three tablespoonfuls should be mixed with 6-8 ounces of water.
- Liquid deterents should not be confused with laundry detergents or electric dishwasher granular products that are corrosive and may cause injury.

- Mechanical stimulation :
- Stimulation of the back of the tongue or pharynx has been recommended by blunt object such as a spoon or tongue depressor. fingers are not advised since that may be bitten by the victim.
- This procedure is available but lack effectiveness (gag is not the same as vomiting).

Lavage:

- Is a process of washing out the stomach with solutions including water , saline , sodium bicarbonate , calcium salts , tannic acid and potassium permanganate .
- Lavage is sometimes indicated when poisons must be quickly removed from stomach or when emesis is contraindicated.
- Patient's airway should be protected by intubation.
- Patient placed in left lateral decubitus position to permit pooling of gastric contents and to reduce risk of aspiration into lung.

- Largest diameter tube should be used (40 F for adults and 16-26 F for children.
- Saline is recommended in children to prevent electrolyte imbalance , 50-100 ml in children and 200-300 ml in adults , allowed to mix and then drained out.
- A minimum of 2L are required to wash out most stomach contents.
- Lavage is contraindicated in corrosives and petroleum distillates and sharp objects and seizures.
- Complications include pulmonary aspiration , esophageal perforation or hastened gastric emptying time into the intestine.
- If a cool solution is used too rapidly , the core temperature may be dangerously lowered.

Adsorbents:

- Another mean to reduce absorption of an ingested poison is by use of an adsorbent.
- Although several adsorptive substances including kaolin , Fuller's earth (high affinity for herbicide paraquat), cholestyramine , pectin and attapulgite are occasionally recommended , they are not always effective binders of ingested chemicals.
- Activated charcoal is used for routine adsorption of GI poison.

- Activated Charcoal:
- Activated charcoal is a finely divided black powder that is sparingly soluble in water. It is prepared by pyrolysis of organic materials such as wood pulp.
- The activation process occurs when charcoal fragments are exposed to oxidizing gas composed of steam or oxygen at temperatures of 600° to 900° . the result is an increased surface area of about 1000 M2/g which increases effectiveness.

- In the stomach and intestine, poisons diffuse through the numerous pores on charcoal surface to form tight chemical bonds .this charcoal – chemical complex then passes through the intestinal tract to reduce the chance of the chemical being absorbed.
- Effectiveness is dependent on the quality of activated charcoal , time between ingestion and charcoal administration , drug dose ,charcoal :drug ratio and stomach contents (PH and composition). .

- Charcoal should be mixed immediately before use because it is readily adsorbs materials from air and water.
- other preparations are ready to use with sorbitol (sweet taste and produces catharsis and single dose is preferred). Activated charcoal leaves a gritty sensation in mouth, temporarily discolors the gums and mouth and sticks to the throat.
- Liquid activated charcoal slurry preparations are commercially available and acceptable to children.

- The optimal dose is uncertain; the usual recommended dose is 50 to 100 g for an adult and 25 to 50 g for a child and 1 g/kg for infants. Effective dose may reach 10:1 charcoal to drug.
- Large doses cause occasional constipation and it is contraindicated if there is gastrointestinal obstruction.
- Multiple doses of 1 g/kg every 2-4 hr has been reported to enhance poison elimination because of interruption of enterohepatic recirculation that adsorb to drug secreted across gastric membranes into bowel lumen.

- It binds poorly to : elemental metals, boric acid, cyanide, electrolytes, ferrous sulfate, pesticides, petroleum distillates, ethanol, methanol and mineral acids and alkali.
- Multiple oral doses useful with : carbamazepine, dapsone, digitoxine, nadolol, phenobarbital, phenylbutazone and theophylline.

- For maximal effectiveness , activated charcoal should be administered within 30 minutes of poison ingestion but could be beneficial after hours especially in drugs that slow gastric emptying e.g., anticholinergics and sedatives .
- It should follow the use of syrup ipecac if they are combined at least 30 min because it adsorbs emetine.
- Prior to this time, it was also common to mix activated charcoal with tannic acid and magnesium oxide to form the traditional (universal antidote).

- Whole bowel irrigation:
- A new therapy for gastric decontamination by using solution of sodium sulfate and polyethylene glycol electrolyte e.g., golytely and colyte that are not absorbed and does not lead to fluid or electrolyte imbalance and seems to be safe in children.
- It used for salicylates, lithium, ampicillin, iron and zinc sulfate and in removing of cocaine packets.

- Demulcents:
- Many poisons cause oral and gastric mucosal irritation but no serious toxicity and all demulcent is all that is needed.
- This includes ice cream, milk and egg whites (up to dozen) in corrosive intoxications

- Topical decontamination:
- Skin:
- Numerous lipid soluble chemicals can be absorbed through skin and cause systemic toxicity.
- All contaminated clothing should be removed, skin should be thoroughly flushed with water and washed with mild soap.
- No creams, ointments or occlusive bandages should be placed over the contaminated area.

- Eyes:
- Many substances are absorbed within minutes through the cornea causing permanent damage.
- Irrigation with lukewarm water must be immediately instituted and continued for at least 15 to 20 minutes, contact lenses should be removed.

- (4) enhancement of elimination of the suspected toxin
- Indications include:
- Patient presents with overt signs and symptoms of toxicity.
- Patient’s status deteriorates despite good supportive care.
- Amount of toxic agent ingested is likely to produce significant toxicity or death.
- Normal routes of detoxification and elimination of the toxic agent are impaired.
- Patient ingested significant quantity of an agent that is metabolized to a toxic metabolite.

- They are include:
- Forced diuresis:
- It was recommended to help remove chemicals and drugs from blood by kidney by either mannitol or furosemide.
- This carries risk of pulmonary and cerebral edema that this method is no longer used.

- The goal of urinary PH manipulation is to enhance renal excretion of compound by increasing the amount of the ionized form in the kidney , depending on dissociation constant (Ka) of compound and the PH of the medium , as toxic agents pass through the kidney, they are filtered ,secreted and reabsorbed across the tubular membrane.
- The ionized form is trapped in the renal tubule and excreted.
- Alkaline diuresis is achieved by sodium bicarbonate 1 to 2 mEq/kg every 3 to 4 hr to remove weak acids such as salicylates , phenobarbital and 2,4-dichlorophenoxyacetic acid.
- Acid diuresis is achieved by using ammonium chloride 75 mg/kg/24 hr.to increase elimination of weak bases such as amphetamines, phencyclidine and quinidine .

Dialysis and Hemoperfusion

- They are used as adjuncts to management of severely intoxicated patients.
- They should never replace the use of more specific treatment or antidotes.
- Dialysis is governed by the laws of osmosis .a diffusible chemical dissolved in water partitions across a semipermeable membrane and the solution moves from an area of higher concentration (blood) to one of lower concentration (dialyzing solution).

Peritoneal dialysis:

- It is the most easily performed method and with low risk for complication and does not require elaborate equipment and needs little medical supervision.
- The procedure is undertaken by inserting a tube into peritoneum .the peritoneal membrane serves as the semipermeable (dialyzing) membrane.
- Dialysis solutions normally consist of a balanced electrolyte and dextrose to maintain osmotic pressure above that of extracellular fluids.

- Solutions vary in composition;
- Hypertonic for water soluble chemicals.
- Albumin for highly protein bound chemicals.
- Adjusting its PH as in penobarbital ingestion using alkaline solution.
- Lipids such as peanut oil are added to attract highly lipid soluble chemicals such as glutethimide.
- Peritoneal dialysis is 5-10 times less efficient than hemodialysis and slow and may complicated by; abdominal pain , intraperitoneal bleeding , abdominal viscera perforation , peritonitis water and electrolytes imbalance and protein loss.

- Hemodialysis:
- Cellophane bag is used to form the semipermeable membrane.
- The chemical must have low molecular size to diffuse passively across dialyzing membrane such as salicylates, usually chemicals greater than 500 daltons do not cross the membrane such as highly protein bound.
- The effectiveness is determined by the rate of clearance, plasma concentration and duration of dialysis.
- It is useless for chemicals that are extensively taken up by tissues.
- Complications include clotting and seepage of blood from around connections, hypotension, convulsions, arrhythmias, infection and hematologic defects.

- Hemoperfusion:
- Hemoperfusion is more effectiveness than dialysis for removing chemicals especially lipid soluble and protein bound.
- Blood is withdrawn and passed directly over the adsorbing material contained in sterile columns.
- Indication is evaluated by;
- 1-Whether the adsorbent will eliminate the chemical from the blood.
- 2-the volume of distribution must be small and the half-life of the chemical relatively long.
- Complications include trapping of WBC and platelets and microembolization.