Principle in management of poisoned patient

What to do, and in what order to do it?!

Poisoning in Jordan: Analysis of Three Year Data from Jordan National Drug and Poison Information Center

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Abstract

Objectives: This study aims at analyzing the patterns of poisoning cases reported to the Jordan National
Drug and Poison Information Center and emphasizes the roles and challenges faced by the center from a
practical perspective.
Materials and Methods: A retrospective analysis of a three year period 2006- 2008 was conducted
depending on the data collected by the center.
Results: Analysis of data shows that a total of 914 inquiries were received by the center during the study
period. More than 90% of the enquiries were from health care providers and 3.6% from the public that
included victims and victims' relatives. The exposed population age ranged from less than 1 year to 80
years, with the highest incidence in children less or equal to 5 years (34.9%). The most common reason
of poisoning was unintentional (49.39%), followed by suicidal attempts (23.94%). The highest incidence
of poisoning was due to drugs which accounted for more than 42% of all exposures, where
acetaminophen products were responsible for most of the cases within this category (13.4%).
Conclusion: The poisoning features in Jordan reflect mostly the incidences of poisoning within
Amman- the capital of Jordan- in addition to other major cities in the country. Yet the center seeks more
perception from the public, support from healthcare providers and verification from related
governmental parties, which will enable the center to fulfill its duties according to international
standards.

Keywords

Poisoning, Information, Jordan.

Poisoning in Jordan

- Period during 2006-2008 at the National Drug and Poison Information Center (NDPIC) (poisoning emergency no. 109)
- The problem is underestimated and sometimes unreported
- The most common reason of poisoning was unintentional (49.39%), followed by suicidal attempts (23.94%)
- The highest incidence was in children less or equal to 5 years (34.9%), then 20-29 years (~23%)

Poisoning in Jordan

- The major cause of poisoning was due to drugs (42%) of all exposures, where **acetaminophen** products were responsible for most of the cases within this category (13.4%) then **benzodiazepines**, **NSAID** and then **antihistamines**
- Bites and stings were relatively highly prevalent (23.7% of exposures), which is justified by the geographical nature of Jordan
- Then household products, hydrocarbons and pesticides

How Does the Poisoned Patient Die?

- Many toxins depress the **central nervous system (CNS)**…coma
- A comatose patients frequently lose their airway protective reflexes and their respiratory drive
- ……may die as a result of airway obstruction by the
  - ✓ flaccid tongue,
  - ✓ aspiration of gastric contents in the tracheobronchial tree, or
  - ✓ respiratory arrest
- ✓ ……most commonly due to overdoses of narcotics and sedative-hypnotic drugs (eg, barbiturates and alcohol)

How Does the Poisoned Patient Die?

- **Cardiovascular toxicity……**Hypotension may be due to depression of cardiac contractility
- ✓ Hypovolemia resulting from vomiting, diarrhea
- ✓ Peripheral vascular collapse due to blockade of -adrenoceptor-mediated vascular tone
- ✓ Lethal cardiac arrhythmias…….overdose of ephedrine, amphetamines, cocaine, digitalis, and theophylline
- ✓ Hypothermia or hyperthermia can also produce severe hypotension

How Does the Poisoned Patient Die?

- **Seizures** may cause pulmonary aspiration, hypoxia, brain damage
- **Cellular hypoxia** may occur in spite of adequate ventilation (poisons that interfere with transport or utilization of oxygen cyanide, HS, CO..)
- Other **organ system damage may be delayed** in onset….. acetaminophen or certain mushrooms / paraquat
- Finally some patients may die because the behavioral effects of the ingested drug may result in traumatic injury (alcohol/sedative-hypnotic drugs)

Principle in management of poisoned patient

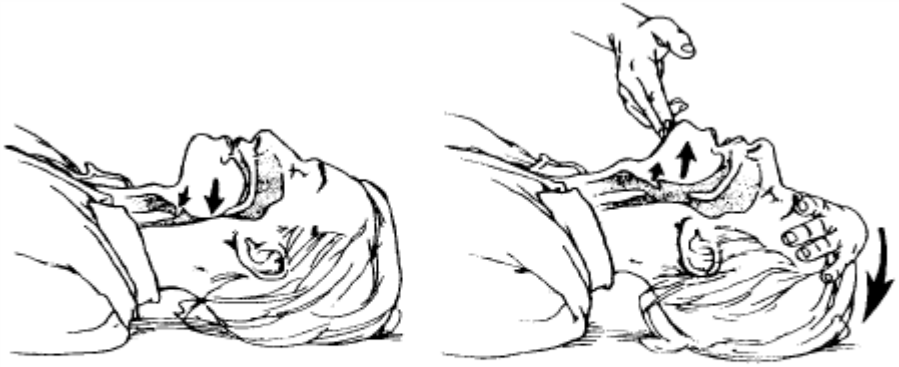
- While the majority of poisoned patients are awake and have stable vital signs, some may present unconscious or in shock…..so….:

1. Always assess the condition of the patients "ABCD"…clinical evaluation
2. Decide what must be done and in what order
3. Once the patient is stabilized, *and only then*, try to identify the poison, the quantity involved and how much time has been elapsed since exposure
4. Then, proceed with antidoting the poison

Airway……Ensure airway and protect cervical spine

- **Airway Assessment:**
  - ✓ Consider to breath and speak to assess air entry
  - ✓ Signs of obstruction (flaccid tongue, vomitus….)
  - ✓ Apnea, dysphonia, cyanosis, airway distress
- **Management Goals:**
  - ✓ Prevent aspiration
  - ✓ Permit adequate oxygenation
- **Basic Management**
  - ✓ Simple positioning in the lateral decubitus position
  - ✓ Chin lift to open the airway
  - ✓ Sweep and suction to clear mouth of foreign material

Oral axis
Pharyngeal axis
Tracheal axis



SOURCE: Copyright. **American Heart Association.** *Instructor's Manual for Basic Life Support.* Dallas: American Heart Association, 1987.

★ *Figure 2-5. Head-tilt/chin-lift technique of opening airway.*

Airway

- The airway can also be maintained with **artificial oropharyngeal or nasopharyngeal airway devices**

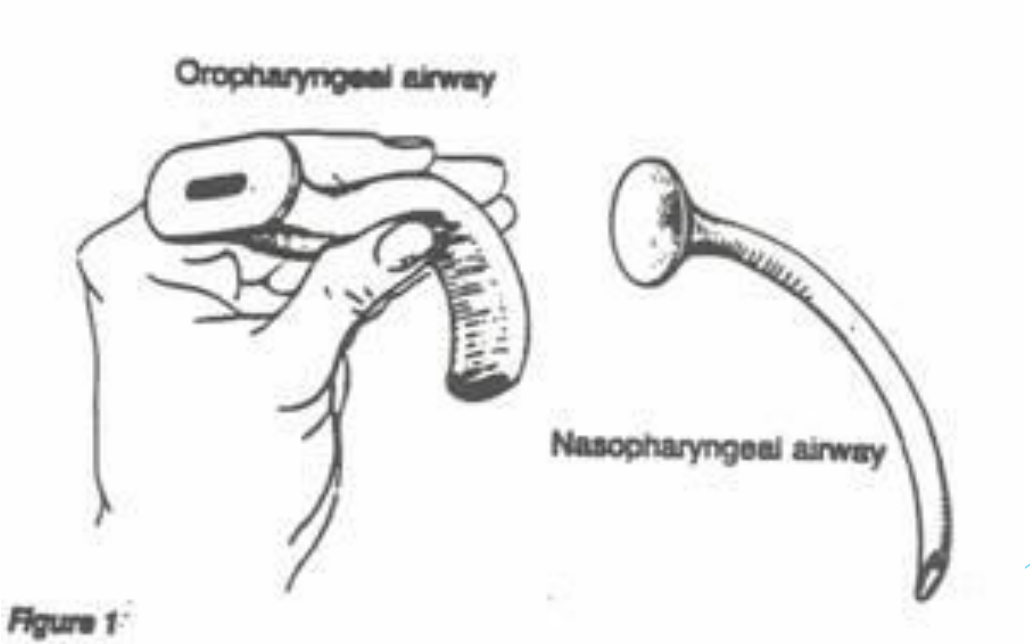
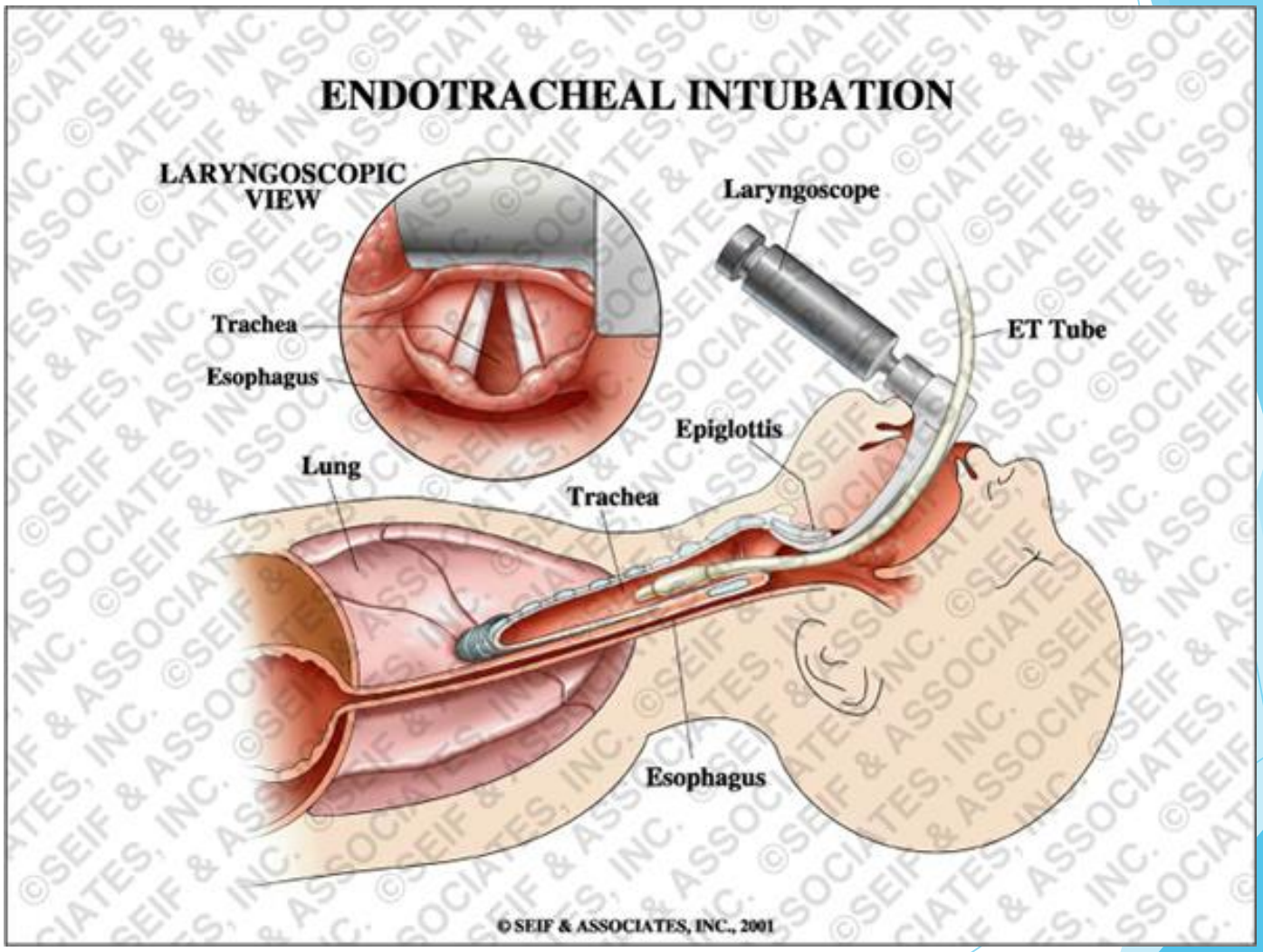


Figure 1

Airway

- **Endotracheal intubation**: *attempted only by those with training*
- Complications: vomiting with pulmonary aspiration; local trauma to the oropharynx, nasopharynx, and larynx; inadvertent intubation of the esophagus or a main-stem bronchus; and failure to intubate the patient after respiratory arrest has been induced by a neuromuscular blocker
- *Indications*:
  - ✓ Unable to protect airway
  - ✓ Inadequate spontaneous ventilation
  - ✓ Arterial blood gases (pCO_2 > 60%)

Orotracheal or nasotracheal intubation



Breathing

Pulse Oximetry

- **By observation and oximetry** (monitor the saturation of pt's Hb)
- **Ventilatory failure**…..most common cause of death in poisoned patients:
- **Hypoxia**……brain damage, cardiac arrhythmias, and cardiac arrest
- **Hypercarbia or hypercapnia**…….acidosis (may contribute to arrhythmias)
- **LOOK** for mental status, chest movement, respiratory rate
- **LISTEN** for air escaping during exhalation, sound of obstruction
- **FEEL** for the flow of air, chest wall for crepitus
- **ASSESS** tracheal position, auscultation of all lung fields

Circulation

- Check skin color, temperature, capillary refill
- Check blood pressure and pulse rate and rhythm
- Management: stop major external bleeding
- Begin continuous ECG monitoring

Disability

- Assess level of consciousness by **AVPU** method
  - **A**…..**ALERT**
  - **V**…..responds to **VERBAL** stimuli
  - **P**…..responds to **PAINFUL** stimuli
  - **U**…..**UNRESPONSIVE**
- Size and reactivity of pupils
- Movement of upper and lower extremities

Neurological status

Depression	Symptoms
Stage 0	Asleep; drowsy but accountable; respond to verbal
Stage 1	Gag reflex, DRT present, respond to pain
Stage 2	DRT present, gag reflex present, no response to pain
Stage 3	DRT absence, no response to pain
Stage 4	Stage 3 symptoms + cardiovascular and respiratory compromise

***DRT**: deep tender reflux*

Neurological status

Excitation	Symptoms
Stage 1	Restlessness, insomnia, tachycardia, flushed face, mydriasis
Stage 2	Stage 1 symptoms + convulsion, mild pyrexia
Stage 3	Arrhythmia, delirium, mania, HTN, hyperpyrexia
Stage 4	Stage 3 symptoms + convulsion and/or coma

Altered mental status

- A decreased level of consciousness is the most common serious complication of drug overdose or poisoning
- **Coma** sometimes represents a postictal phenomenon after a **drug- or toxin-induced seizure**
- Coma may also be caused by brain injury associated with **infarction or intracranial bleeding**
- Coma frequently is accompanied by **respiratory depression, which is a major cause of death**
- May be complicated by **hypotension**, **hypothermia**, **hyperthermia**, and **rhabdomyolysis**

The *DONT* Cocktail

- Administer supplemental **oxygen**
- **Dextrose**: All patients with depressed consciousness should receive concentrated dextrose unless hypoglycemia is ruled out
- Adults: 50% dextrose, 50 mL (25 g) IV.
- Children: 25% dextrose, 2 mL/kg IV
- **Thiamine**: is a cofactor in a number of metabolic pathways allowing aerobic metabolism to produce ATP and,
  - ✓ Important in normal neuronal conduction

The DONT Cocktail

- Given to prevent or treat Wernicke-Korsakoff syndrome (encephalopathy & psychosis) resulting from thiamine deficiency in alcoholic patients (poor diet) and others with suspected vitamin deficiencies (100 mg, in the IV bottle or intramuscularly)
- **Naloxone:** All patients with CNS depression and respiratory depression should receive naloxone!
- ***Caution:*** may precipitate abrupt opioid withdrawal

The DONT Cocktail

- DOSE:
- 0.4 mg **IV** (may also be given **intramuscularly**)
- If there is no response within 1–2 minutes, give naloxone, 2 mg IV
- If there is still no response and opioid overdose is highly suspected give naloxone, 10–20 mg IV

Exposure

- Remove clothes and other items that interferes with a full evaluation

History

- Historical data should include the type of toxin
- Route of administration (e.g. ingestion, inhalation, intravenous)
- Also ask about prior suicide attempts or psychiatric history

Identify the toxicant

- Patient history
- **SATS**
  - **S**: substance (name, ingredients, regular acting or sustained release, enteric coated?)
  - **A**: amount ingested
  - **T**: time ingested/exposure
  - **S**: symptoms (relate time ingestion to symptoms)

Identify the toxicant

- **AMPLE**
  - **A**: allergies, age, gender, wt
  - **M**: medication (including prescription drugs, OTC medication, vitamins, and herbal preparation)
  - **P**: past diseases, substance abuse or intentional ingestion
  - **L**: last meal….influence absorption
  - **E**: events leading to current condition

2. Physical Examination

- During the collection of data (history), a **brief physical examination** should be performed, emphasizing those areas most likely to give clues to the toxicologic diagnosis

- These includes: **vital signs** (BLOOD PRESSURE, PULSE, RESPIRATIONS AND TEMPERATURE), **eyes** and **mouth**, **skin**, **abdomen**, and **nervous system**

Blood Pressure

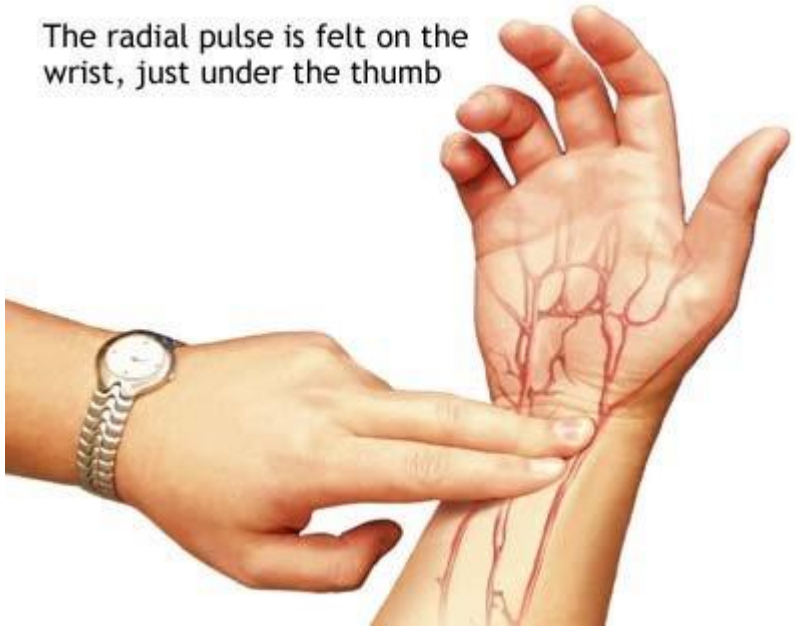
HYPERTENSION

- Sympathomimetics
- Amphetamines
- Cocaine
- MAOI
- Nicotine

HYPOTENSION

- Antipsychotic
- Beta blockers
- Calcium channel blockers
- Ethanol
- Nitrates
- Opioids
- Sedative-hypnotics
- Tricyclic antidepressants *(with tachycardia)*

Pulse


The radial pulse is felt on the wrist, just under the thumb


A.D.A.M.

TACHYCARDIA

- Amphetamines
- Atropine
- Antihistamines
- Caffeine
- Cyanide
- Nitrates

BRADYCARDIA

- Beta blockers
- Calcium channel blockers
- Clonidine
- Digitalis
- Mushrooms
- Organophosphates
- Sedative hypnotics

RESPIRATION

HYPERVENTILATION

- Rapid respirations are typical of toxins that produce metabolic acidosis or cellular asphyxia..
  - Salicylates
  - Carbon monoxide
  - Ethylene glycol
  - Hydrocarbons

HYPOVENTILATION

- Anesthetics
- Cyanide
- Ethanol
- Sedative hypnotics
- Opioids

TEMPERATURE

- **HYPERTHERMIA (>40˚C)**:
- Sympathomimetics
- Amphetamines
- MAOI
- Anticholinergic
- Drugs producing seizures or muscular rigidity

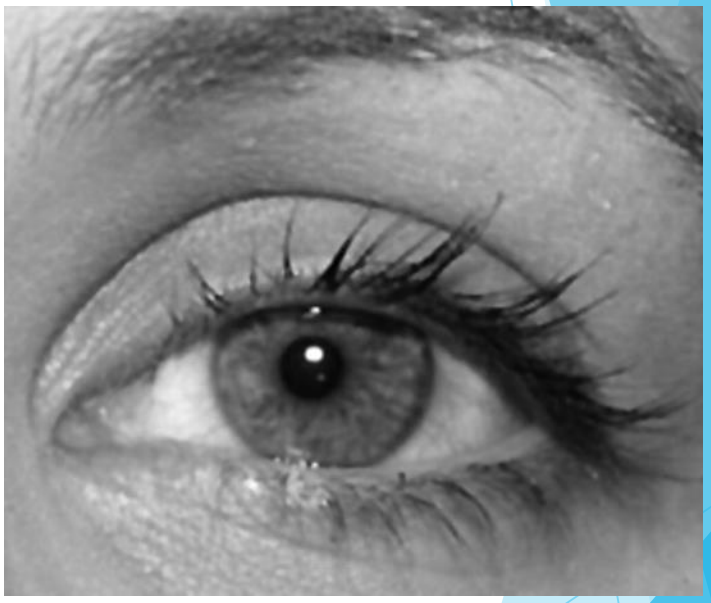
TEMPERATURE

- **HYPOTHERMIA (<32°C)**:
  - ✓ CNS depressants (barbiturates, opioids, ethanol, TCA...),
  - ✓ Hypoglycemic agents
  - ✓ Drugs that cause vasodilation
- …..(especially if accompanied by cold environment)
- N.B: commonly accompanied by hypotension and bradycardia

EYE FINDINGS

Miosis:

- Cholinergic
- Clonidine
- Insecticides
- Narcotics
- Phenothiazines



EYE FINDINGS

Mydriasis:

- Anticholinergic
- Sympathomimetic
- Withdrawal states

Nystagmus:

- Horizontal……phenytoin, alcohol, barbiturates
- Both vertical & horizontal: strongly suggest phencyclidine poisoning

OTHERS

- **Absent bowel sounds**: paralytic ileus……anticholinergic intoxication or perforation coz of acid ingestion
- **Hyperactive bowel sounds**, abdominal cramping and diarrhea….organophosphates, *A muscaria*
- Determine if **bladder distention and urinary retention exist**…..anticholinergic intoxication
- **Skin appearance**: red, white, blue, warm, cool, dry, moist, piloerection (opioid withdrawal)

Decontamination

- Gastric exposure
- Inhalation exposure
- Dermal exposure
- Ocular exposure

Inhalation exposure

- Dangerous because of high surface area and high vasculature for absorption…systemically to vital organs
- **Irritant gases exposure**!! mainly in industry, but also after mixing cleansing agents at home, or smoke inhalation in structural fires
- **Health care providers should protect themselves from contamination**
- Eg.: "organophosphate, fumes of H_2S, cyanide, ammonia, formaldehyde"

Inhalation exposure

Treatment:

- Immediate removal from hazardous environment
- 100% humidified O2
- Assisted ventilation
- Bronchodilators
- Observe for edema of respiratory tract, or noncardiogenic pulmonary edema. Early signs and symptoms include **“dyspnea, tachypnea, hypoxemia”**
- Monitor arterial blood gases or oximetry, chest x-ray, and pulmonary function

Dermal exposure

- Attendant should wear protective gear “gloves, goggles, shoe cover”
- Remove contaminated clothes, contact lenses and jewelry and place them in a plastic bag
- Gently rinse and wash skin with copious amount of water for at least 30min….start with lukewarm water “vasoconstriction”
- Use soap to remove oily substances
- Caustic contamination may need prolonged irrigation

Dermal exposure

- Some **substances may react with water**, should be **brushed off** e.g. chlorosulfonic acid, Ca oxide, titanium tetrachloride

- For some substances, **local application of certain chemical compound as soaks may be useful**
  - Hydrofluoric acid…calcium gluconate 2.5%
  - Oxalic acid…calcium gluconate.

Ocular exposure

- At least 15-20min irrigation with fully retracted eyelids
- Don’t neutralize acid or alkali; continue irrigation until pH of the tear is neutral
- After irrigation examine the eye for corneal damage
- Ophthalmogist consultation:
  - Ophthalmogist may instill topical cycloplegic agent, e.g. 5% homatropine or 2% scopolamine to prevent spasm of ciliary body
  - Topical antibiotic (sulfisoxazole or gentamicin)
  - Apply a sterile patch

Decontamination

- Gastric Decontamination
- Inhalation exposure
- Dermal exposure
- Ocular exposure

Decontamination

- Gastric decontamination *(decrease absorption)*
  - Dilution
  - Emesis
  - Gastric lavage
  - Activated charcoal
  - Cathartics
  - Whole bowel irrigation

Gastric Decontamination

- **Controversy** about the roles of emesis, gastric lavage, activated charcoal, and cathartics to decontaminate the gastrointestinal tract
- **Little medical support** for gut-emptying procedures, especially after a **delay of 60 minutes** or more very little of the ingested dose is removed by emesis or gastric lavage
- Moreover, **simple oral administration of activated charcoal without prior gut emptying seems to be as effective as the traditional sequence of gut emptying followed by charcoal**

Gastric Decontamination

- However, in some circumstances, aggressive gut decontamination may potentially be life saving, even after more than 1–2 hours

- Examples: ingestion of highly toxic drugs (eg, calcium antagonists, colchicine), ingestion of **drugs not adsorbed to charcoal** (eg, **iron**, **lithium**), ingestion of **massive amounts of** a **drug** (eg, **150–200 aspirin tablets**), and ingestion **of sustained-release or enteric-coated products**

Decontamination

- Gastric decontamination *(decrease absorption)*
  - Dilution
  - Emesis
  - Gastric lavage
  - Activated charcoal
  - Cathartics
  - Whole bowel irrigation

DILUTION

- Dilution of the poison:
  1. 1-2 cupfuls of water to children
  2. 2-3 cupfuls of water to adult
  3. A better rule to give a quantity comfortable swallowed
- Water??
  1. Reduce gastric irritation
  2. Add bulk to the stomach needed later for emesis
- Carbohydrated beverages??....NO!!
  - CO_2 distension of the stomach….opening pyloric sphincter
- Milk??....NO!!
  - Increase absorption of lipophilic toxicant…&....delay emetic action of ipecac

- * …..water is the BEST and ONLY fluid to used when a poison is unknown.
- * Excessive water will distend the stomach, pyloric sphincter relaxation, emptying gastric content into the duodenum….more difficult to remove the poison
- * Emesis successful only if there is fluid in the stomach….water dissolve the poison and provide a vehicle for expulsion
-

General consideration

- Fluids should not be forced
- Excessive liquid may distend the stomach…premature evacuation
- In case of solid form do not dilute
- Nothing administered orally to unconscious patient or if gag reflux absent

UpToDate

- **Dilution** — Dilution was historically recommended following the ingestion of acidic or alkaline corrosives to decrease the concentration and, thus, the tissue damage from the ingestion.

- This approach is problematic and we recommend that it not be performed.

EMESIS…Outdated treatment

- Emesis was induced with syrup of ipecac (SoI)
- Not longer routinely recommended….BUT activated charcoal
- Decrease absorption of drug but sometimes dangerous….?
- Precautions!!!!

- The following modalities of GI decontamination have been used in the past but are **no longer routinely recommended**

- **Syrup of Ipecac** — Previously a mainstay of prehospital and emergency department management of toxic ingestions, Syrup of Ipecac (SoI)-facilitated gastric emptying is no longer recommended by the American Academy of Clinical Toxicology (AACT), the European Association of Poisons Centres and Clinical Toxicologists (EAPCCT), or the American Association of Pediatrics (AAP).

-

EMESIS

- **Do not induce vomiting if the poison is a:**
  - Convulsant, or sedative-hypnotic
  - Hydrocarbon (HCs are viscous and have low surface tension…readily aspirated)
  - Corrosive acid or alkali
- **Do not induce vomiting if the patient:**
  - Unconscious or comatose
  - Absence of gag reflex
  - Have severe CVD or emphysema, extremely weakened blood vessels
  - < 6 months in age (poorly developed gag reflex)

SYRUP OF IPECAC (1648)

- **Indications:**
  - Children that recently ingested known substances that are not well adsorbed by activated charcoal and for whom transport time to a healthcare facility is delayed….save time
  - Less traumatic than gastric lavage
  - Remove particles of material too large to pass through the opening of a lavage tube

SYRUP OF IPECAC

- Ipecac induce vomiting has 2 phases:
  - ✓ Early: within 15-20 min….direct stimulation of GIT
  - ✓ Late: after 20 min….direct stimulation of medullary chemoreceptor trigger zone
- The dose may be repeated once if no response within 15-20 min
- Repeat the fluid administration
- Have the patient sit up or move around, because this sometimes stimulates vomiting
- If the second dose of ipecac does not induce vomiting, use an alternative method of gut decontamination

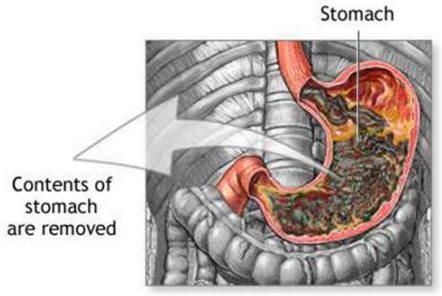
Syrup of Ipecac: side effects

- **Drowsiness** occurs in about 20% and **diarrhea** in 25% of children
- **Persistent vomiting** may delay administration of activated charcoal or oral antidotes
- **Protracted forceful vomiting** may result in hemorrhagic gastritis
- **Intracerebral bleeding** in elderly patients, **diaphragmatic rupture**, **aspiration pneumonia**
- Repeated daily use (**bulimic patients**) may result in **cardiac arrhythmias** owing to accumulation of cardiotoxic alkaloids
- Convulsion, skeletal muscle weakness

SYRUP OF IPECAC

- Contraindications:
- Loss of airway protection reflexes
- Caustic or corrosive
- Toxicant produce abrupt loss of conscious (ethanol, ultrashort BZDs, short acting barbiturate, heterocyclic antidepressant)
- Seizures (amphetamine, cocaine, ibuprofen >400mg/kg)
- Petrolium distellate
- Infant <6 months age
- Prior significant vomiting or hematoemesis
- Absence of bowel sound…gastric lavage
- Special situations (late pregnancy, elderly, HTN)

GASTRIC LAVAGE

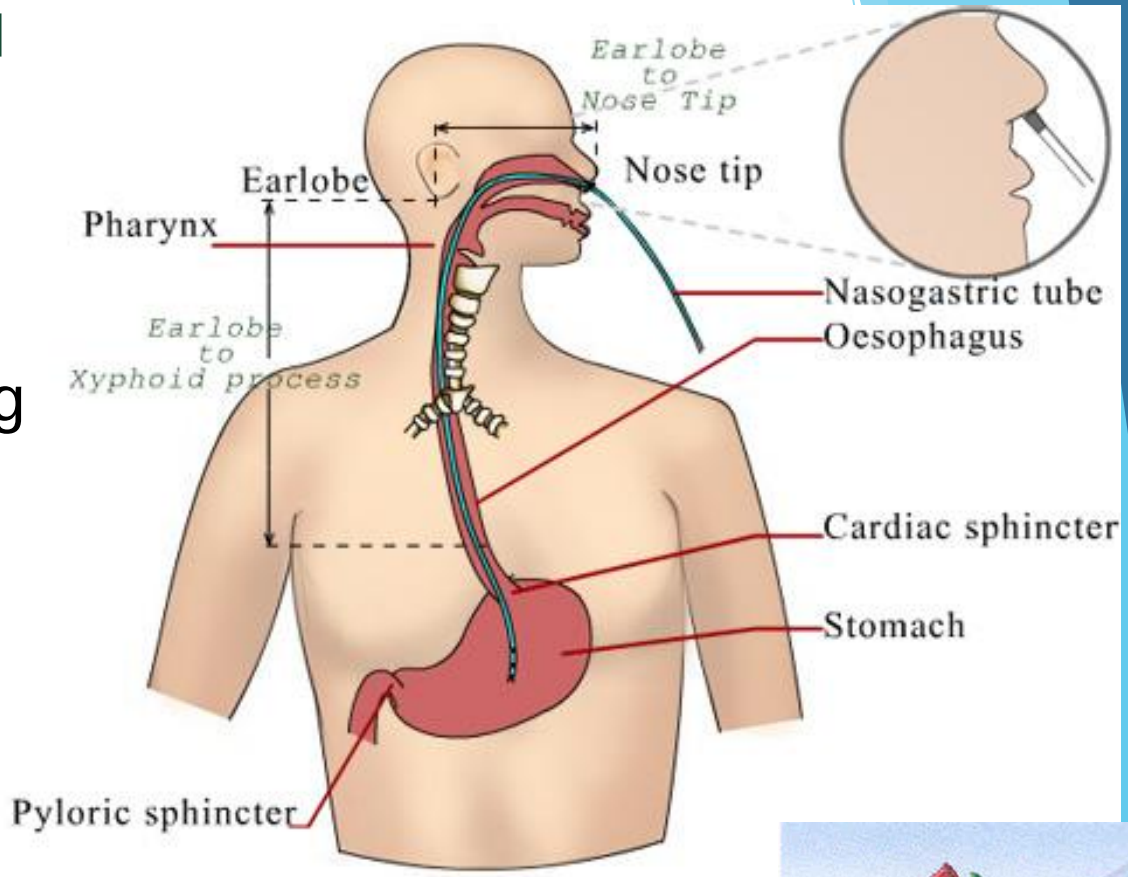


- Process of washing out the stomach

with various solutions including lukewarm water, saline, sodium bicarb.

- Gastric lavage **should not be employed routinely**, if ever, in the management of poisoned patients
- Effective within 30-60 minutes of the ingestion…. Usefulness decrease with time
- Still useful several hours after ingestion of agents that slow gastric emptying (eg. anticholinergic drugs)

The patient is placed on the left lateral decubitus position (pylorus pointed up) to reduces the chance for emptying into the small intestine and to permit pooling of gastric contents with head lower than the rest of the body. The largest catheter is inserted into the stomach



GASTRIC LAVAGE

- Attempt to aspirate as much of the stomach content as possible then…
- Lavage fluids should be introduced into the stomach (50-100ml aliquots for children) and (200- to 300-ml aliquots for adults)
- Lavage till clear
- **Complication** (3%) aspiration pneumonia, esophageal perforation, electrolyte imbalance
- **Advantages**: prepare the stomach for endoscopy

GASTRIC LAVAGE

- Do not perform in any patient with an **impaired level of consciousness** unless the airway is protected by a cuffed endotracheal tube….prevent aspiration
- In patients < 2 years
- A specific antidote is then given if available; otherwise, a slurry of activated charcoal is given
- Do not perform if ingestion of tablets (especially big in size)

GASTRIC LAVAGE

- **CONTRAINDICATION:**

- **Unprotected airway**
- **Caustic ingestion** (due to risk of exacerbating any esophageal or gastric injury)
- **Hydrocarbon ingestion** (due to high aspiration risk)
- Patients at risk of **GI hemorrhage** or **perforation** (recent surgery, underlying anatomic abnormality or pathology, coagulopathy)

ACTIVATED CHARCOAL

- ✓ Is a highly adsorbent powdered material produced by the superheating of wood pulp
- ✓ Form of carbon that has been processed in order to make it very porous with a **large surface area** to adsorb chemicals
- ✓ ……it is highly effective in adsorbing most toxins when given in a ratio of approximately 10 to 1 (charcoal to toxin)
- ✓ Only a few toxins are poorly adsorbed to charcoal and in some cases this requires a higher ratio (eg, for cyanide a ratio of about 100:1 is necessary)

ACTIVATED CHARCOAL

- ✓ Indications: whenever an emetic cannot be used, following successful chemical induction of emesis, or when the patient is unconscious
- ✓ Give activated charcoal aqueous suspension orally or by gastric tube. Initial dose (1 g/kg)
- ✓ Then 0.5g/kg every 2-6hrs

ACTIVATED CHARCOAL

- ✓ Within 30min of ingestion
- ✓ Should not be given within 30 min of syrup of ipecac unless the victim has already vomited (adsorbed on charcoal)
- ✓ In the stomach and intestine, poisons diffuse through the numerous pores on the charcoal surface and form tight chemical bonds
- ✓ This charcoal-chemical complex then passess out of the body
- ✓ **Risk**: pulmonary aspiration due to loss of airway reflex

Substances poorly adsorbed by activated charcoal

- Alkali
- Iron
- Lithium
- Ethylene glycol
- Mineral acids
- Fluoride
- Potassium
- Heavy metals
- Cyanide*
- Rapid onset

ACTIVATED CHARCOAL

- **CONTRAINDICATION:**
  - ✓ Absence of bowel sounds
  - ✓ Sign of intestinal obstruction
  - ✓ Lack of airway protection
  - ❖ May decrease the absorption of the antidote given later

Decontamination

- Gastric decontamination *(decrease absorption)*
  - Dilution
  - Emesis
  - Gastric lavage
  - Activated charcoal
  - Cathartics
  - Whole bowel irrigation

Cathartics

Cathartics — (eg, magnesium citrate, magnesium sulfate, sorbitol, mannitol) are intended to decrease poison absorption by enhancing rectal evacuation of toxins or the poison-AC complex.

Toxicoloists advise against the use of cathartics as single agent therapy.

The combination of a cathartic and AC (eg, sorbitol and AC) should be used sparingly in adults, if at all, and should not be used in children.

If the only available formulation of AC contains sorbitol, it may be necessary to give it to a child, but treatment must be limited to a single dose in such cases

Cathartics

Adverse effects associated with cathartic use include:

- increased abdominal pain,
- nausea,
- vomiting,
- excessive diarrhea,
- dehydration, and
- electrolyte abnormalities.

Decontamination

- Gastric decontamination *(decrease absorption)*
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Whole Bowel Irrigation

- **WBI**: aggressive form of GIT decontamination attempt to cleanse the bowel by the enteral administration of **large volume of an osmotically balanced nonabsorbable polyethylene glycol electrolyte solution** (PEG-ES) which induces a liquid stool

- Contains the osmotically active sugar (PEG) with sodium sulfate, sodium chloride, sodium bicarb and potassium chloride to maintain electrolyte balance

Whole Bowel Irrigation

- Rarely performed because risk-benefit analysis reserves this intervention for **life-threatening indication**:
  - Ingestion of sustained-release or enteric coated preparations (valproic acid, verapamil or diltiazem)
  - Agent that do not bind to charcoal (iron, other heavy metals, lithium)
  - Ingestion of illicit drug packets
  - No good clinical outcome is expected with antidote administration and the patient presents before established severe toxicity
- Complications such as: N, V

Contraindications

- Ileus, bowel obstruction, or intestinal perforation
- Clinically significant **GI hemorrhage**
- **Hemodynamic instability** (concern for sequestration of bowel and worsening of shock)
- Intractable **emesis**

Table 5 *Gastrointestinal Decontamination*

Method	Advantages or Disadvantages	Uses
Syrup of ipecac	Typically induces vomiting within 20 min. Effectiveness questionable if given more than 30-60 min after ingestion. Vomiting may delay administration of activated charcoal and in an obtunded patient may lead to pulmonary aspiration of gastric contents.	Limited to use at home in children discovered within a few minutes of selected ingestion. Should not be given if the child has ingested a corrosive agent, most hydrocarbons, or if the child is drowsy.
Gastric lavage	May be performed without delay or patient cooperation. Decompresses the stomach, reducing the risk of vomiting and aspiration. Efficacy questionable if initiated more than 1 hour following ingestion. Not likely to remove intact pills, especially sustained-release products.	Rapid removal of recently ingested liquids; decompression of distended stomach; ingestion of massive quantities of drug, especially if the drug delays gastric emptying *(eg,* aspirin, anticholinergics).

Gastrointestinal decontamination

Activated charcoal (AC)	A highly refined powdered charcoal with enormous surface area, can adsorb most drugs and toxins. Ideal ratio of AC to drug is about 10:1 by weight. Ineffective for lithium, iron, other highly polar or low molecular weight substances	Administer AC alone in uncomplicated oral ingestions. Obtunded patients may be given the AC by nasogastric tube after gastric decompression and suctioning; cathartic may hasten gut transport and elimination
Whole-bowel irrigation	Balanced electrolyte-polyethylene glycol solution is iso-osmotic, can flush out gut contents without significant fluid shifts or electrolyte changes. May be mixed with AC if poison suspected to be adsorbed.	Ideal for ingestions of iron, lithium, sustained-release products, drug or poison-filled packets or other foreign bodies.

Methods to ENHANCE Elimination of Toxic Agent

Enhanced Elimination

- 3 critical questions must be answered:

A. **Does the patient need enhanced removal?**

1. Severe or critical intoxication with a deteriorating condition despite maximal supportive care (eg, phenobarbital overdose with intractable hypotension)
2. The normal or usual route of elimination is impaired (eg, lithium overdose in a patient with renal failure)
3. The patient has ingested a known lethal dose or has a lethal blood level (eg, theophylline or methanol)
4. The patient has underlying medical problems that could further complicate the situation

Enhanced Elimination

B. **Is the drug or toxin accessible to the removal procedure?** The drug 'poison' should be located primarily within the bloodstream or in the extracellular fluid…..If extensively distributed to tissues, it is not likely to be easily removed

1. **The volume of distribution (Vd)** provides info on the accessibility of the drug:

- Very large Vd……Small Vd???

2. **Protein binding**……highly protein-bound drugs have low free drug concentrations……difficult to remove by dialysis

Enhanced Elimination

C. **Will the method work?**.....Does the removal procedure efficiently extract the toxin from the blood?

1. The **clearance (CL)** is the rate at which a given volume of fluid can be "cleared" of the substance

- CL = extraction ratio x blood flow rate
- Extraction ratio across the dialysis machine or hemoperfusion column

2. **Total clearance**.....If the contribution of dialysis is small compared with the total clearance rate, the procedure will contribute little to the overall elimination rate

- Urinary manipulation
- Extracorporeal methods
  - Peritonial dialysis
  - Hemodialisis
  - Hemoperfusion

- **Urinary manipulation:**

These methods require that the renal route be a significant contributor to total clearance

Forced diuresis

- Increase GFR, used in conjugation with ion trapping to prevent reabsorption
- Administration of enough fluids to establish a renal flow of 3-5ml/kg/hr
- Dangerous due to fluid overdose:
  - CHF
  - RF
  - Electrolyte disturbances
  - Pulmonary edema
  - Cerebral edema

Ion trapping

- Alteration of urine pH prevent renal reabsorption of poison that undergo glomerular filtration and active tubular secretion
- Many substance are reabsorbed in the nonionized form
- Urine alkalization (pH= 7.5-8)
  - $NaHCO_3$ ± acetazolamide
- Urine acidification (PH= 4.5-6)
  - Ascorbic acid, NH_4Cl, HCl

Indications:

- Renal elimination is the 1° route of excretion
- Significant renal tubular reabsorption of toxin
- Small Vd
- Low protein binding

Contraindications

- Renal dysfunction…fluid overload
- Cardiac insufficiency…pulmonary edema
- Uncorrected fluid deficit
- Electrolyte abnormality

Dialysis

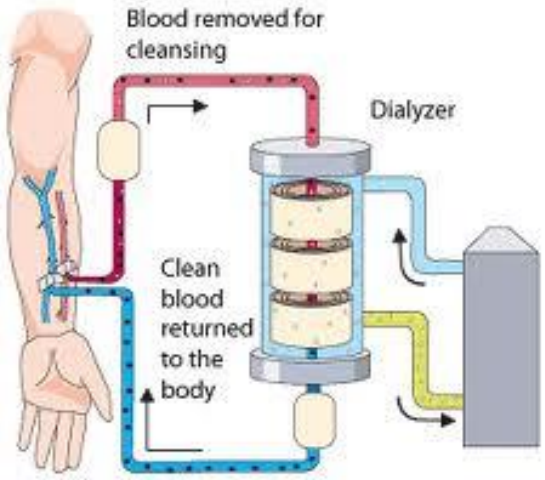
- Is a process for removing waste and excess water from the blood, and is used primarily to provide an artificial replacement for lost kidney function in people with renal failure
- Diffusion of solutes across a semi-permeable membrane….substances tend to move from an area of high concentration to an area of low concentration
- Smaller solutes and fluid pass through the membrane, but the membrane blocks the passage of larger substances (for example, red blood cells, large proteins)

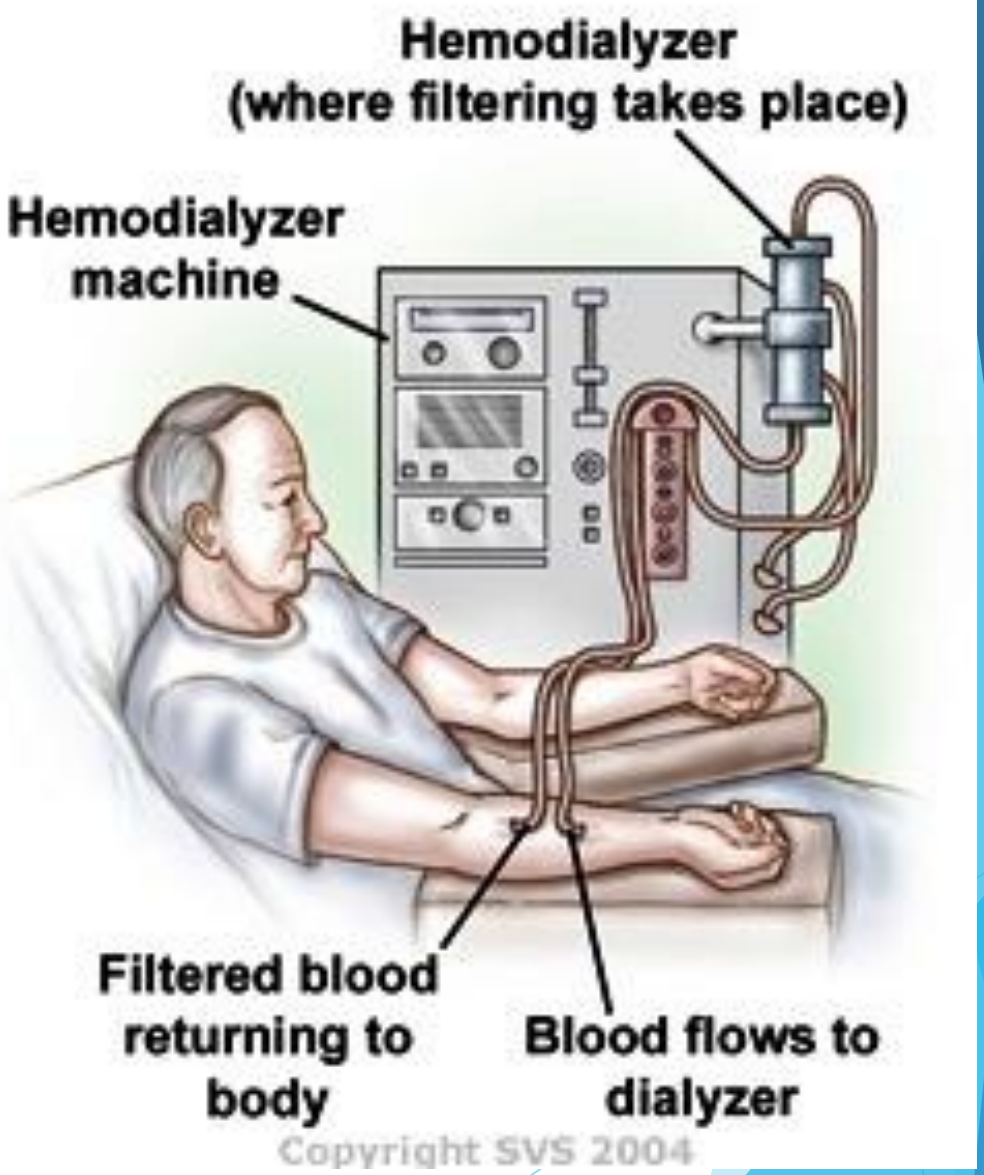
dialysis

- most useful in removing toxins with the following characteristics:
  - Dialyzable toxin
  - Vd < 1L/kg (phenobarbital, salicylate, theophylline)
  - Protein binding <50%
  - Water soluble
  - Low Mol. Wt. < 500 Da
  - Long elimination $T_{1/2}$

BAGELS:

- Bromide
- Alcohols
- Glycols
- Electrolytes
- Lithium/long-acting barbiturates
- Salicylate





Hemoperfusion

- Significantly more effective than hemodialysis
- Same procedure as hemodialysis including anticoagulant, but the blood is pumped directly through a column containing adsorbent material (charcoal or resin)
- Even if the toxin is lipid soluble, protein bound, or high Mol. Wt.
- **Factors**: **adsorbability** of resin or charcoal, (short acting barbiturates, theophylline, phenytoin), **low Vd, plasma conc. of the toxin**
- Similar complications….thrombocytopenia (hemorrhage), hypotension, hypoglycemia, infection