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, NSAIDs, 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 بلع اللسان
  - ✓ aspiration of gastric contents in the tracheobronchial tree استنشاق القيء الى الرئتين
  - ✓ respiratory arrest → توقف التنفس
- ✓ .....most commonly due to overdoses of narcotics and sedative-hypnotic drugs (eg, barbiturates and alcohol)

قد يموت بسبب انسداد مجرى التنفس !

How Does the Poisoned Patient Die?

كيفيا يموت المريض المسموم

تسمم القلب والاوعيه الدموية

- **Cardiovascular toxicity**.....Hypotension may be due to
  1. depression of cardiac contractility (ممكن يصير بسبب منع انقباض العضلة)
  2. Hypovolemia resulting from vomiting, diarrhea (نقص حجم الدم)
  3. Peripheral vascular collapse due to blockade of -adrenoceptor-mediated vascular tone (توسع الاوعية)
  4. Lethal cardiac arrhythmias.....overdose of ephedrine, amphetamines, cocaine, digitalis, and theophylline
  5. 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.
- 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:** → تقييم مجرى التنفس
  - ✓ Consider to breath and speak to assess air entry → نتأكد انه المريض يتنفس و يتكلم
  - ✓ Signs of obstruction (flaccid tongue, vomitus....) → نبحث عن علامات انسداد
  - ✓ Apnea, dysphonia, cyanosis, airway distress (توقف التنفس، بحة، كسر نطق، لون ازرق)
- **Management Goals:**
  - ✓ Prevent aspiration → منع الاختناق
  - ✓ Permit adequate oxygenation → ضمان وصول الاوكسجين
- **Basic Management**
  - ✓ Simple positioning in the lateral decubitus position
  - ✓ Chin lift to open the airway (رفع الذقن)
  - ✓ Sweep and suction to clear mouth of foreign material

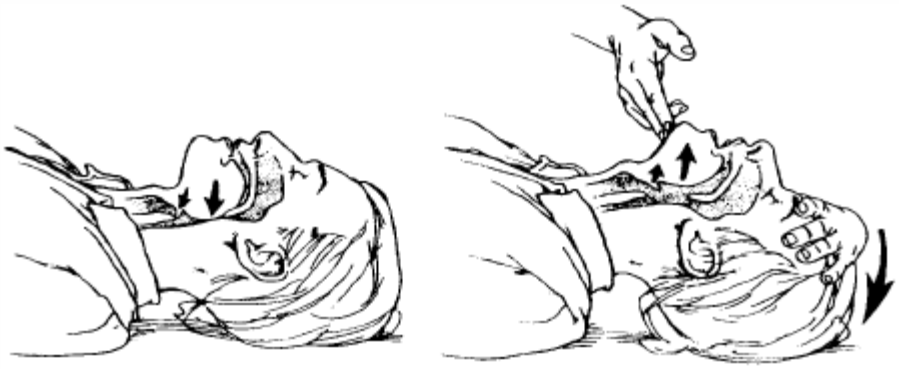
The lateral decubitus position for performing lumbar puncture. Note assistant is "curling" the patient to maximally flex the spine open.

The sitting position for lumbar puncture. Note the patient is curled over a bedside table to maximally flex the spine open.

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

بعض الموضى ما بيقدروا يحافظوا
على مجرى التنفس، فبستخدم
لهم واحد صناعي مثل :- 2+1

- The airway can also be maintained with **artificial oropharyngeal or nasopharyngeal airway devices** ① ②

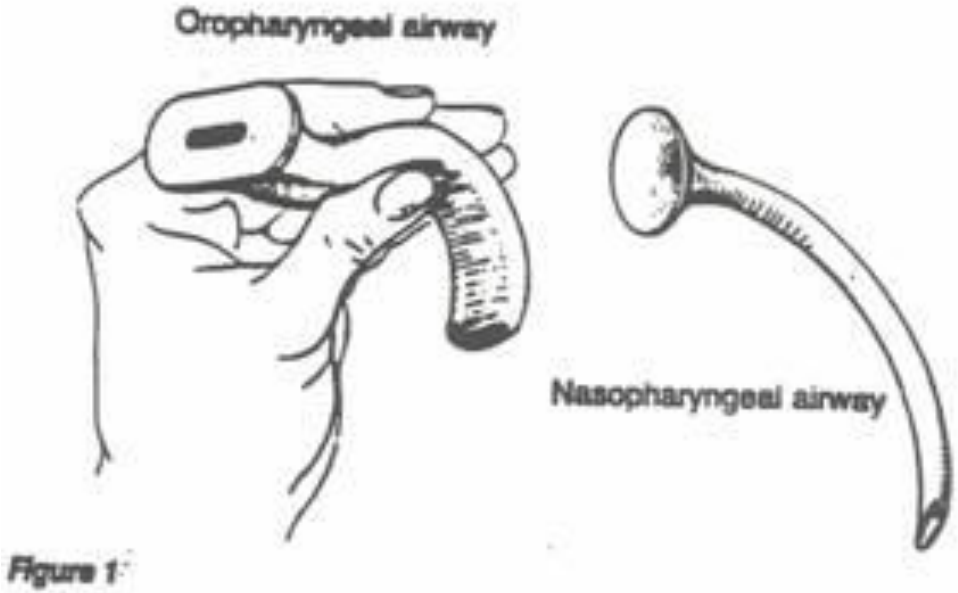


Figure 1

Airway

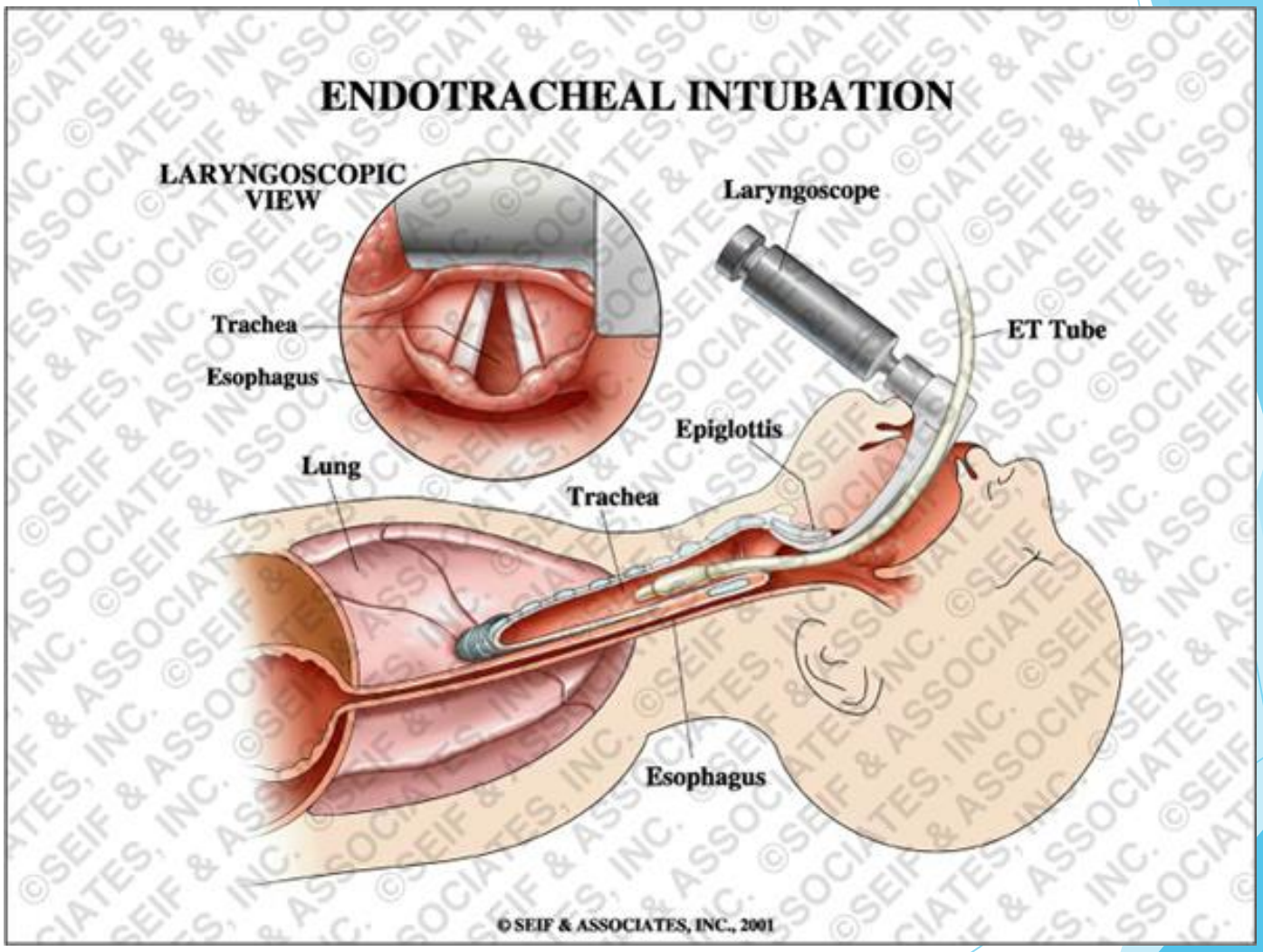
- **Endotracheal intubation**: *attempted only by those with training*
- Complications: vomiting with pulmonary aspiration; local trauma to the oropharynx, nasopharynx, and larynx; inadvertent intubation of the esophagus or a main-stem bronchus; and failure to intubate the patient after a neuromuscular blocker has induced respiratory arrest.
- *Indications*:
  - ✓ Unable to protect the airway
  - ✓ Inadequate spontaneous ventilation
  - ✓ Arterial blood gases (pCO2 > 60%)

اسمه من الفم الى القصبة الهوائية

Orotracheal or nasotracheal intubation

الاكثر شيوعا

من الانف او الفم الى القصبة الهوائية



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)

1. LOOK for mental status, chest movement, respiratory rate
2. LISTEN for air escaping during exhalation, sound of obstruction
3. FEEL for the flow of air, chest wall for crepitus
4. 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 → تقييم الوعي

- Assess level of consciousness by **AVPU** method
  - **A**.....**ALERT** → اعراضها واعي ومنتبه
  - **V**.....responds to **VERBAL** stimuli → يستجيب للكلام فقط
  - **P**.....responds to **PAINFUL** stimuli → يستجيب للألم
  - **U**.....**UNRESPONSIVE** → غير مستجيب
- Size and reactivity of pupils
  - استجابتها
- Movement of upper and lower extremities

Neurological status

غير محفظ

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 tendon reflexes

Neurological status

غير محفظ

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

تغير الوعي

- A decreased level of consciousness is the most common serious complication of drug overdose or poisoning

نتيجة تشنج سابقا

- **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**

لم تحلل عضلي

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)

antidot
هو مضاد المخدرات

- **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 الفحص الخارجي

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

History

1

- Historical data should include the type of toxin

2 طريقة دخولها للجسم

- Route of administration (e.g. ingestion, inhalation, intravenous)

3

- Also ask about prior suicide attempts or psychiatric history

وجود حالات انتحار سابقة

او تاريخ نفسي للمريض

Identify the toxicant

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

Identify the toxicant

- **AMPLE** → نجمع معلومات دقيقة عن المريض

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

الاحداث التي سبقت الاصابة الحالية.

2. Physical Examination

الفحوصات السريرية

- 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

العلامات الحيوية

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

Blood Pressure

HYPERTENSION

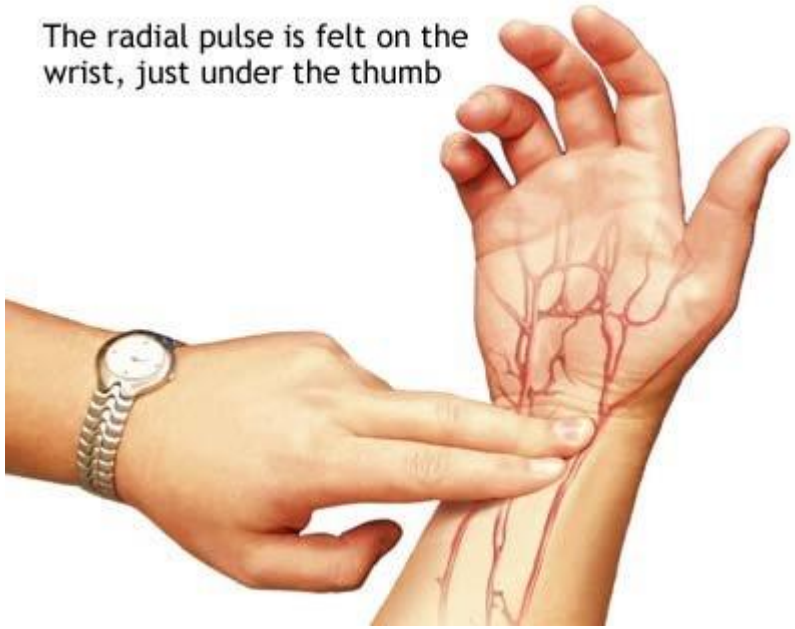
- Sympathomimetics
- Amphetamines
- Cocaine
- MAOI
- Nicotine

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

فرط التنهويه

- 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

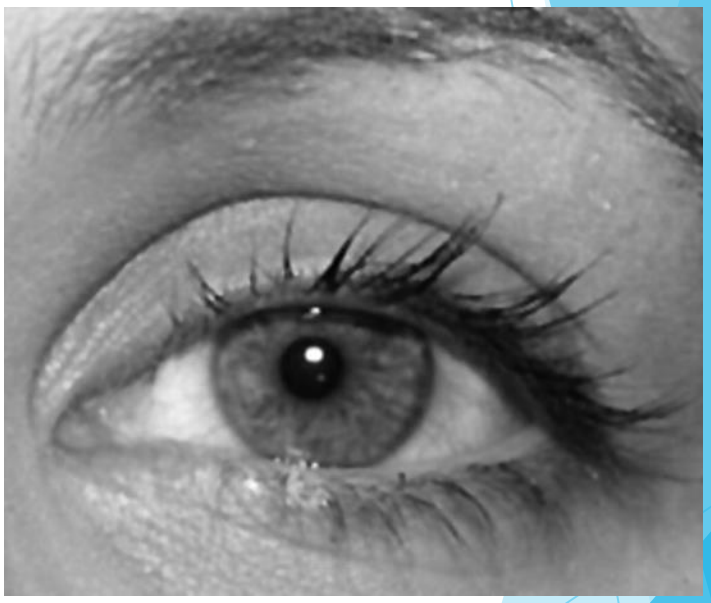
TEMPERATURE

- **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

اهتزاز العين

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

  اذا شفت بالمعده نتيجه اهانه هويه

- **Hyperactive bowel sounds**, abdominal cramping and diarrhea….organophosphates, *A muscaria*
- Determine if **bladder distention and urinary retention exist**…..anticholinergic intoxication

Decontamination

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

Inhalation exposure

امتصاص عبر الرئة إلى الدم مباشرة

- Dangerous because of high surface area and high vasculature for absorption…systemically to vital organs

eg.

- **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" ماء دافئ
- Use soap to remove oily substances
- Caustic contamination may need prolonged irrigation المواد الكاوية

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

فتح الجفون جيد!

- 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
- Ophthalmologist consultation: → استشارة طبيب عيون
  - The ophthalmologist may instill topical cycloplegic agent, e.g. 5% homatropine or 2% scopolamine to prevent spasms 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 → التخفيف
  - Emesis → التقيؤ
  - Gastric lavage → غسيل المعدة
  - Activated charcoal → الفحم النشط
  - Cathartics → المسهلات
  - Whole bowel irrigation → تنظيف الامعاء الى اسفل

Gastric Decontamination

يوجد جدل

- **Controversy** about the roles of emesis, gastric lavage, activated charcoal, and cathartics to decontaminate the gastrointestinal tract

غير فعاله بعد اكثر من 60min

- **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**

اعطاء الفحم النشط مباشره
افضل من بعض الطرق التقليديه

Gastric Decontamination

الاستثناءات

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

في بعض الحالات ممكن الغسيل يفيد حتى بعد ساعتين مثل

- 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

الاعتبارات العامة

- Fluids should not be forced → لا تجبر المريض على الشرب
- Excessive liquid may distend the stomach…premature evacuation → مزيد من السوائل للمعدة
- In the case of solid form do not dilute
- Nothing administered orally to unconscious patient or if gag reflex absent

لا يتم إعطاء أي شيء للمريض الفاقد للوعي

UpToDate التخفيف في حالات الحروق الكيميائية

- **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.

التقيؤ

EMESIS…Outdated treatment

- Emesis was induced with syrup of ipecac (Sol)
- Not longer routinely recommended….BUT activated charcoal → استبدلناه ب الفحم النشط
- 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**

ممنوعا استخدامه

- **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

يمنع تحفيز التقيؤ اذا

- **Do not induce vomiting if the poison is a:**
  - Convulsant, or sedative-hypnotic (مسبب للتشنجات)
  - Hydrocarbon (HCs are viscous and have low surface tension…readily aspirated)
  - Corrosive acid or alkali → حارق
- **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: → الاستخدامات.
  - 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 → عدم الوصول إلى المستشفى في أسرع وقت.
  - Less traumatic than gastric lavage → أقل ضرر من غسيل المعدة.
  - 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

تكرار الجرعة مرة واحدة

- 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

غسيل المعدة

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
- Toxicants produce abrupt loss of consciousness (ethanol, ultrashort BZDs, short-acting barbiturate, heterocyclic antidepressant)
- Seizures (amphetamine, cocaine, ibuprofen >400mg/kg)
- Petroleum distillate
- Infant <6 months age
- Prior significant vomiting or hematemesis
- Absence of bowel sound.
- Special situations (late pregnancy, elderly, HTN)

GASTRIC LAVAGE →

غسيل المعدة

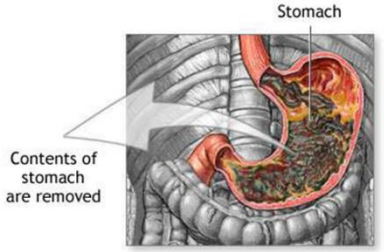
- Process of washing out the stomach

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

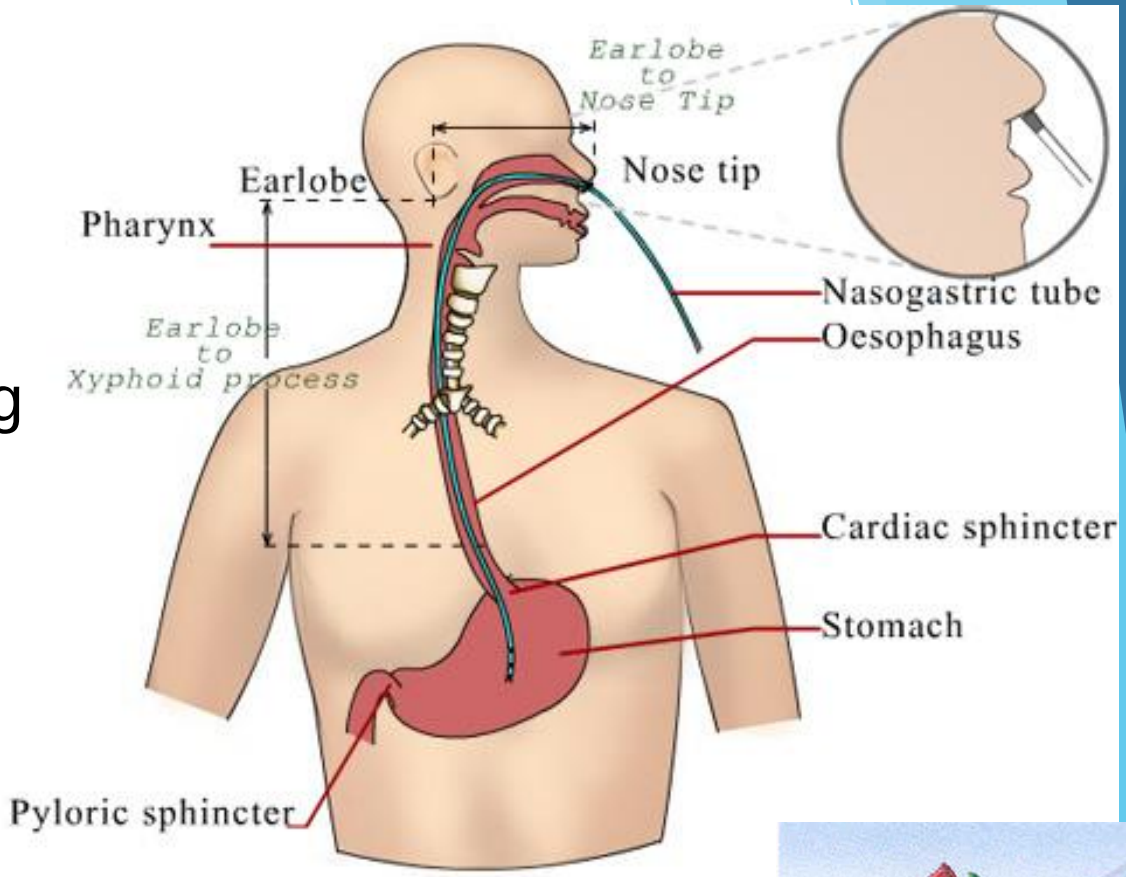
- Gastric lavage **should not be employed routinely**, if ever, in the management of poisoned patients

- Effective **within 30-60 minutes of the ingestion…. Usefulness decreases 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

تجهيز معده لإجراء استنظير

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

لـ لزم افتح مجرى الهواء
يا نبوب تنفسي

- In patients < 2 years.

- Do not perform if ingestion of tablets (especially big in size)

- A specific antidote is then given if available; otherwise, a slurry of activated charcoal is given

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 → تسخين لبا الخشب
- ✓ 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

المواد التي لا يمتصها الفحم النشط

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

ACTIVATED CHARCOAL

- **CONTRAINDICATION:**
  - ✓ Absence of bowel sounds
  - ✓ Sign of intestinal obstruction →
  - ✓ Lack of airway protection

انسداد او خلل معوي

  - ❖ 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.**

Toxicologists 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)*
  - Dilution
  - Emesis
  - Gastric lavage
  - Activated charcoal
  - Cathartics
  - Whole bowel irrigation

Whole Bowel Irrigation

غسيل الامعاء بالكامل

شكل مكثف من تنظيف الامعاء باستخدام محلول PEG

- **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**

Methods to ENHANCE Elimination of Toxic Agent

تعزيز اخراج السم

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

يعتمد على ان الكلية تفرز
جزء كبير من الدم

Forced diuresis

الإدرار الاجباري

نستخدم طريقتين

- Increase GFR, used in conjugation with ion trapping to prevent reabsorption

زيادة الترشيح وضبط درجة حموضة الدم

- Administration of enough fluids to establish a renal flow of 3-5ml/kg/hr
- Dangerous due to fluid overdose:
  - CHF → فشل قلبي
  - RF → فشل كلوي
  - Electrolyte disturbances
  - Pulmonary edema
  - Cerebral edema

Ion trapping → احتجاز الايونات

- 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)
  - NaHCO3 ± acetazolamide
- Urine acidification (PH= 4.5-6)
  - Ascorbic acid, NH4Cl, 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 → نقص سوائل
- Electrolyte abnormality

Dialysis →

غسيل الدم

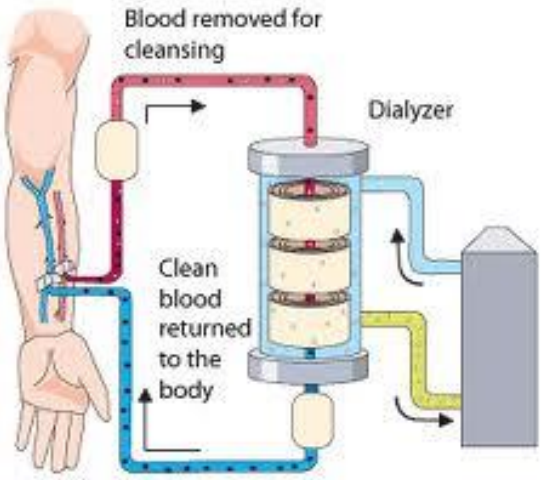
- Is a process for removing waste and excess water from the blood, and is used primarily to provide an artificial replacement for lost kidney function in people with renal failure
- Diffusion of solutes across a semi-permeable membrane….substances tend to move from an area of high concentration to an 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)

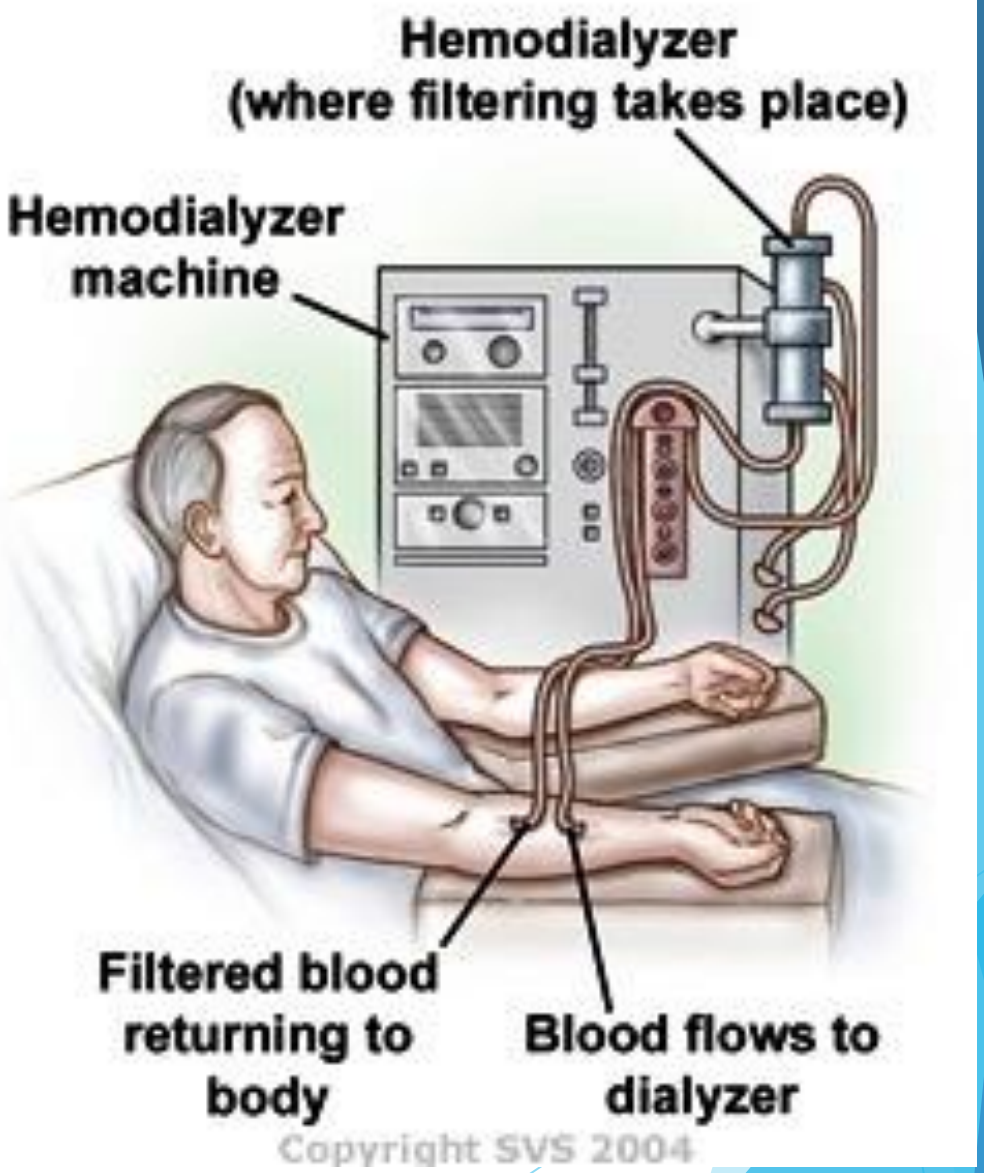
dialysis

- 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/lon g-acting barbiturates
- Salicylate





Hemoperfusion → الترشيح الدموي

- 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