- **Chemical and Drug Poisoning**
- What is a poison?
- **In common usage - poisons are chemicals or chemical products that harmful to human**
- **More precisely - a poison is a foreign chemical (xenobiotic) that is capable of producing a harmful effect on a biologic system**
- **50% nondrug substances (cosmetics, personal care items, cleaning solutions, plants, and foreign bodies.**
- **Drugs remainder of exposures**
- **analgesics, topical preparations, cough and cold products, and vitamins (most common**
- **Causes in relation to age 2peak**

  <u>1.Accidental;</u> <6 year age (♂ > ♀)

  <u>2.Intentional;</u> >12 years adolescent (♀ > ♂)

  3.Iatrogenic
- **Historical features that leads to suspect drug poisoning**

  1.Age of the child (toddler or adolescent)

  2.Acute onset of symptoms without prodrome

  3.Sudden alteration of mental status

  4.Multiple system organ dysfunction

  5.High levels of household stress

  Initial medical care

  1) Supportive care Airway, Breathing, Circulation ABC

  2) A targeted history and physical examination

  Treatment Plan

  1) Decontamination

  2) Enhanced elimination
- **3) Antidotes**

- **History and Examination**

  1.What toxin/medication was taken

  2.How much was taken

  3.What time was it taken

  4.Who was the witness

  5.What medications or toxic substance was available to the child

  6.Presence of symptoms

  7.Past history and social history

- **Physical exam**

  1. Vital signs

  2.Mental status

  3.Pupils (size, reactivity nystagmus)

  4.Skin, bowel sounds, and odors

- **Investigations**

  1.Full blood count ,Blood gas

  2.Urea, creatinine, electrolytes , Blood glucose

  3.Serum and urine for toxicology

- **4.Special investigations as ECG ,radiology**

- **Gastric Decontamination**

  1.Induction of emesis ?

  2.Gastric lavage?

  3.Activated charcoal single dose

  4.Cathartics

  4.Whole bowel irrigation

Induction of Emesis : Emetic alkaloids work on CNS and GIT

After a review of the evidence and assessment of the risks and benefits of ipecac use, the American Academy of Pediatrics, the American Academy of Clinical Toxicology, and the American Association of Poison Control Centers have all published statements in favor of abandoning the use of ipecac

Gastric Lavage

- **Time-consuming and painful**
- **Induce bradycardia via a vagal response to tube placement**
- **Delay administration of more definitive treatment (activated charcoal)**
- **Only removes a fraction of gastric contents**
- **No longer recommended**

Single dose activated Charcoal

- **Potentially useful method of GI decontamination**
- **Complex Molecule with large surface area; binds many poisons**
- **Substances Poorly Adsorbed By Activated Charcoal (heavy metal , iron, lithium, acid or alkali, Hydrocarbons, cyanide)**
- **Effective when given within 1st hour of ingestion**

Whole-Bowel Irrigation

- **Instilling large volumes (35 mL/kg/hour) of a polyethylene glycol electrolyte solution**
- **Indications 1. Slowly absorbed substance 2.Substances not well adsorbed by charcoal (e.g., lithium, iron)**

Enhancing Excretion

A. Urinary Alkalinization, For drugs that are weak acids forming charged particles "trapped" within the renal tubules and excreted.

- **by a continuous infusion of sodium bicarbonate goal urine pH of 7.5-8**
- **most useful in managing salicylate and methotrexate toxicity.**

B. Hemodialysis :- the major indications for salicylate intoxication, methanol and ethylene glycol, theophylline

C. Multiple dose activated charcoal

Antidotes

- **Antidotes are available for relatively few poison thus emphasizing the importance of supportive care and close clinical monitoring.**
- **Early and appropriate use of an antidote is a key element in managing the poisoned patient.**
- **Common antidotes to common drug poisoning**
- **Benzodiazepines----------flumazenil**
- **Iron----------Deferoxamine**
- **Opiates----------Nalaxone**
- **Paracetamol--------N-acetylcysteine**
- **B-Blockers-------Glucagone/Adrenaline**
- **Digoxin---------Fab antibodies**

Acetaminophen poisoning

- **Acetaminophen (APAP) is the most widely used analgesic and antipyretic in pediatric**
- **Most common cause of acute liver failure**
- **The single acute toxic dose >200 mg/kg in children and >7.5-10 g in adolescents and adult**
- **Repeated administration of APAP at supratherapeutic doses (>90 mg/kg/day for consecutive days)**

Pathophysiology

- **Toxic metabolite, N-acetyl-p-benzoquinone imine(NAPQI)**
- **Therapeutic dose glutathione stores in the liver detoxify this metabolite**
- **Acute overdose depletes glutathione stores in the liver. As a result, NAPQI accumulates, causing hepatocellular necrosis and possibly damage to other organs (eg, kidneys, pancreas**

Clinical and Laboratory Manifestations

- **Initially nonspecific (nausea and vomiting).Thus, the diagnosis not based on clinical symptoms alone**
- **Requires combination patient's history, symptoms, and laboratory findings (Liver Function tests, INR, serum creatinine , Blood gas analysis, 4hours serum paracetamol**
- **Classic Stages in the Clinical Course of Acetaminophen Toxicity**

STAGE	TIME AFTER INGESTION	CHARACTERISTICS
I	0.5-24 hr	Anorexia, vomiting, malaise Labs typically normal, except for acetaminophen level
II	24-48 hr	Resolution of earlier symptoms; right upper quadrant abdominal pain and tenderness; elevated hepatic transaminases (aspartate aminotransferase > alanine aminotransferase), INR
III	3-5 days	Peak transaminase elevations; development of liver failure, multi organ-system failure, death *or* recovery begins
IV	4 days-2 wk	Resolution of liver function abnormalities Clinical recovery precedes histologic recovery

Treatment

- ABCs
- Decontamination (emesis, gastric lavage, activated charcoal)
- Antidote **N-acetylcysteine (NAC) iv or oral a glutathione precursor**
- **The patient fall in either of following**

1/Prophylactic:

- **normal aspartate aminotransferase (AST) N-acetylcysteine (NAC) if APAP on probable or possible hepatic toxicity**

2/ Hepatic Injury:

- **(AST rises first, then the alanine aminotransferase), followed by a rise in the INR. N-acetylcysteine (NAC)**

3/ Acute Liver Failure : liver transplant

- **These criteria (that indicate poor prognosis)**
- **1-acidemia (serum pH <7.3**
- **2- coagulopathy (INR >6),**
- **3-renal dysfunction (creatinine >3.4 mg/dL)**
- **4- grade III or IV hepatic encephalopathy**

Cholinesterase inhibiting insecticides (Organophosphates and carbamates) poisoning

Pathophysiology

Organophosphates and carbamates Bind to cholinesterase enzymes-----Preventing the degradation of acetylcholine -----Resulting in accumulation at nerve synapses---cholinergic crisis

- **If untreated this process called aging occur as soon as 18hr to 2-3 day.**
- **Exposure : Oral, Dermal, Conjuctival , GIT, Respiratory**
- **Cause/ agricultural use, accidental, suicide, chemical warfare weapons "nerve agents**
- **Clinical and laboratory manifestation Toxicity related to the accumulation of acetylcholine at peripheral nicotinic and muscarinic synapses and in the CNS**

Muscarinic Features : DUMBBELS

- **D diarrhea/defecation**
- **U Urination**
- **M Miosis**
- **B bronchorrhea /bronchospasim**
- **B bradycardia**
- **E emesis.**
- **L lacrimation**
- **S salivation**

Nicotinic signs and symptoms.

- **Muscle weakness.**
- **Fasciculations, termors**
- **hypoventilation (diaphragm paralysis)**
- **Hypertension, tachycardia and dysarrhythmias.**

CNS effects include: Malaise, confusion ,delirium ,seizures ,and coma.

Symptoms caused by carbamate toxicity usually less severe than those seen with organophosphate

Diagnosis of poisoning is based primarily on history and physical exam findings

Cause of death respiratory failure combined with depressed CNS and increase respiratory secretions.

Treatment of organophosphate poisoning

Priority in management

- **Resuscitation is the mainstay ABCs Carful attention to Airway and Breathing**
- **intubation and ventilation if necessary**
- **fluid and electrolyte replacement**
- **Atropine is part of ABC to control symptoms Antagonizes the muscarinic acetylcholine receptor (organophosphate , carbamate)**
- **DOSE 0.05 mg/kg repeated every 5-10 min as needed, dilute in (2ml)of normal saline**
- **Decontamination :skin , GIT SKIN: washing all exposed skin with soap and water and immediate removal of all exposed clothing.**
- **GIT decontamination: with 1-2 hr, protect the airway, conscious GCS>12**

  gastric lavage ,activated charcoal
- **Pralidoxime breaks the bond between the organophosphate and the enzyme.**

  It is effective if used before the bond (ages) and becomes permanent(18hr-2,3days).

  Pralidoxime is not necessary for carbamate poisonings.

  25-50mg/kg over 5-10 min(max 200mg/min) can be repeat after 1-2hr then 10-12 hr as needed.

- **Iron poisoning**

- **Iron was a common cause of childhood poisoning deaths**
- **The severity of an exposure is related to the amount of elemental iron ingested.**
- **Ferrous gluconate 12% , Ferrous sulfate contains 20%,**
  Ferrous fumarate 33%. elemental iron
- **Pathophysiology**

  Iron is directly corrosive to the GI mucosa, leading to hematemesis, melena, ulceration, infarction, and potential perforation.
- **TOXIC DOSE**

  Ingestion >40 mg/kg of elemental iron ---referred to medical care for evaluation

  Moderate to severe toxicity is typically seen with ingestions of >60 mg/kg
- **Clinical and Laboratory Manifestations**

  4 overlapping stages

  1- 1st Stage (30 min to 6 hrs) GIT symptoms profuse vomiting and diarrhea (often bloody), abdominal pain, hypovolemic shock

  2- 2nd stage (6-24 hrs) "quiescent phase," GI symptoms typically have resolved

  3-3rd stage (12-36 hrs) multisystem organ failure, shock, hepatic and cardiac dysfunction, acute lung injury or acute respiratory distress syndrome (ARDS), and profound metabolic acidosis. Death occurs most commonly during this stage.

  4- 4th stage (4-6 wk) patient who survive formation of strictures and signs of GI obstruction

- **Investigations**

- **Serum iron levels 4-6 hr after ingestion.**

  < 500 µg/dL--- low risk of significant toxicity

  > 500 µg/dL---significant toxicity
- **An abdominal x-ray --presence of iron tablet**
- **arterial blood gas, complete blood count, serum glucose level**
- **liver function tests, and coagulation parameters**

- **Treatment of iron poisoning**

1-Supportive care and Close clinical monitoring

2-Decontamination: Activated charcoal does not adsorb iron

WBI decontamination strategy of choice

3-Antidote : Deferoxamine, a specific chelator of iron ,continuous IV infusion at a rate of 15 mg/kg/hr ,Indications for deferoxamine: a.Serum iron concentration of >500 µg/dL or b.Moderate to severe symptoms regardless of serum iron concentration

- ***Kerosene poising***
- **The most important manifestation is aspiration pneumonitis via inactivation of the type II pneumocytes and resulting surfactant deficiency**
- **Aspiration occurs during coughing and vomiting**
- **aspiration pneumonitis is inversely proportional to hydrocarbons viscosity**

Clinical and Laboratory Manifestations

Local toxicity includes defeating of skin ,irritation of mucous membrane

Aspiration pneumonitis is characterized by coughing

CXR initially be normal, but they often show abnormalities within 6 hr of exposure in patients who have aspirated. Fever and leukocytosis are common accompanying signs in patients with pneumonitis

(2-3 wk)after exposure pneumatocel may appear on the chest x ray.

CNS depression ,congestive heart failure, headache, vertigo , ataxia, euphoria and renal , hepatic damage may be seen.

Management of Hydrocarbon poisoning