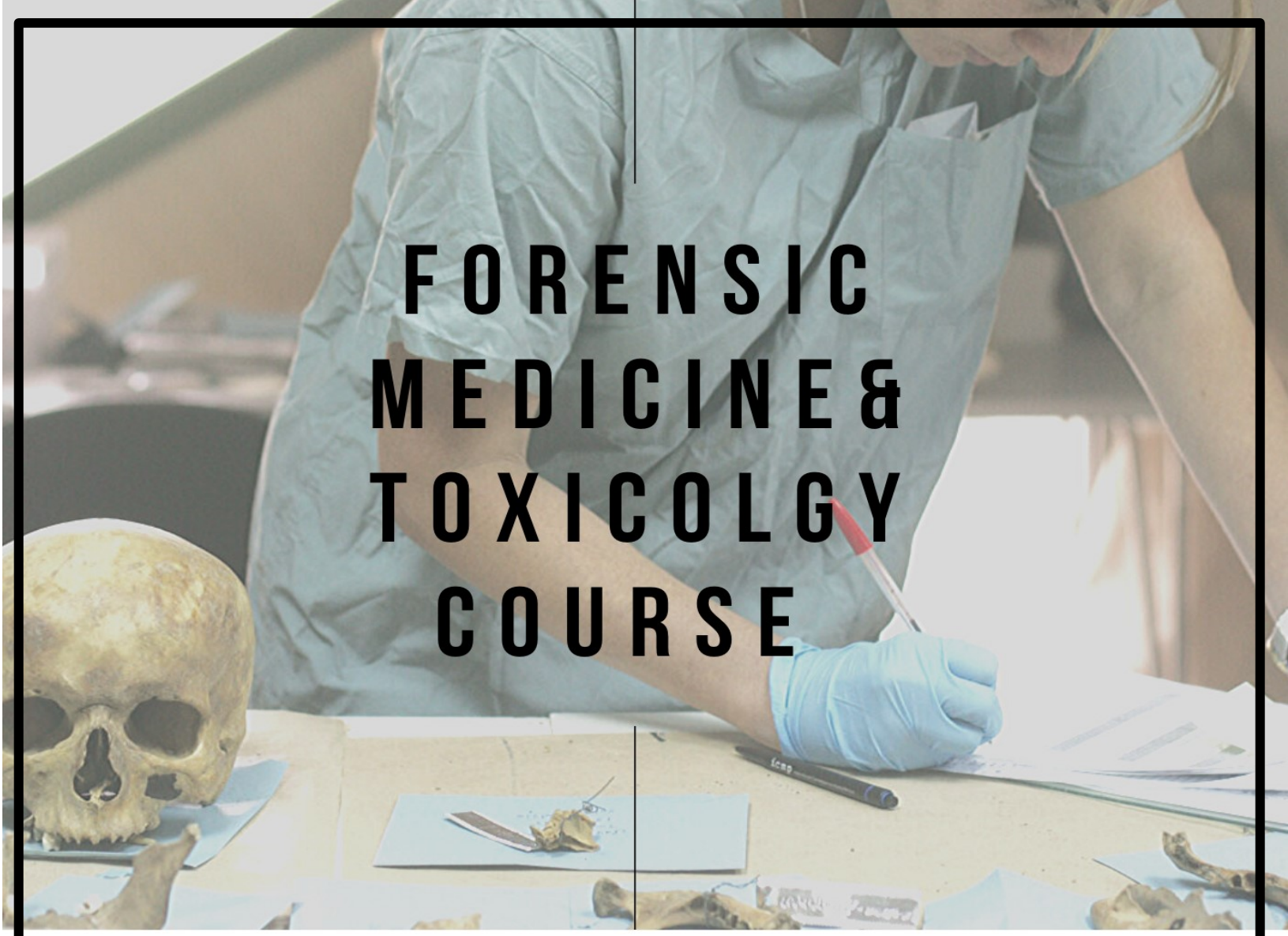

FORENSIC MEDICINE& TOXICOLGY COURSE

هذه الدوسية شاملة لكل المحاضرات المطلوبة و الملاحظات لامتحان مادة الطب الشرعي النظري و العملي مزودة بملحق cases للمادة و مجموعة من الأسئلة على المادة أيضًا ،
تم تعديل و تحديث المادة في عام 2020 .

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L1: General Toxicology

Classes of Toxicology

- Factorial Toxicology
- Clinical Toxicology
- Environmental Toxicology: *pollution
  *industrial
- Forensic Toxicology
- Social Toxicology : drug dependence
- Reproductive Toxicology
- Genetic Toxicology : mutagenicity
- Military Toxicology : warfare agents

Classification of toxic agents

- By pattern :
- intentional: suicidal, homicidal
- unintentional
- Action : local ---- remote --- both
- Source : plant --- animal --- food
- Character : metal - gas - organic- vapour - fluid
- Duration of exposure : acute --- chronic
- Onset : immediate ---- delayed
- Uses: pesticide--- pharmaco---food additive
- Target organ : renal---hepatic….cardiac…..
-

What is a poison?

Is a substance which when introduced into the living body, will produce some form of ill health or even death.

Major pathophysiologic Mechanism :

- Interfere with transport or tissue utilization of O_2 : as CO, cyanide
- CNS stimulation: Convulsions as cocaine
- CNS depression : coma as sed.hypn
- Autonomic NS : 1. anticholin : atropine
  - 2. cholinergic : organoph
- Affect lungs : aspiration: hydrocarbon
  - systemic : paraquate
- Local damage: corrosives
- Affect heart & Circulation:
- arrhythmic
- hypertensive
- hypotensive
- Delayed effect : metals : kidney

Factors affecting severity of poisoning

<table>
<tr><td colspan="2">1. Factors related to the host :</td></tr>
<tr><td><u>Age :</u> 2 peak age groups:
Preschool & toddlers : exploring the environment
Young adult : suicidal behaviour
? Old age : forget doses , changes in metabolism rate & excretion</td><td><u>Sex</u> :
occupational</td></tr>
<tr><td><u>Health nutrition</u> , disease</td><td><u>State of stomach</u> : empty or full , type of food, disease</td></tr>
<tr><td><u>Genetic factors</u> : individual variation: Idiosyncrasy</td><td></td></tr>
<tr><td colspan="2">II. Factors related to the Poison</td></tr>
<tr><td><u>1. Amount : dose</u>
Dose :The amount of chemical entering the body. This is usually given as mg of chemical/kg of body weight = mg/kg .
Paracelsus, a Swiss physician (1493-1541), proposed dose-toxicity relationship “all substances are poisons; there is none which is not a poison. The right dose differentiates a poison and remedy”
LD50 :If Mortality is the response, the dose that is lethal to 50% of the population is LD_{50} ,can be generated from the curve</td><td><u>2. Route</u>
Route and Site of Exposure : In the following order :
Intravenous
Inhalation
Intraperitoneal
Subcutaneous
Intramuscular
Oral
Dermal</td></tr>
<tr><td><u>3. State</u> : gas , liquid , solid.</td><td><u>4. Duration and Frequency of Exposure</u>
<u>Acute</u>: Defined as exposure to a chemical for less than 24hr
<u>Subacute</u>: Usually refers to repeated exposure to a chemical for 24 hrs up to 1 month
<u>Subchronic</u>: 1 to 3 months
<u>Chronic</u>: More than 3 months</td></tr>
<tr><td><u>Allergic Reactions</u>: Chemical allergy is an <u>immunologically</u> mediated adverse reaction to a chemical. Results from previous sensitization to the chemical or to a structurally similar one.</td><td><u>Idiosyncratic Reactions</u> : <u>Genetically determined</u> abnormal reactivity to a chemical.</td></tr>
</table>

Drug interaction:

- **<u>Additive</u>: When the combined effect of the two chemicals is equal to the sum of the effects of each agent given alone. (2+2=4)**
- **<u>Synergistic</u>: When the combined effect of the two chemicals is greater than the sum of the effects of each agent given alone (2+2=10)**
- ***<u>Potentiation:</u>* Occurs when one substance has no toxic effect but when added to another chemical makes that one much more toxic (0+2=10).**
- ***<u>Antagonism</u>*: Occurs when two chemicals administered together interfere with each other’s action or one interferes with the action of the other (2+2=1; 4+0=2)**

Tolerance:

. It means tendency to increase the dose of certain drug or substance to get the same original effect.
So persons addicted to drug like morphine, alcohol and cocaine can stand big dose without serious effects due to tolerance of the tissues.

GENERAL MANAGEMENT

You have to suspect poisoning if:

- ✓**A comatose patient in whom the etiology is unknown.**
- ✓**Arrhythmias of unknown etiology.**
- ✓**Patients with metabolic acidosis of unknown etiology.**
- ✓**A trauma victim especially if young.**
- ✓**Bizarre symptoms.**
- ✓**Psychiatric patient**
- ✓

History and circumstantial evidences:

- **Sudden appearance of symptoms in a person or number of persons (previously in good health) after taking certain food or drink or exposed to gas are suggestive of food poisoning and carbon monoxide poisoning.**
- **History of recent purchase of poison (rat poison) or a drug.**
- **History of failure in examination, in love or marital disharmony, financial or family troubles ... etc may point to attempted suicide by self poisoning.**
- **Fumigation تبخير of ships from rats, suggest hydrogen cyanide poisoning.**

<table>
<tr><th colspan="2">GENERAL MANAGEMENT</th></tr>
<tr><td colspan="2">1. Diagnosis</td></tr>
<tr><td colspan="2">A. History: (Should be brief, focused. and complete, The standard questions are : who , what ,when , where , why , how & how much?.</td></tr>
<tr><td>a. known poisons:
substance (s)including ingredients
estimate amount
elapsed time,
early symptoms
home treatment</td><td>b. unknown poison:
Multiorgan system dysfunction
Past psychiatric history
Past overdoses
History of depression
History of drug abuse
Family : Medicines at home</td></tr>
<tr><td colspan="2">B. Physical Examination</td></tr>
<tr><td colspan="2"><u>1. State of consciouness</u></td></tr>
<tr><td colspan="2"><u>2. Pupils</u></td></tr>
<tr><td><u>3. Odours:</u></td><td>(alcohol, kerosene, cyanide (bitter almond), organo-phosphorus insecticides (garlic)</td></tr>
<tr><td><u>4. Four vital signs (Respiratory Rate, Heart Rate, Blood Pressure andTemperature)</u></td><td>    </td></tr>
<tr><td><u>5.Abdominal findings</u></td><td><u>Peristaltic activity</u> is affected by drugs and toxins
Nausea, vomiting, abdominal colic and diarrhea are <u>the most common symptoms</u> especially with insecticides and metallic poisons (except lead) where the characters of the vomitus or the diarrhea are diagnostic of each.
<u>Ileus</u>: Anticholinergic</td></tr>
</table>

6.Skin findings:	***Sweating*** ***Flushed skin:*** **e.g. CO, boric acid, corrosives, anticholinergics** ***Pale skin*****: + diaphoresis: sympathomimetics.** **Ergot, amphetamines may cause severe arterial vasospasm** ***Cyanosis*****: may indicates** **- hypoxia** **- methaemoglobinaemia** **- sulf haemoglobinaemia** ***Needle marks with*** **sclerosed veins: in I.V. drug abusers.**

Toxidromes" *A pattern of signs or symptoms that suggests a specific class of poisoning* "

Type of Toxidromes	Characterictics	Common Causes
I.Anticholinergic toxidrome	-altered mental status (hallucinations, agitation, coma) -large pupils - tachycardia, high temperature --dry flushed skin -decreased bowel sounds -urinary retention	-Anticholinergic plants (e.g., Jimson weed, Atropa beladona)- -Atropine -Antihistamines (Benadryl- Diphenhydramine, Gravol - Dimenhydrinate) -cyclic Antidepressants -Antiparkinsonian agents -Antiemetics -Antispasmodics -Antipsychotics -Antipruritics
II.Sedative hypnotic toxidrome	-depressed mental status -relatively small pupils -vital signs usually normal -significant respiratory depression is rare with pure benzodiazepine overdose -hypotension in large ingestions	-overdose of benzodiazepines -some sedative hypnotics
III.Cholinergic toxidrome	-lacrimation, salivation -bradycardia -respiratory secretions -hypoxia -diaphoresis -increased bowel sounds -vomiting -diarrhea and urinary incontinence -fasciculations may occur and muscle weakness can result in respiratory failure	organophosphate and carbamate insecticides
IV.Sympathomimetic toxidrome *Note: This toxidrome is usually differentiated from the anticholinergic toxidrome by the presence of marked diaphoresis (instead of dry skin). Also bowel sounds are not decreased + pallor	-agitated delirium is common -large pupils -elevated vital signs -tachycardia -hypertension -hyperthermia -diaphoresis (unless severely dehydrated) -bowel sounds present	-overdose of cocaine or amphetamine -alcohol or sedative hypnotic withdrawal results in similar findings.

V-Serotonin syndrome	**-confusion** **-hypomania** **-restlessness** **-myoclonus** **-hyperreflexia** **-hyperthermia** **-diaphoresis** **-shivering** **-tremor** **-rigidity** **-incoordination** **ANA (Altered mental status, Neuro-muscular abnormalities, Autonomic effects)**	**Serotonin Reuptake Inhibitors (SSRIs), Meperidin (Demerol), Fluexitin (Prozac), or other serotonin-enhancing drug ----- especially when a patient taking an MAO inhibitors with SSRI.**

End of the lecture

L2 :Investigations and Treatment

I.Nonspecific tests:

1. Electrolytes: Na, K, and anion gap
2. Arterial blood gases (ABG)
   *respiratory depression leading to respiratory acidosis
   *seizures or shock leading to lactic acidosis
   *Anion gap
3. Serum Glucose
4. Renal function tests: blood urea nitrogen (BUN), serum creatinine.
5. Hepatic transaminases and hepatic function tests
6. ECG
7. Radiology: Chest X-ray: for poisons with respiratory manifestations
   CT: CO & Methyl alcohol
   Abdominal X-ray : radio opaque tablets

II.Specific investigations:

1- Toxicology screening:

Obtain gastric and urine specimens on admission for screening of poisons and blood for quantitative testing

1. Urine: is the most suitable body fluid for drug detection analysis:

Available in ample amounts
Least expensive, non-invasive
Drugs and its metabolites are present in higher concentration and in stable form for long periods.

2. Gastric content
3. Blood
4. Sweat
5. hair
6. Saliva

2- Screening tests for drugs of abuse:

- Initial tests to differentiate negative sample from positive sample, depending on "Cut off" levels which is an administrative threshold that separate positive from negative

- Negative screens can be reviewed again
- Positive screens are submitted for confirmatory testing

- Colour tests
- Radioimmunoassay
- ELISA
- Enzyme multiple immunoassay technique (EMIT) EMIT :VIVA (DADE BEH
- Fluorescent Polarizing Immunoassay (FPIA)
- Thin Layer Chromatography (TLC)

****Confirmatory tests for drugs of abuse :**

- High Performance Liquid Chromatography (HPLC)
- Gas chromatography (GC)
- Gas chromatography / Mass Spectoscopy (GC / MS)

3. Other tests for poisoning :

1- Anticholinesterase Agents

- True cholinestrase (RBC) (rarely done)
- Plasma or pseudo-cholinesterase (UV visible spectrophotometer)

20 – 50 % of normal : mild
10 – 20 % " " : moderate
< 10 % " " : severe

2- Level of carboxyHb by oximeter

General management of acute poisoning

First, ***treat the patient, not the poison.***

ABC's of resuscitation then add 'D' + 'E'

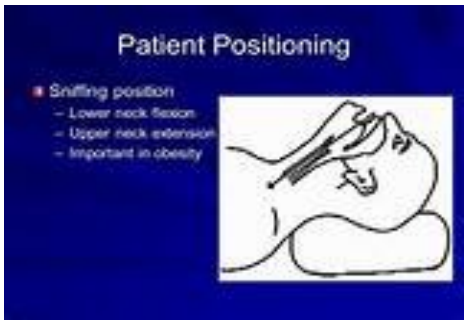
A: Airway

B: Breathing

C: Circulation

D: Disability, Decontamination, Drugs

E: Elimination: diuresis , dialysis



A. Airway Assessment:

1- Check airway protective reflexes : gag reflex and cough reflex

2- Position the patient to force the flaccid tongue forward and to maximize the airway opening:

- Sniffing position (with neck flexed forward and head extended) (not used in cases with neck injury)
- Jaw thrust
- Head down, left-sided position

3- Clear airway : remove secretions by suction

4- Create artificial airway depending on the grade of unconsciousness:

- Oropharyngeal
- Nasopharyngeal
- Cuffed endotracheal tube
- Tracheostomy

B. Breathing

- Assess arterial blood gases ($P_{O2} - P_{CO2}$) to detect early respiratory failure (P_{O2}< 60 mmHg, P_{CO2} >50mmtHg)
- Assist ventilation if P_{CO2} > 50mmHg :

1- Hand ventilation (bag – valve – mask device)

2- Mechanical respiration

3- Respiratory stimulant (coramine)

- Give supplemental O_2 if P_{O2} < 60 mmHg.
- Treat bronchospasm: administer O_2 , bronchodilators.

C. Circulation

1- Check blood pressure, pulse rate and rhythm.

Shock is considered if systolic blood pressure is below (80 – 90mmHg)

Treatment of shock:

- Maintain airway, assist ventilation and give O_2
- Elevate the bed foot
- Bandage legs to help venous return
- Keep the patient warm
- Give IV fluids (glucose 5% or 0.9% saline)
- Use vasoactive drugs (dopamine: one ampule 200 mg in 500 ml normal saline).

2-ECG monitoring

3-Draw blood for routine studies

4- Begin IV infusion

If patient is severely ill (hypotensive, convulsing, comatosed), place a Foley catheter in the bladder to measure urine output hourly.

D. Disabilities

Altered mental status:

Perform a brief neurologic examination, establish level of consciousness.

1- Mathew and Lawson scale : 0 - 4

2- *AVPU grading:*

A:awake, alert, responsive, oriented to person, time and place.
V:response to verbal stimuli
P:response to painful stimuli
U:unresponsive

3- Glasgow coma scale E+M+V= 3…….15 (worst……best)

Glasgow Coma Scale		
Response	Scale	Score
Eye Opening Response	Eyes open spontaneously	4 Points
	Eyes open to verbal command, speech, or shout	3 Points
	Eyes open to pain (not applied to face)	2 Points
	No eye opening	1 Point
Verbal Response	Oriented	5 Points
	Confused conversation, but able to answer questions	4 Points
	Inappropriate responses, words discernible	3 Points
	Incomprehensible sounds or speech	2 Points
	No verbal response	1 Point
Motor Response	Obeys commands for movement	6 Points
	Purposeful movement to painful stimulus	5 Points
	Withdraws from pain	4 Points
	Abnormal (spastic) flexion, decorticate posture	3 Points
	Extensor (rigid) response, decerebrate posture	2 Points
	No motor response	1 Point
Minor Brain Injury = 13-15 points; **Moderate Brain Injury** = 9-12 points; **Severe Brain Injury** = 3-8 points		

D. Drugs

All unconscious patients and patients who are having convulsions should receive dextrose, naloxone & or oxygen as indicated.

- **Treat hypoglycaemia using *dextrose***
  adults: 50ml of 50% dextrose
  children: 2ml/kg IV of 25% dextrose

- ***Naloxone (Narcan)* 0.4 mg IV. In some cases more than 2 mg of naloxone may be required to reverse the effect of synthetic narcotics .**
- **Treat seizures (**Diazepam* 5-10 mg IV)**

D. Decontamination

A. Surface decontamination

Skin	***Eye***	***Inhalation***
Remove contaminated clothing **Flush exposed areas with copious quantities of water or saline** **No need for chemical neutralization: the generated heat can create worse injury**	**Flush exposed eyes with copious quantities of tap water or saline**	**Remove the victim from exposure** **Give supplemental humidified oxygen**

B. GI decontamination

-1- Emesis

Syrup of ipecac عرق دهب is the preferred method for induction of emesis.
Dose: 30 ml (adults) and 15 ml(children) followed by drinking 2-3 glasses of water. The dose can be repeated once if no vomiting occurs in 15-30 minutes. Indicated in conscious patients

Contraindications	- Loss of protective airway reflexes (coma and convulsions) - Caustic or corrosive ingestion - Ingestion of petroleum distillates, Kerosene. - Ingestion of substances that impair the protective airway reflexesSubstances likely to produce abrupt depression of consciousness: e.g. ethanol, ultrashort acting benzodiazepines or Substances likely to produce early onset of seizures e.g. amphetamine, cocaine - Prior significant vomiting or hematemesis - Children less than 1 year of age - Ingestion of foreign body - Neurologically impaired individuals - Absence of bowel sounds

-2- Gasrtic lavage

Indications:	1- If emesis fails in conscious patients 2- In patients taking antiemetic drugs 3- In comatosed patients after inserting endotrachael tube - In patients who have ingested a substance not bound to activated charcoal; e.g. heavy metals (iron, lead, lithium, Hg), cyanide, alcohols and glycols
Contraindication:	1- Caustic or corrosive ingestion because of the danger of perforation 2- Uncontrolled convulsions because of the danger of aspiration or injury during the procedure 3- Ingestion of petroleum products without endotrachael intubation to protect against aspiration 4- If time elapsed since drug ingestion exceeded 6 hours (except for salicylates)

4- -3- Activated charcoal (AC)

5- It is a harmless material of vegetable origin. It is fine black powder, odourless and tasteless.
AC may be used alone, after emesis, or with or after gastric lavage for substances known to be significantly absorbed by it.

Indications:	Used after any toxic ingestion to limit drug absorption from the GIT, even if the substance is not known to be well adsorbed to charcoal. # Repeated oral doses of activated charcoal may enhance elimination of some drugs from the bloodstream
(b)Dose	The initial oral AC dose is 1-2 g/kg, or 15-30 g in children and 60-100g in adults. It is administered as a soupy, slurry suspension in at least 100 ml of water. ## One or two repeated doses of AC may be given at 1 or 2 hour interval to ensure adequate gut decontamination .
Contraindications	1- Caustics or corrosives: charcoal is ineffective and may obscure the lesion or resemble a burn 2- Absence of bowel sounds (adynamic ileus) 3- Signs of intestinal obstruction, perforation, or peritonitis 4- Unable to confirm the location of the gastric tube 5- Lack of adequate airway protection, e.g. in comatose patients. If necessary, endotracheal intubation is used

Gastrointestinal (Gut) dialysis:	**refers to repeated doses of AC.** **Dose: 25-50 g every 4 hours,** **or 25g every 2 hours ,or 10-15 g every hour.**

-4- Cathartics

The two groups of cathartics commonly used to treat patients with overdoses are (1) saline (magnesium citrate, magnesium sulfate, sodium sulfate, disodium phosphate) and (2) saccharides (eg. sorbitol).

Sorbitol is now the cathartic of choice because it may be more effective than saline cathartics. In addition, sorbitol improves the palatability of activated charcoal

Contraindications :	**1-** **2- ingestion of corrosives,** **3- severe diarrhea,** **4- adynamic or dynamic ileus,** **5- serious electrolyte imbalance** **6- recent bowel surgery.** **7- Cathartics should be used with caution when bowel sounds are absent.**

5. Elimination

1.Urinary manipulation:

a.Forced diuresis **may increase glomerular filtration rate, and ion trapping by urinary pH manipulation, may enhance elimination of polar drugs.** **Forced diuresis (producing urine volumes of up to 1 L/h) is generally not used because of the risk of fluid overload.**	**b.Alkalinization :** **Alkalinition of urine increases urine excretion of weak acids eg. Salicylates , Phenobarbitone .. This occurs because the 2 forms of the acid have different lipid solubility and therefore are reabsorbed by the renal tubules . As an acid loses a hydrogen ion ,it becomes ionized and less lipid soluble . Alkalinization of urine , by reducing the concentration of free hydrogen ions , causes more the acid to maintain an equilibrium . As the ionized form has low lipid and high water solubility it remains trapped in the renal tubules and is excreted in urine** ***Method* : For mild toxicity add 1-2 mEq of Sodium bicarbonate /kg to the first 1liter of dextrose /saline .** ***Alkaline diuresis should not be attempted in patients who have evidence of pulmonary oedema or those with renal failure .** ***Hypokalaemic patients are unable to produce an alkaline urine and potassium must be corrected .**

2.Hemodialysis:

Blood is taken from a large vein (usually femoral vein) using a double-lumen catheter and is pumped through the hemodialysis system. The patient must be anticoagulated to prevent clotting of blood in the dialyzer. Drugs and toxins flow passively across the semipermeable membrane down a concentration gradient into a dialysate (electrolyte and buffer) solution.

Fluid and electrolyte abnormalities can be corrected concurrently.

Flow rates of up to 300-500 ml/min can be achieved, and clearance rates may reach 200-300 ml/min

##Characteristics of the drug or toxin that enhance its extractability include:

1- Small size (molecular weight)
2- Water solubility
3- Low protein binding
4- Low fat solubility
5- eg. Methanol
6- Salicylates
7- Theophylline

##Before haemodialysis : test for HIV.

Contraindications:	**1- poison not dializable** **2- if other therapeutic modalities are present** **3- shock** **4- presence of coagulopathy**
Complications:	**1- Haemorrhage** **2- Venous thrombosis** **3- Hypotension** **4- Infection** **5- Electrolyte dysequilibrium** **6- Air embolism**

3.Hemoperfusion

: Using equipment and vascular access similar to that for hemodialysis, the blood is pumped directly through a column containing an adsorbent material (charcoal). Systemic anticoagulation is required, often in higher doses than for hemodialysis and thrombocytopenia is a common complication

4.Peritoneal dialysis:

Dialysate fluid is poured into the peritoneal cavity through transcutaneous catheter and drained off, and the procedure is repeated with fresh dialysate. The gut wall and peritoneal lining serve as the semipermeable membrane.

##Peritoneal dialysis is easier to perform than hemodialysis or hemoperfusion and it does not require anticoagulation, but it is only about 10-15% as effective owing to poor extraction ratios and slower flow rates (clearance rates: 10-15ml/min)

However, peritoneal dialysis can be performed continuously, 24 hours a day.

A 24-hour peritoneal dialysis with dialysate exchange every 1-2 hours is approximately equal to 4 hours of hemodialysis.

Complications:	**1- Infection** **2- Perforation or haemorrhage** **3- Pleural effusion** **4- Electrolyte imbalance** **5- Arrhythmia** **6- Perforation of the intestine , urinary bladder , liver , spleen.**

The end of the lecture

L3- Child Abuse

****This is the updated lecture with the notes needed to be studied and all of the practical slides**

- **CHILD ABUSE : is also known as "the battered baby" or "non-accidental injury in childhood" (NAI) or syndrome of child abuse and neglect (SCAN).**
- **WHO DEFINITIONS**

ALL forms of physical and emotional, sexual abuse, and neglect that results in actual or potential harm to the child's health, survival, development or dignity.

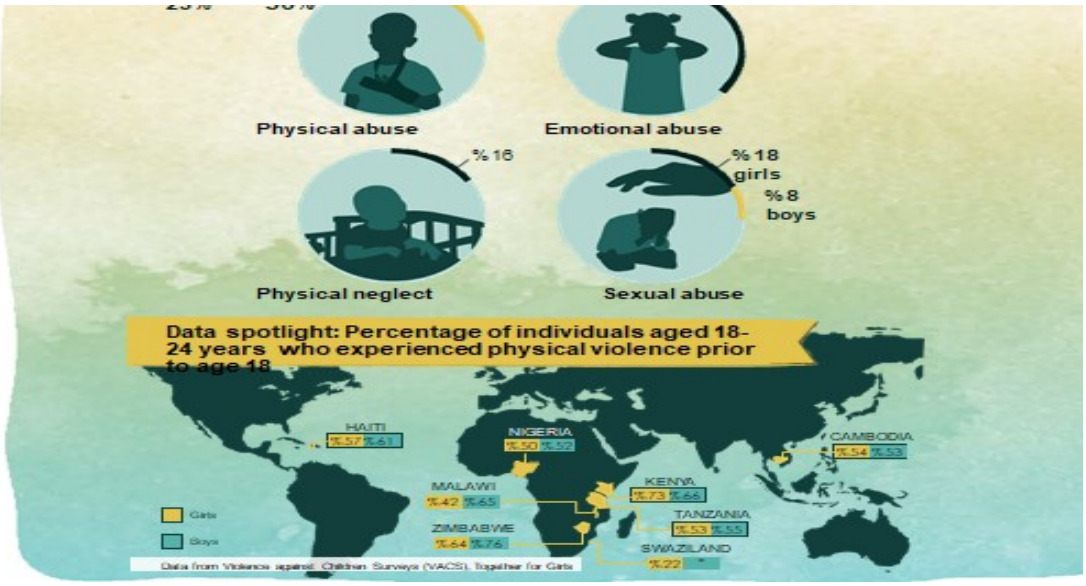
DEFINITION of CHILD ABUSE

Non accidental repetitive physical injuries including minimal as well as fatal injuries inflicting upon infants or children by persons caring for them.

Child Maltreatment

Worldwide,1 in 4 adults were physically abused as children.

Worldwide children report that they suffered some form of violence in the past year:



Classification of Maltreatment:

1- **Physical abuse ;** hitting, beating and shaking

2- **Sexual abuse :** sexual contact or exposure to sexual acts or materials

3- **Emotional or psychological abuse :** Threatening , insulting or ridiculing

4- **Neglect:** Failing, despite having the means, to provide medical care, education, shelter or other essentials for a child's healthy development

5- **Another types of child abuse :**

- NEONATICIDE
- INFANTICIDE
- EUTHANASIA
- MURDER-SUICIDE
- MURDER-HOMICIDE
- WITNESSING OF FAMILY ABUSE

• MURDER- SUICIDE	• MURDER- HOMICIDE
• Act which an individual kills one or more other persons before, or at the same time killing him- or herself. • Parents are always depressed • Often whole family is killed usually in one accident	• Filicide is deliberate act of a parent killing his or her own son or daughter ## Classified into five 1- altruistic 2- acutely psychotic 3- accidental filicide 4- unwanted child 5- spouse revenge filicide • Victims after sexual assaults طفل البمبرز

-CHILD NEGLECT-

Failure by parents or caregiver to provide a child for their physical and emotional development and wellbeing.

- Physical neglect
- Educational neglect
- Emotional neglect
- Environmental neglect

-EMOTIONAL ABUSE –

Persistent inappropriate verbal or symbolic acts toward a child which affect the child's behaviour and development.

Five behaviours:

1- **rejecting**

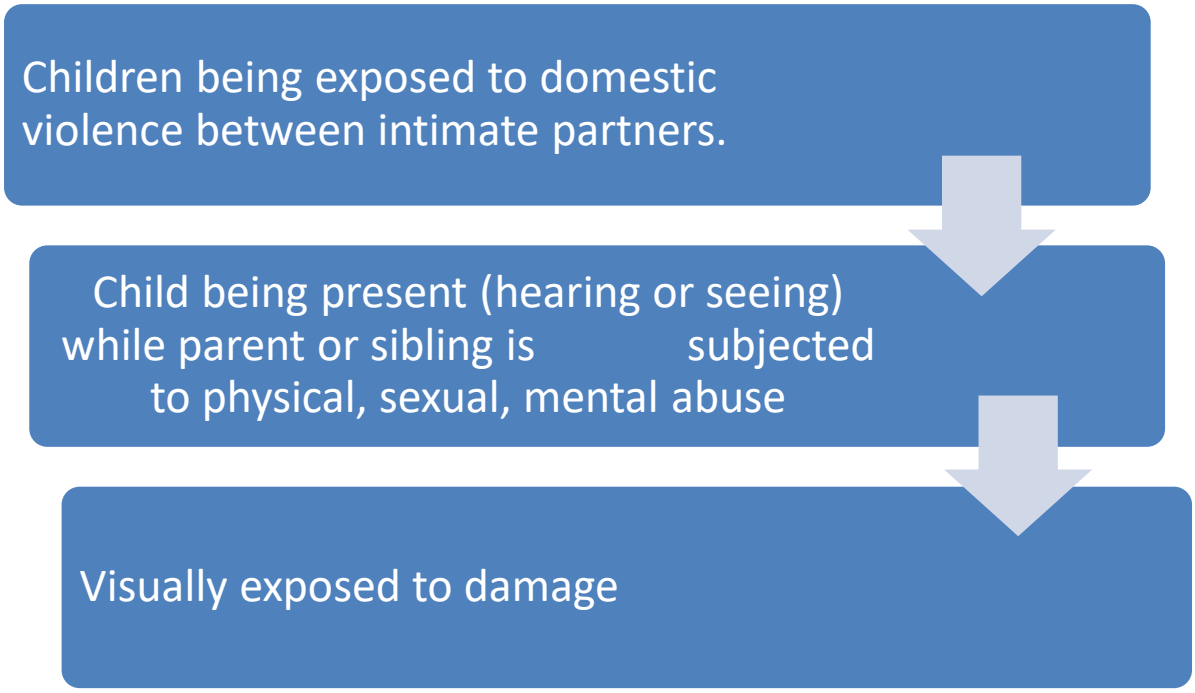
2- **terrorizing**

3- **isolating**

4- **corrupting**

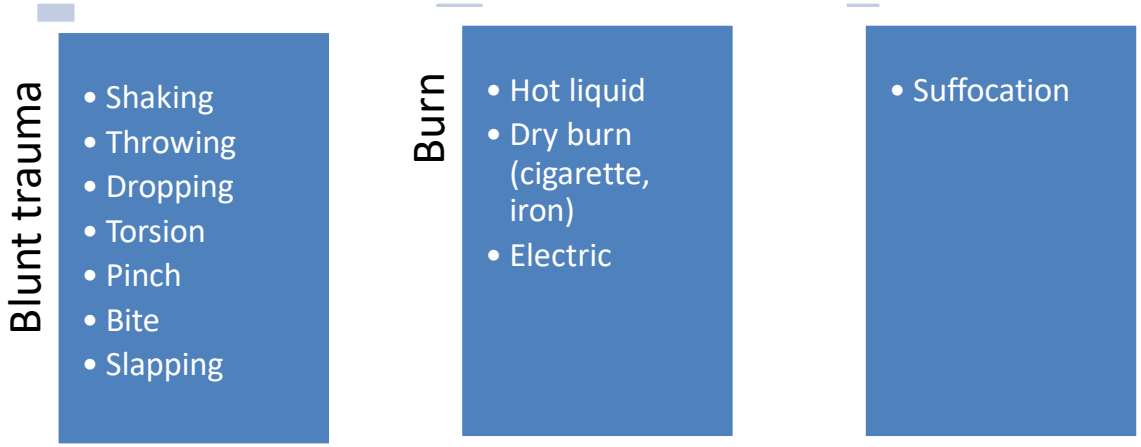
5- **ignoring**

-WITNESSING OF FAMILY ABUSE-



-Physical abuse-

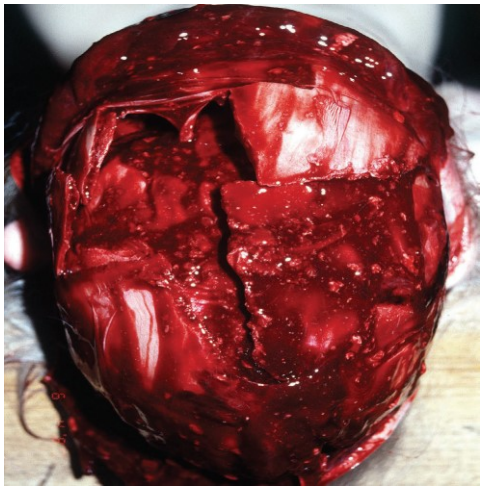
Here is the end of the first lecture of child abuse and will be continued from page no 19



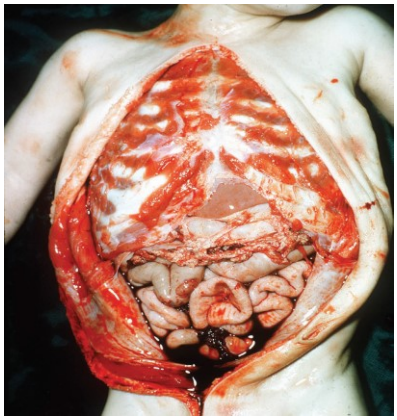
Child Abuse – part 2

The most common cause of death are:

Head Injuries



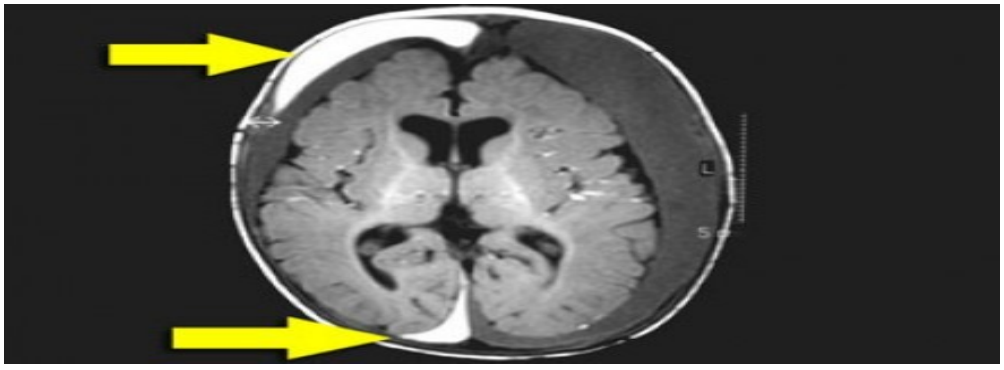
Abdominal (internal organs) Injuries



- **Types of Physical Injuries(Seen In Abuse) :**

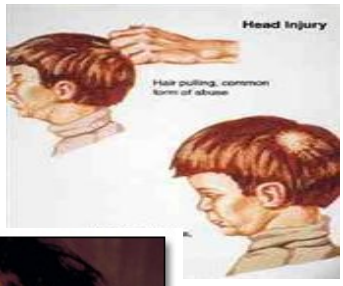
1- Head Injuries :

- **80% of child abuse related death due to head I. in children < 2 Y.**
- **Most fractures are in occipitoparietal areas.**
- **Often associated with subdural he.**
- **Brain injuries may occurs.**
- **Suture diastasis without bone fracture may occurs.**



Chronic bilateral subdural hematomas and new subdural hematomas in the right frontal and posterior interhemispheric region.

There is part of the head injury which is most common to see in cases of Abuse which is the SCALP Injuries and Bruises (are easily felt and observed)
as shown in these pictures



SCALP Bruise

SCALP Laceration

traumatic Alopecia

2- Face Injuries .

Finger tips bruises on the sides of the cheek across the mouth to stop the child crying. Teeth: Loosening, breakage even total avulsion of teeth from the sockets.

SLAPPING MARKS

BURNS

BRUISES AND PETECHIAE

3- Abdominal (internal organs) Injuries

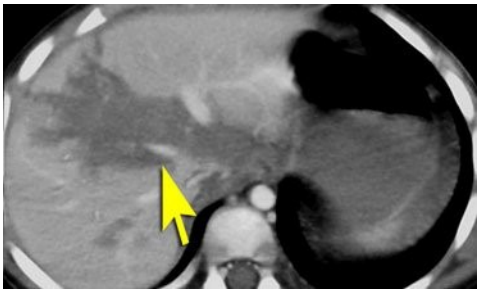
- The mortality rate is 50% due to "patients and doctors delay"

. Children are brought to hospital days after the injury,
when perforation has already resulted in peritonitis and sepsis

Common abdominal injuries in abused children are:

- Liver and pancreas: hemorrhage and laceration
- Stomach: traumatic rupture
- Small intestine: bowel ruptures especially duodenum.
- These are produced by compression or kneeling on the child.

Liver Laceration



Pancreatic Laceration

4- Bruises :

The most common injury.

Common sites:

- ✓ Limbs: wrist, forearm, upper arm, thigh.
- ✓ Buttocks: hand smack and strap.
- ✓ Face: slapping, mouth area, scalp.
- ✓ Abd., and chest: finger pressure.

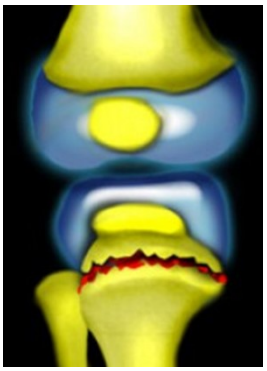
Bruises are of different ages and can not explained by parent story.

5- Skeletal injuries :

include the long bones,Ribs(chest Injuries), and head which discussed before

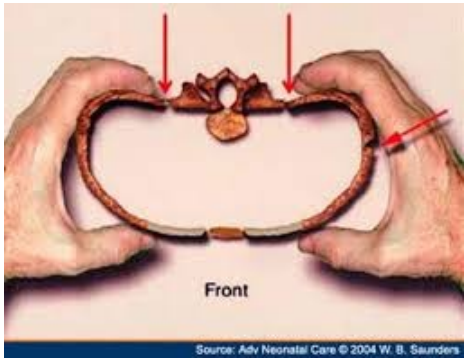
1. Long bones:

- Mostly around metaphysis and epiphysis of
- growing bone.
- Called corner or bucket hundle fracture.
- Twisting or arms……..< spiral fracture.
- Delayed seeking medical advice…….
- .>callus formation in the first presentation.



2-Rib Fractures :

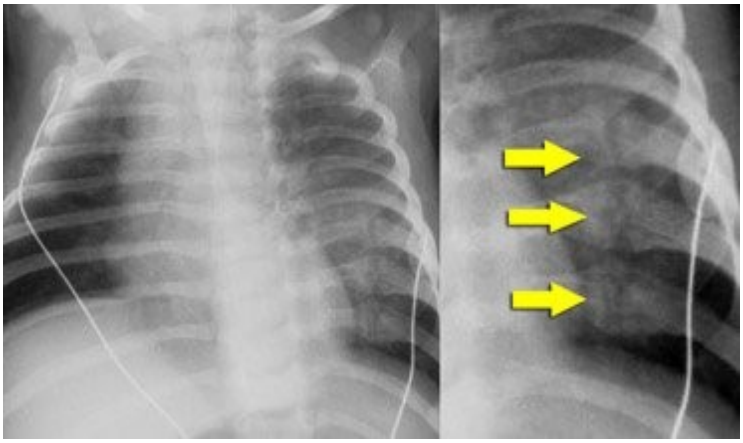
1. Compression force.
2. Posterior ribs fracture are common.
3. Occurs in several contiguous levels, frequent bilateral.



##Chest

Injuries :

healing rib fractures with callus formation that gives string beaded appearance in X-ray
They are not evidence on X-ray in acute stage ,as little displacement occurs.



6- Neck Injuries

Burns On the side of neck

BURN ON SIDE OF THE NECK

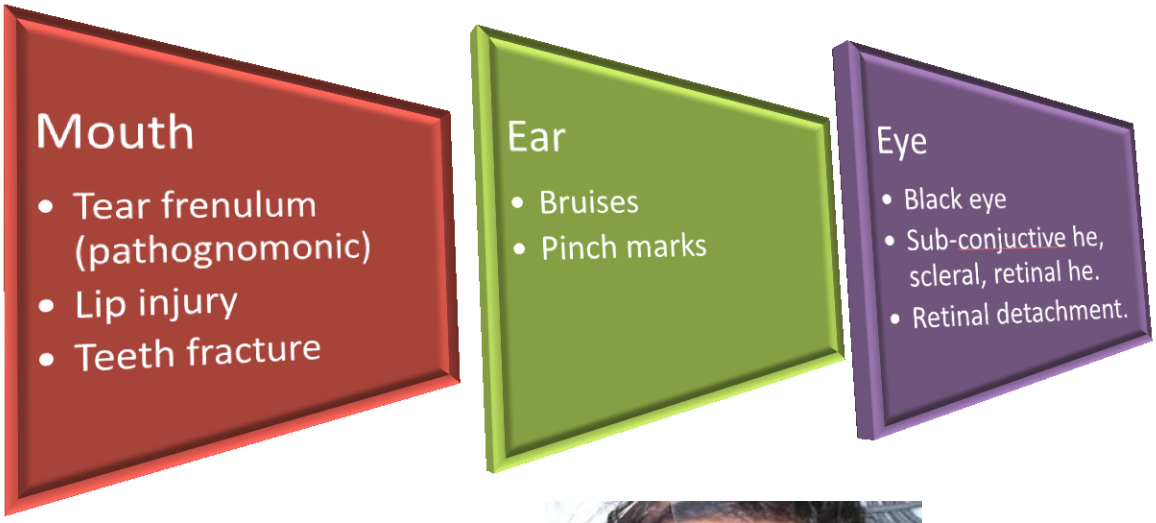
Strangulation Marks

STRANGULATION MARK

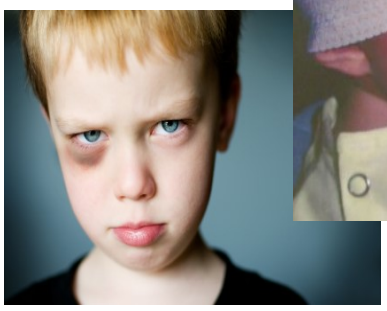
7- Limb Injuries.

A. **Bruises around the joints from gripping in order to swing or shake the infants.**
B. **Fractures at any site in diaphysis, may be multiple.**
C. **Spiral fractures indicate twisting injury.**
D. **Avulsion of parts of metaphysis and slipped epiphysis are causes by traction.**

8- Eye, ear, mouth



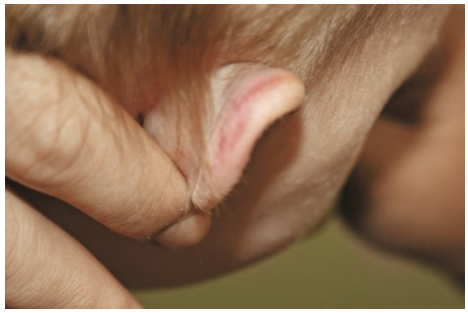
Eye(black eye The raccoon eye)

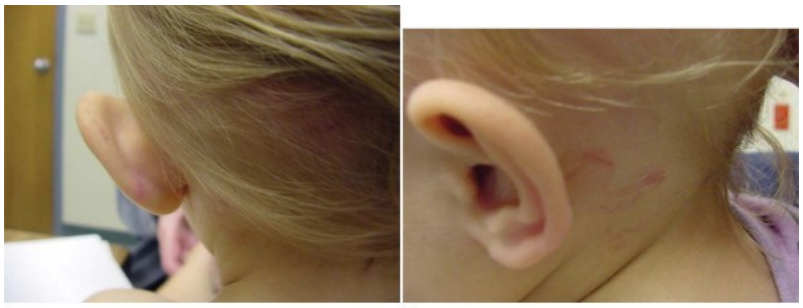


-conjunctival hemorrhages
-scleral hemorrhages
-vitreous hemorrhage
-retina hemorrhage
-lens dislocation

EAR INJURIES

BITE
MARK





A B

MOUTH INJURIES

***Torn Frenulum* is pathognomonic sign of deliberate child abuse.**

SHAKEN BABY SYNDROM (Caffeys' Syndrome)

- It is characterized by retinal, subdural and/or subarachnoid hemorrhages.
- It may be associated with shaking the baby violently or with an extreme blow to the head, such as occurs when children are thrown against a hard object.
- It is a form of child abuse that can result in permanent brain damage or death.
- The chest is compressed resulting in rib fractures.
- Arms and legs move in a whiplash movement resulting in the typical 'corner' or 'bucket-handle'-fractures in the metaphyseal region

9- Burns :

Represent 10 % of cases with child abuse.
10% of child admitted to burn unit are due to child abuse.

Types of Burns :

1- Dry burns:

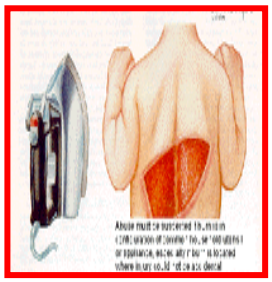
- **Unlikely sites such as buttock and perineum**
- **Cigarettes burns**

2- Scalds :

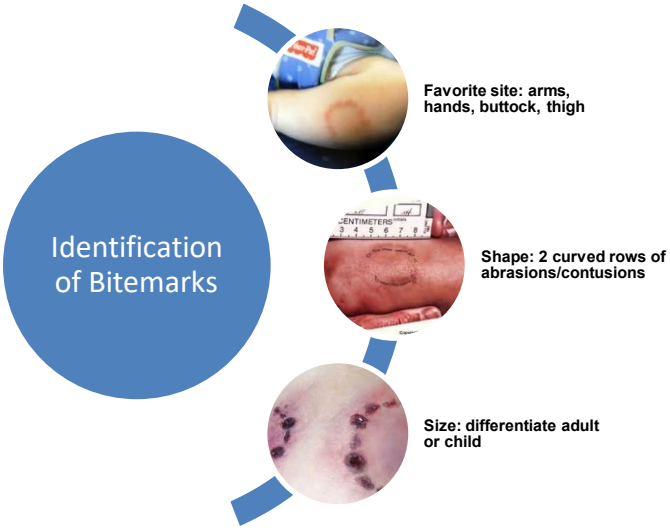
- **Hot bath water**
- **Dipping in hot liquid**
- **Scald burns may be either a spill/splash type of burn or an immersion burn, the most common of the liquid burn injuries.**

Accidental burns	Non Accidental burns
• Scalds are usually more shallow, irregular, and less well defined, spilling from above downward. • Cigarette burns on a child's back or buttocks are unlikely. • Cigarette burns at the face and eyes can occur accidentally if the child walks or runs into the adult's lighted cigarette held at waist height	• Extensive, immersion burn, from downward upward, clear margins. • The child reacts by flexion resulting in relative protection of body creases, which results in stripped pattern that will be more important than the extent and location. • Purposely inflicted "branding" injuries usually mirror the objects that caused the burn and are much deeper.

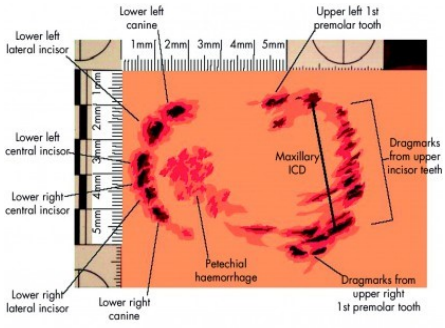
128–130 Burns to the bilateral feet in a "stocking" pattern. This type of injury is pathognomonic for child abuse and occurs when the feet are forcibly held in scalding water. The skin on the sole of the foot is spared by being in contact with the bottom of the bathtub. This child suffered second-degree burns to both feet.



If the physical sign look as a Bite !!!



Human bite marks are identified by their shape and size. They have an elliptical or oval pattern containing tooth and arch marks. These impressions can be matched against the dentition and dental impressions of the victim and suspects



How to identify and Document the child Abuse ?

1- Characteristics and signs : General signs highly suggestive of child abuse

A. Emotional abuse

- The child may be alert or apathetic or in an excessive fear
- Anxious about doing something wrong
- Extremes in behavior
- Depression or stress
- Lack of attachment with the parent/caregiver

B. Physical abuse

- Presence of different type of injuries e.g. fractures together with burns of different kinds
- Presence of multiple lesions of different ages (recent and old)
- Multiple lesion from a single cause e.g. 2 separate cigarette burns
- Unusual soft tissue injuries e.g. avulsion of frenulum of the lips
Unexplained injuries e.g. bruises, burns or cut
- Certain pattern such as marks from hand or belt
- The suspected lesions are covered by sticking plasters or clothes

C. Child neglect

- The suspected constant hunger, sometimes stealing food from other children
- Wear inappropriate clothing
- Consistently bad hygiene or smelly
- Left alone in unsafe environment
- Loss of weight, or being constantly underweight
- Untreated illness any physical injuries

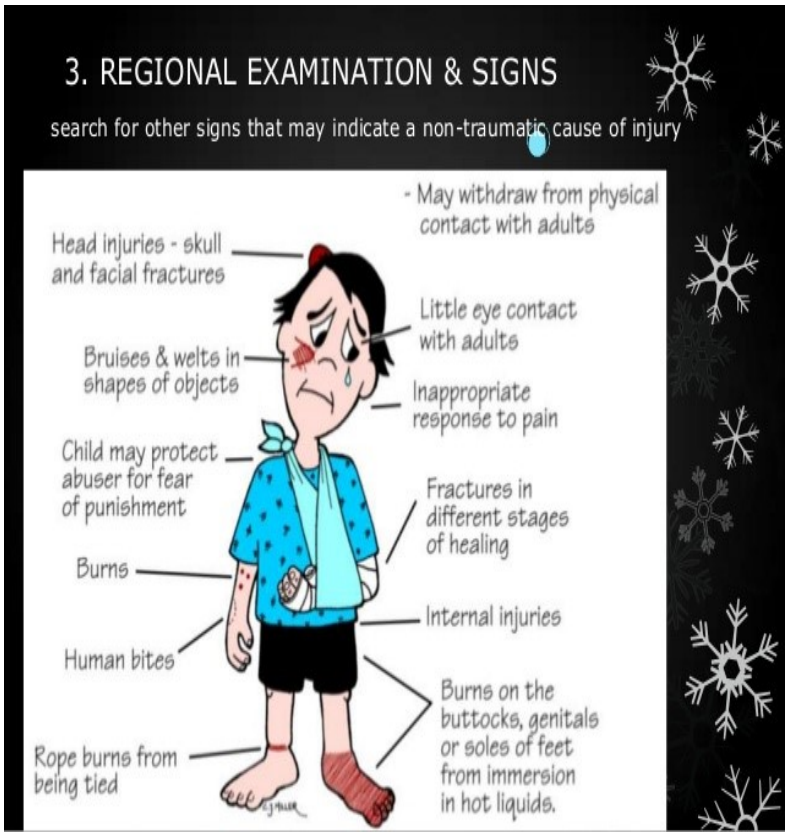
D. Sexual abuse

- Trouble walking or sitting
- Starting to wet at bed and having nightmare
- Doesn't want to change clothes in front of others
- Lustful act and seductive behavior
- Medical conditions like STDs or pregnancy

2-EXAMINATION OF THE CHILD

A. Clothing: examination for cleanliness, quality, suspected stains
B. Photography: colored photographs of all injuries
C. Reginal examination
D. Radiological Examination :

X-ray – CT- Ultra sound – MRI



L4- Medicolegal aspects of wounds And wound reporting

• **Wound definition :**
loss of continuity of any tissue or organ either externally or due to injury or violence.

• Classification

1- Legal: Simple, Dangerous, Fatal
2- According to circumstances: Homicidal, suicidal, accidental, defense, fabricated.
3- Medical classification

Medical classification (Types of wounds)

1- Abrasions
2- Contusions (bruises)
3- Contused wound (lacerated wound)
4- Incised wound (cut wound)
5- Penetrating wounds

1- Abrasionسحجات

Destruction of the superficial layers of the skin following contact with rough or sharp object. (the simplest form of wounds)

A- Scratches خدوش
B-Pressure abrasions سحجات ضغطية
C- Impact abrasionسحجات طبعية
D- Grazing abrasions سحجات احتكاكية
E-Bites عضات

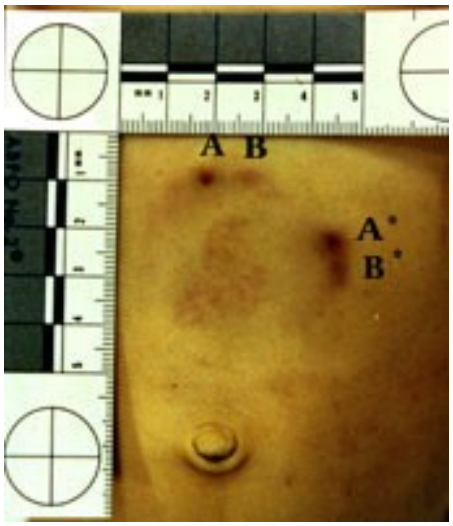
Instrument type : blunt (Rough blunt object e.g. finger nail, teeth, tyre,....آلة صلبة راضة

Scratch Abrasions

Grazing Abrasions

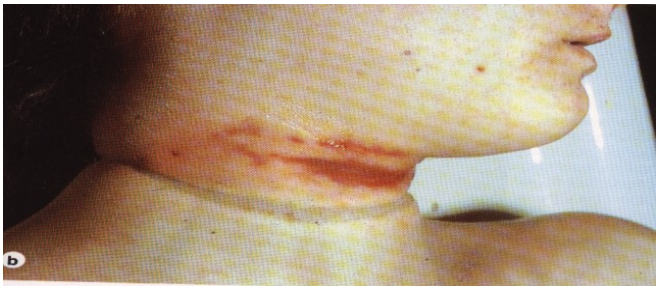
Abrasion : impact (impression or patterned)

Bite Abrasion



Pressure abrasions

- **Rope in hanging**
- **Showing contusion and echemosis**



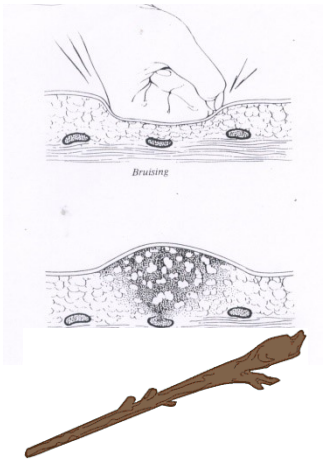
- **Medicolegal importance of abrasions:**

1- It may be the only evidence of a crime or violence i.e. signs of resistance.
2- It can give an idea about the type of the crime from its site. e.g.
3- Finger nail abrasions around the mouth and nostrils means smothering.
4- Finger nail abrasions on the sides of the neck means throttling (manual strangulation).
5- Finger nail abrasions on the inner side of the thighs means rape.
6- Rope mark on the neck means strangulation or hanging.
7- It can give an idea about the instrument used from its shape e.g. finger nails, radiator of a motor car, rope mark.
8- Differentiate incised and contused wounds.
9- The age of abrasion gives an idea about the date of the crime.

- **Abrasions must be distinguished from**

- Post mortem injuries caused by ants or insects (usually are found at mucocutaneous junctions e.g. angles of mouth, eyelids, margins of nose.
- Excoriation of the skin by excreta seen in infants.
- Pressure sores.

2-Contusions (bruises) كدمات



Definition:

Extravasations of blood under intact skin or membrane or capsule due to injury or violence.

##Instrument:

Blunt object e.g. stick or big stone ألة صلبة رضة

##Shape :

Usually it takes the shape of the causal instrument e.g. small rounded bruises caused by fingertips, closed fist and the end of stick. An elongated bruise caused by a stick. A bruise in the form of two thin parallel lines produced by a whip كرباج or a pliable stick خرزانة,

##AGE:

The age of a bruise usually depends on its size and depth. The color of a bruise is first bright **red** (oxy HB) → **violet**, then → **bluish** color (reduced HB) → **green** colour (biliverdin) → **yellow** color (bilirubin) and gradually disappears in 15 days (range from 2-4 weeks). The color changes occur from the periphery inwards.

##Factors Affecting Bruises:

1. The amount of violence applied to the body.
2. The instrument used.
3. The condition and type of tissues.
   Bruises are more easily and extensive in loose and lax tissue e.g. eyelids and in tissues with excessive subcutaneous fat. On the other hand, bruises are less and even absent in tissues strongly supported by fibrous tissues e.g. scalp, palms and soles, also in persons with good muscle tone e.g. in boxers.
4. Texture and colour of the skin: Bruises are more apparent in fair people than dark people.
5. Age: Children and old peoples tend to bruise easily
6. Sex: Women bruised more easily than men due to delicacy of tissues and presence of subcutaneous fat especially if obese.
7. Certain diseases: Patients suffering from hypertension, cardiovascular degenerative changes, purpura, hemophilia, leukemia and survey are more easily bruised.
8. Gravity: bruises can appear at places away from the site of violence e.g. a blow on the forehead → bruise round the eye, a blow on the abdomen → bruise in the scrotum

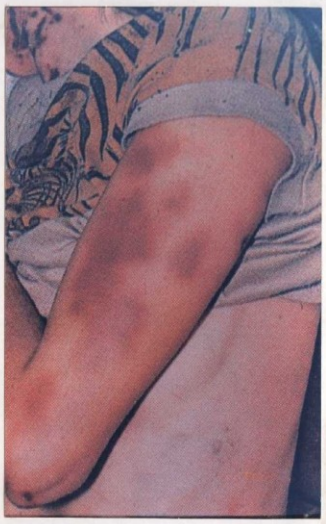
Differentiation between hypostasis and bruises:

	Bruise	**Hypostasis**
Incidence	Occur inn living	Postmortem
Site	Anywhere	Dependent
Skin	Accompanied by abrasions	intact
	Swelling + color change	None
Pressure	Color not disappear	Color disappear
Blood	The blood is extravascular not , washable and clotted.	The blood is intravascular , washable and fluidy.
Cell infiltration	There is cellular infiltration	Absent

Medicolegal importance of a Bruise:

1. May be the only evidence of crime or violence.
2. May be the only evidence of signs of resistance.
3. The date of the crime can be estimated from its age.
4. Give an idea about the instrument used (from its shape).
5. Differentiate between incised and contused wound.
6. May be the cause of death.
7. It should be differentiated from hypostasis.

BRUISES , FROM PUNCH OF HAND OR BLUNT INSTRUMENT



Contusion
(Showed colour changes)

3-Contused wound (lacerated wound)
الجرح الرضي (متهتك)

 # Definition:

Tearing or splitting of tissues OR An open injury produced by the impact of blunt force.

It is caused by a stick, stone,

 # Characteristics :

Doesn't bleed a lot, High infection rate, slow bleeding, very painful, can cause a scar and/or disfigurement, The edges are usually abraded with contusions around, and the angles may be multiple and irregular.

 # Instrument: آلة صلبة راضة

Heavy blunt object e.g. heavy stick or big stone, heavy object falling on you or fall from a height.

 # Types of Contused Wounds :

Type	Name in Arabic, As should be written in the medicolegal report	Characteristics
A-Contused wound	A. جرح رضى	Skin + Subcutaneous tissue
B- Lacerated wound	B. جرح رضى متهتك	cuts the muscle; either cut laceration caused by a sharp object (E) or heavy blunt object
C- Crushed	C. جرح هرسي	Cuts tendon, (nearly) reaches bone. If the machine chain wraps around their arm DO NOT untie, the cut muscle is filled with myoglobin its release will cause renal failure = crash syndrome
D- Tear laceration	D. جرح مزعي	like removal of scalp
E- Cut laceration	E. جرح قطعي متهتك	Caused by الفأس او البلطة

How to differentiate between the Lacerated wound and the Cut laceration ?

Lacerated wound:

it is a contused wound where the edges are severely damaged and highly irregular, with multiple angles.

Not necessarily a sharp object.

Cut laceration:

inflicted by heavy sharp cutting instrument e.g. by the blade of fass or axe.

A "Balta" will cause a triangle shaped wound; the tip will be to the inside and the base to the outside

Note (:بيجي سؤال)

The Contused wound could simulate incised wound in the skin stretched over bone e.g. scalp.

Images for multiple cases of contused Wounds :

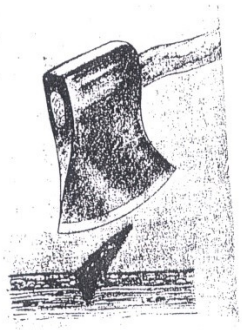
A contused wound

A Sutured contused wound

CRUSH : Bone should be involved

Lacerated wounds

Contused wound; Amputated finger, crush



Cut laceration

Lacerated wound

Instrument in case of Photo: heavy blunt آلة صلبة ثقيلة
Type of lesion :traumatic amputation (بتر اصابى)

4-Incised wound (cut wound)جروح قطعية

#Definition:
Drawing edge of sharp instrument along surface of skin.

#characterstics:
- **Close Edges: The edges of the wound are usually gaping.**
- **Free Bleeding External bleeding is usually free**
- **Fast healing :usually the wound heals by first intention**
- **less infection , less sepsis**
- **Surgical Wound**
- **more long than deep, having clearly cut sharp edges and base.**
-

 # Shape of the wound
It is usually linear

#Instrument:
Sharp object e.g. knife or broken glass OR Single bladed (Knife) – Double bladed (مطوة)

#Differentiated from contused wounds by:
presence of abrasions and color changes in contusions, if you look using a magnifying glass the hair will be clear sharply cut in cut wounds and crushed in contusions with the presence of dirt and glass.

CUT Wound Cases :

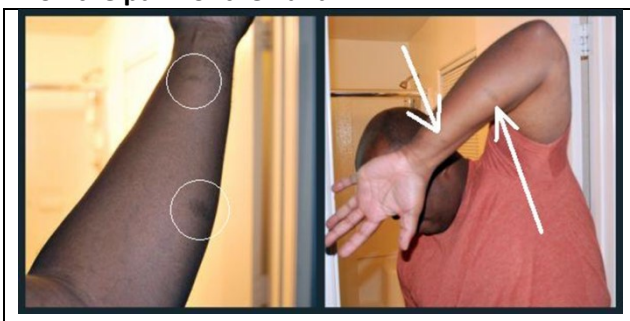
Incised wound-Cut wounds , Type of instrument: sharp
جروح قطعية ، الاداة المستعملة هي آلة صلبة حادة

 # Types cut wounds :
the lecture mentioned 3 types and topics regarding it, those are the :
1. **defensive wounds**
2. **fabricated wounds**
3. **the Cut throat**

1- Defensive wounds:

these appear while trying to protect the face, they will take the shape of slashes on the are of the forearm.

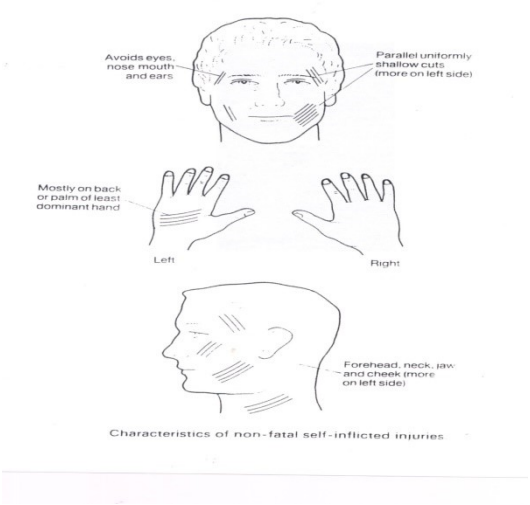
These (and the one in the previous slide) appear due to grabbing the knife while trying to protect yourself, they appear on the palm of the hand.



These appear due to grabbing the knife while trying to protect yourself, they appear on the palm of the hand.

2- Fabricated Wounds :

- **Common in crime-filled societies.**
- **Done in "safe" areas like banging their heads or by slashing their hands superficially on their non dominant hand, the clothes are slash-free or the slashes on the clothes are not corresponding with what is on their hands. It is within reach.**
- **Sometimes can be done on the back (if help was provided) by <u>faking whip marks</u> (using a coin) – This is distinguished from real whiplashes easily as the latter hit the scapula only and doesn't hit the vertebral column.**



Characteristics of non-fatal self-inflicted injuries

#characterstics :

1- **Parallel, uniformly, shallow cuts, more on left side .**
2- **On forehead, neck, checks , and mostly on the left side**
3- **On the back of the least dominant hand .**
4- **On safe area: he-she avoids the eyes,nose,ears,mouth**

3- Cut throat- Suicidal

Suicidal Vs. Homicidal Cut throat:

##Suicidal is mostly judged by the circumstances:

1- Patient's history will include either a diagnosis of depression, psychosis or the patient being blackmailed.

2- Presence of a suicidal note, written willingly.

3- Doors are closed from the inside, no broken glass (intact windows), furniture is in place (no sign of struggle)

4- Usually the patient likes to look at himself in the mirror while cutting, his skin is tensed (tight), there is a hesitation mark, starts from above and continue obliquely and faints at the sight of blood or upon touching the Vagus.

5- The blood will spurt on the mirror.

##HOMICIDAL

1- The wound will be lower (victim lowers his head to protect his neck).

2- Transverse - crosses the midline -

3- Covers almost the entire neck (bilateral and continues)

4- Blood flows downward

5- Absence of any circumstantial evidence.

Suicidal	
HOMICIDAL	

6- Stab wound جرح طعني

##Definition : A wound caused by thrusting or forcing sharp pointed instrument into the body, having a sharp edged blade e.g. knife, scissors.

Its severity correlates with injury to the vital organs and infections.

##Instrument:

By flat sharp object e.g. knife آلة صلبة حادة

##Types:

A. A- Stab penetrating wound جرح طعني نافذ

These are stab or punctured wounds reaching a body cavity e.g. chest (pleura, pericardium), abdomen (peritoneum), joint cavity.

B. B-Transfixing wound/ Perforating Wound; جرح مخترق

enter and exit through a surface "يثبتك" These are stab or punctured wounds transfixing a limb or even the whole body.

C- Puncture wound;جرح وخزى

Caused by thrusting an instrument with a blunt edge and pointed end e.g. nail.

OR by simple instruments – screwdriver, needle ..

Instruments used in puncture wound

##Characters of Stab Wound:

1. Is usually more deep than long.

2. Its depth being usually relative to the length of the blade.

3. The width is also relative to the breadth of the blade, sometimes the wound may be enlarged on withdrawing the instrument.

4. The edges are cleanly cut without surrounding abrasions or contusions except in punctured wounds and those produced by the handle of the knife.

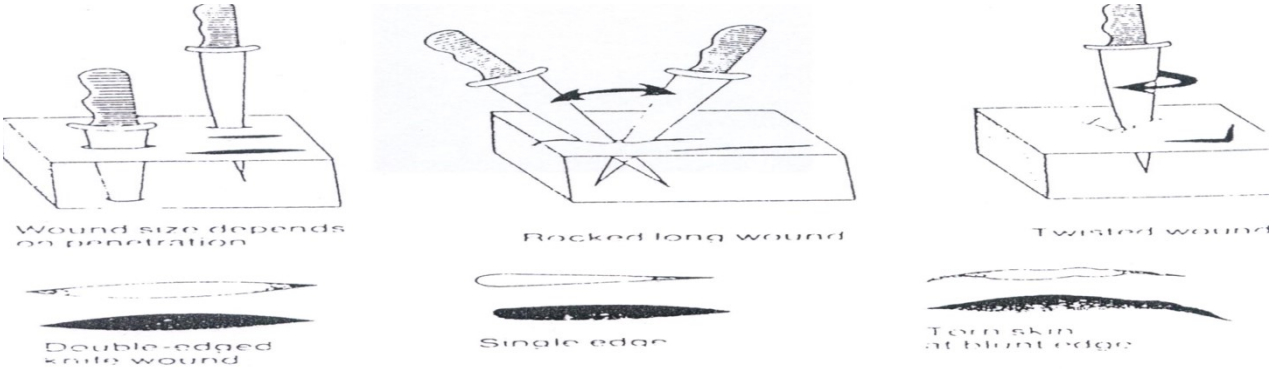
5. The shape of the wound is related to the shape of the causal instrument.

- Double bladed/ Bibladed knife → Two pointed sharp angle. (Eye shaped)

- Single bladed/ Monobladed knife → One end is sharp pointed, the other is transverse (curved).

- Closed scissor → Quadrangular rhomboid wound.

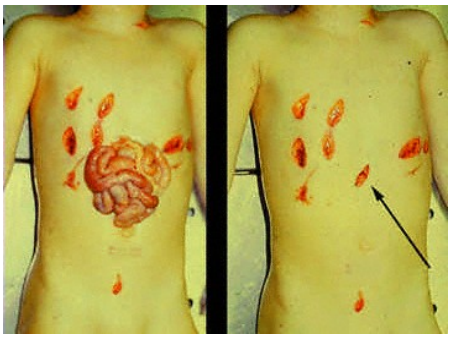
- Stabbing with rounded end of the nail → Circular wound.



Stab Wound Cases :

Stab wound

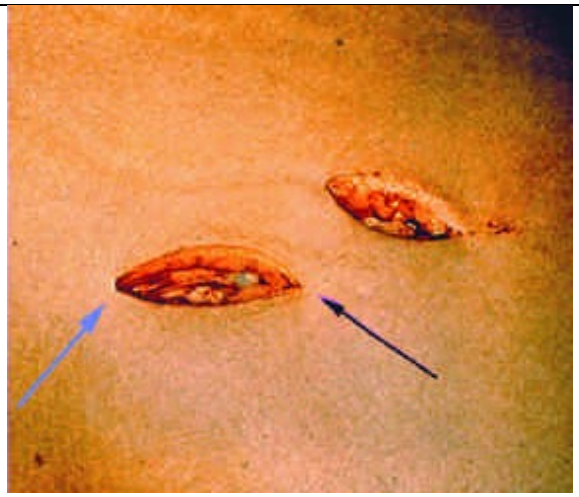
Multiple stab wound



Multiple stab wound

Stab wound : the instrument is Single bladed/ Monobladed knife → One end is sharp pointed, the other is transverse (curved).

Stab wound



Stab wound : the instrument is Double bladed/ Bibladed knife → Two pointed sharp angle. (Eye shaped)

Danger, complications, causes of death in wounds

- **All found in the word "SHE IS" : Shock, Hemorrhage, Embolism, Infection, Surgical Complication**

I. TRAUMATIC SHOCK

A. Primary or neurogenic shock: This includes

i. Death from reflex vagal inhibition of the heart i.e. parasympathetic stimulation → slowing of the heart → instantaneous death.'

- An "injury" to a High vagal tone area – Carotid, epigastrium and genitalia - causes severe hypotension, patient will faint but not die due to the vagal escape (the vagal tone is blocked so the ventricle will beat on his own at a pace of 40 beats/min.)
- When faced with a wound, give atropine before to stimulate vagal block and prevent shock.

ii. Death from sympathetic stimulation of the cardiovascular system (There needs to be predisposing factor – atherosclerosis - + a rise in adrenaline leading to increase in coronary rate, especially in young ages *Notes

B. Secondary or hematogenic shock = Surgical shock

It is of gradual onset, there is reduction of the total circulating blood volume due to local loss of fluids (blood, plasma) at the site of injury with capillary dilatation due to absorption of histamine like substance liberated from the injured tissues.

II. HEMORRHAGE

Loss of blood is the commonest cause of death in wounds e.g. stab or incised wounds and especially if it results from injury of an artery. Symptoms from hemorrhage start to appear if the person loses one liter of blood and grave danger occur if he loses 2 liters or one third of the total blood volume, this is termed external hemorrhage.

Types of hemorrhage

1. Primary hemorrhage: follow immediately after injury.
2. Reactionary hemorrhage is usually delayed for several hours up to 24 hours after injury.
3. Secondary hemorrhage is due to infection of a wound, it occurs between 10-16 days after injury.

Postmortem picture of death from hemorrhage

Externally:

- Large amount of blood at the scene and on the clothes (may be inside a body cavity), also a wound is present.
- The body looks pale.
- Post mortem hypostasis is ill defined or even absent.

Internally:

- Pallor of organs (heart, lungs, brain).
- Heart and big vessels are empty of blood.
- Petechial hemorrhages under serous coats especially the endocardium (sub-endocardial petechial hemorrhages).
- Spleen is contracted.

III. INFECTION OF THE WOUND

Wound infection may be caused by organisms which are normally present on the body surfaces e.g. staphylococci, streptococci, Pneumococci or by organisms which invade the tissues from the environment.

Infection of the wounds may be:

1**. Primary** is caused by organisms which are carried into the wound at the time of the injury e.g. from the skin, clothing or street dirt (tetanus). Primary infection often cannot be avoided.

2**. Secondary** is caused by organisms which invade the wound after the injury e.g. by air droplet infection, contaminated dressing . It can be prevented by adequate aseptic surgical measures.

IV. EMBOLISM

A. Air embolism

The minimum amount of air to cause air embolism is 60 ml.

	Venous air embolism	**Arterial air embolism**
Incidence	Common	Less common
causes	* Open injuries (neck, chest) * During blood transfusion * Others: criminal abortion, insufflation (like in the fallopian tube).	Stab in chest communicating a bronchus with pulmonary vein – Transfixing Injury
P.M. picture	Puncture of right ventricle under water → air comes out (Bubbles)	Puncture of Lt. ventricle under water → air comes out. Beaded coronary & cerebral arteries

B. Pulmonary embolism due to deep vein thrombosis:

Injury to the veins of a limb leads to deep vein thrombosis, the effects of pulmonary embolism depend upon the size of the emboli released from the venous thrombus. When a large branch of one of the pulmonary arteries is obstructed, an infarct may develop in the lung. It occurs 2-3 days after trauma and about the 10th day of operation.

C. Fat embolism

It is due to obstruction to the flow of blood through the capillaries by fat globules.

It usually occurs after

1. fractures involving long bones i.e. bones containing marrow fat, but it may follow severe injury.
2. burn to fatty tissues in any part of the body. Pulmonary fat embolism occurs less than 2 days after fracture while cerebral fat embolism occurs 2 days and more after fracture.

Case studies

Case study (1):

1- a female 20 years old , had been killed at her home after 8 hours from death. The post mortem examination showed that there are stabs and cut wounds all over her body.

A- what are the characters of stab wounds and incised wounds

B-what are the PM changes that could be noticed in this case

Case study (2)

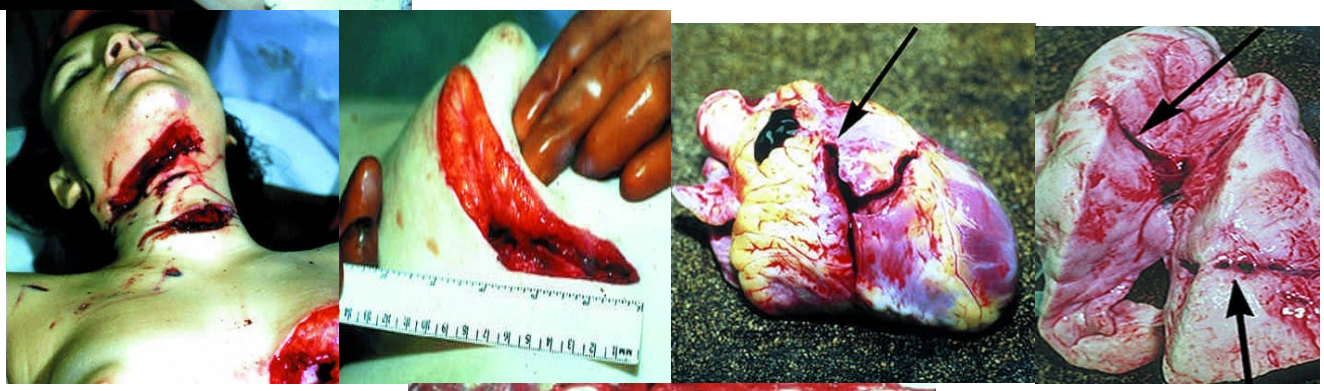
A 20 years old man was found dead in his farm. There was a big wound in the neck . Disarrangement of the furniture .small cut wounds, bruises and abrasions all over the body. The medicolegal expert diagnosed the case as homicidal cut throat.

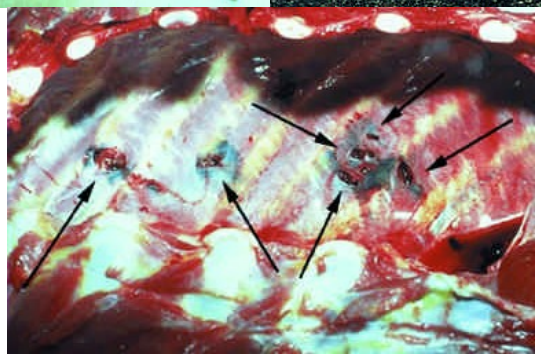
1- how the medico legal expert reached this diagnosis?

2-what is the probable cause of death?

Case study (3)

This woman was talking on the phone with her mother when a man entered her apartment and killed her. A and a side view of the neck reveals the clean deep cuts with no hesitation marks and Her windpipe (larynx) was severed, causing her to suffocate. Few blood vessels were cut. The abrasions on her chin are “rug burns.” This incised wound of the arm occurred when the decedent raised her arm in a defensive posture. There were multiple incised and stab wound of the neck, trunk, and extremities, There was a large defect in the chest with more than one stab wound, The stab wounds to the heart revealed a blunt angle (arrow). Some organs such as the heart and the liver may give better views of the angles than the outside of the body m There were multiple stab wounds in lungm The arrows in the last picture point to some of the ten stab wounds to the inside left chest wall. The victim was stabbed at least ten times through the single large wound of the chest.





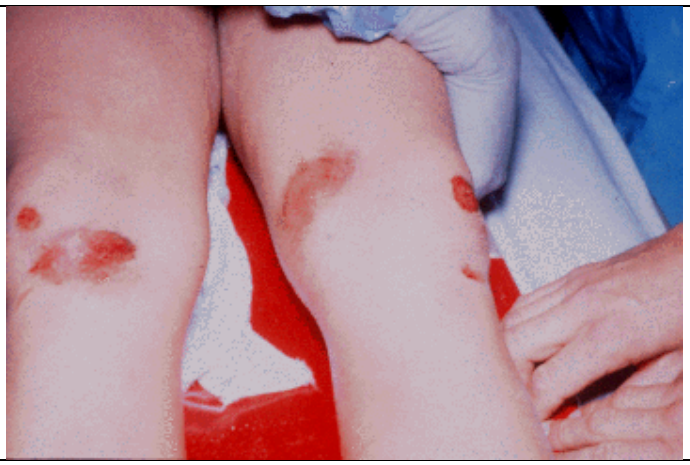
##

How to write a Medicolegal report ?سؤال مهم جدا جدا جدا

لكتابة تقرير شرعي قضائي لوصف كدمة، جرح، ضربة أيا كان نوعها ، يجب ذكر 5 نقاط مهمة في كتابة التقرير :

1- نوع الجرح ، نوعه، عددها و شكلها ، لونها ، مكانها من الجسم (يجب وصف و كتابة كل ما تستطيع وصفه في الجرح و الصور المرفقة (جرح طعني، جرح قطعي ، كدمات ، سحجات...)
2- نوع الاداة المستخدمة فيه (آلة صلبة رضة ، آلة صلبة حادة ، آلة حادة...)
3- الفحوصات اللازمة للحالة (اشعة مقطعية ، اشعة سينية ، رنين مغناطيسي...)
4- العلاج المطلوب للحالة – حسب التشخيص- (مضادات حيوية ، تقطيب و تعقيم ، اجراء عمليات صغرى ، اجراء تجبير بحال وجود كسور، عمليات كبرى...)
5- مدة العلاج المطلوبة (قل من 20 يم أو أكثر من عشرين يوم)

Case	a Medicolegal report
	1- سحجات ضغطية طبعية، على منطقة الظهر ، ذات حجم كبير (تغطي المنطقة السفلية من الظهر كاملًا) 2- الأداة المسببة : آلة صلبة رضة، من الصورة و الطبعات السحجات بسبب اطارات عجل سيارة\شاحنة 3- الفحوصات اللازمة : اشعة مقطعية ، اشعة سينية ، رنين مغناطيسي...) 4- العلاج المطلوب: تجبير الكسور ، وقف اي نزف بحال وجود نزف داخلي .. 5- مدة العلاج: أكثر من 20 يوم
	1- سحجات ضغطية طبعية ، في منطقة الرقبة و ممتدة للجوانب 2- الأداة المسببة :آلة صلبة ،حبل قوي 3- الفحوصات اللازمة : اشعة مقطعية ، اشعة سينية ، رنين مغناطيسي... 4- العلاج المطلوب: اعطاء المريض الأكسجين (قناع اكسجين)، تجبير الكسور ، وقف اي نزف بحال وجود نزف داخلي .. 5- مدة العلاج: أكثر من 20 يوم
	1- سحجات و كدمات ، على منطقة الرقبة و أسفل الذقن، تتراوح ألوانها بين الأحمر و الأزرق 2- الأداة المسببة : باستخدام اليد (الخنق اليدوي) 3- الفحوصات اللازمة : اشعة مقطعية ، اشعة سينية 4- العلاج المطلوب: اعطاء المريض الأكسجين (قناع اكسجين)، تجبير الكسور ، وقف اي نزف بحال وجود نزف داخلي 5- مدة العلاج: أكثر من 20 يوم

1- كدمات ، على كلا الفخذتين ، متعددة و ذات لون أحمر (أي أنها حديثة و أصيبت بها قبل أقل من يوم) 2- الأداة المسببة : آلة صلبة ، هنا الكدمات تمت الاصابة بها باليدين (حالة اعتداء جنسي) 3- الفحوصات اللازمة : فحص اكلينيكي كامل، ممكن عمل اشعة سينية ... 4- العلاج المطلوب: تضميد الكدمات و وقف اي نزف موجود ، في حال تأكيد الاعتداء الجنسي يجب اخذ عدة عينات اخرى 5- مدة العلاج: أقل من 20 يوم	
1- جرح رضي ، في منطقة الوجه، أعلىالعين اليمنى فوق الحاجب ، مصحوب برضوض متعددة يتراوح لونها من البنفسجي إلى الأحمر ، عدد الجروح 1 فقط 2- الأداة المسببة : أداة صلبة رضة حادة 3- الفحوصات اللازمة : : فحص اكلينيكي كامل، اشعة مقطعية ، اشعة سينية ، رنين مغناطيسي 4- العلاج المطلوب: : تقطيب الجروح و تعقيمه ، اعطاء مضادات حيوية و الكزاز، تجبير الكسور ، وقف اي نزف بحال وجود نزف.. 5- مدة العلاج: أكثر من 20 يوم	

اسئلة للحل :

	
1- نوع ال..... 2- الأداة المسببة : 3- الفحوصات اللازمة : 4- العلاج المطلوب: 5- مدة العلاج:	1- نوع ال.... 2- الأداة المسببة : 3- الفحوصات اللازمة : 4- العلاج المطلوب: 5- مدة العلاج:

L5- Ballistics and firearm Injuries

Ballistics

##Definition :

It is the science that studies the motion of a projectile (projected from a firearm weapon).

##Anatomy of the Gun :

##Classification of firearm weapons:

Classification according to :

1-according to number of projectiles:

*** Single missile firing (bullet)**

e.g: service rifle, automatic pistol & revolver (old, new).

*** Multiple missile firing(shots or pellets)**

e.g: sporting gun

2.According to the length of the barrel:

***Long barreled**

e.g: service rifle automatic & non automatic

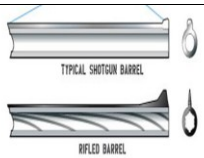
*** short barreled**

e.g: pistol (automatic), revolver(old,new

3-According to the inner surface of the barrel:

*** Rifled weapons**

e.g: service rifle (long barreled), automatic pistol, revolver (short barreled).



*** Non rifled weapons(smooth bore weapons)**

e.g: sporting gun

##What is rifling ?

Rifling refers to the spiral grooves on the internal surface (bore) of a gun barrel .

Functions of rifling are:

1.Spiraling motion of the bullet which leads to:

- Increase distance of firing.
- Increase power of penetration.
- decrease resistance

2.Gyroscopic steadiness. (It gives the bullet stability during its path)

3.It differs from one weapon to another according to:

- Number of lands and grooves.
- Direction of twist.
- Width of lands and grooves.

So it is considered as "family characteristic"

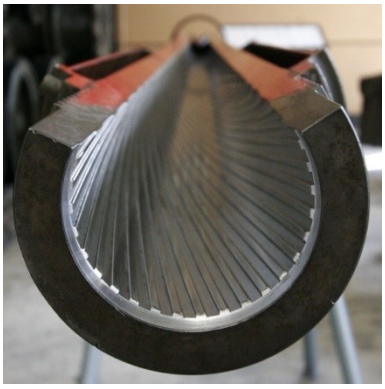
##Medico-legal importance :

Rifling characteristic of bullets can give clue to the manufacturing and model of the firearm weapon from which they were fired , so it can identify the weapon*called Primary rifle marks

##Signs of firing on a bullet:

- **Primary rifle marks:**

Longitudinal parallel oblique grooves on the surface of the fired bullet resulting from rifling inside the barrel equivalent to them as regards their number, depth, width& direction of twist.



1- Seen by naked eye
2- Only screening not confirmatory

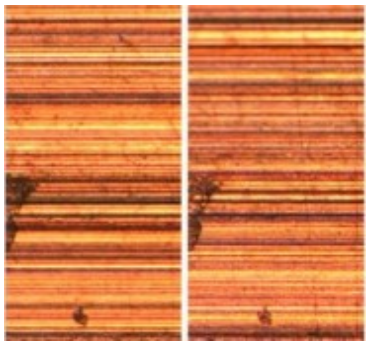
- **Secondary rifle marks :**

They are irregular microscopic scratches on the surface of fired bullet.
Caused by defects in the barrel of the gun or in its muzzle during manufacturing process. Also it .could be rust

1- They are considered confirmatory marks that act as a signature of the used gun on the fired bullet.
2- They form the individual characteristics of the barrel.
3- Seen only by comparison microscope
4- Bullets can be test fired by a suspect weapon and compared under a comparison microscope to a bullet recovered from the crime scene by Shooting in a Water Tank **

comparison of two bullets from the same weapon under comparison microscope

Same scratches on both



Signs of firing on a cartridge

Firing pin marks:

Is an impression (dimple) of the striking portion of the firing pin on the percussion cap at the base of the cartridge.

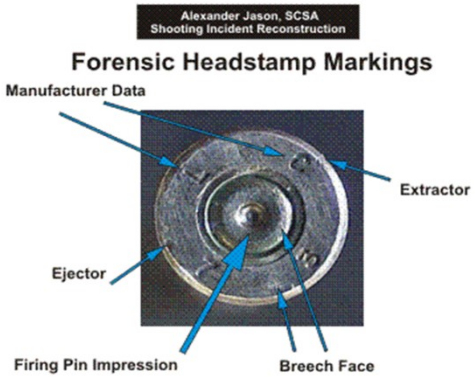
Complete cartridge of any weapon may be either:

*Non fired.

*Misfired.

Differentiated by

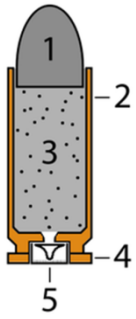
the dimple on the percussion cap.

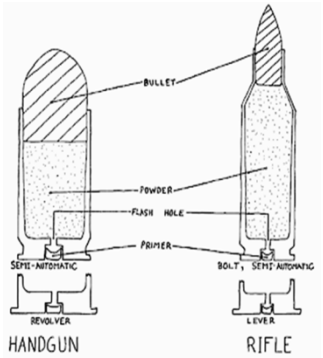


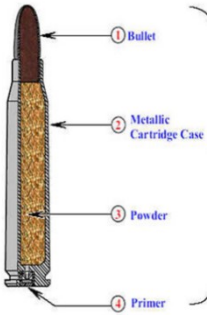
Ammunition for rifled weapons

Is a cartridge that consists of a cartridge case and a bullet (projectile).

Anatomy of the cartridge:







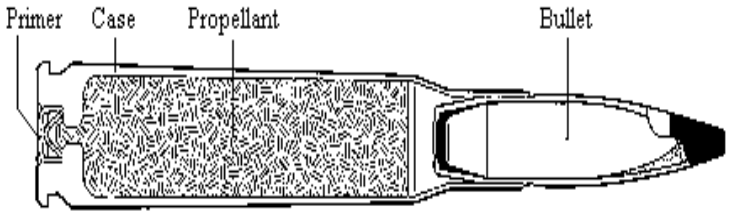
HandGun

Service Rifle

* The base of the cartridge contains the percussion cap.

The case contains primer & propellant powder.

Contents of the complete cartridge



1.The primer (igniting powder) :

It is the paste that lines the percussion cap , It consists of

1- Mercury fulminate(explosive).
2- Potassium nitrate or chlorate(source of oxygen).
3- Powdered glass(friction surface).

2.propellant powder:

- It is the actual source of energy.
- It accelerates the projectile to a certain velocity.
- The pressure of a compressed gas acting on the base of the projectile is the necessary propelling force.
- This pressure is obtained by the combustion of a chemical compound in a limited volume.

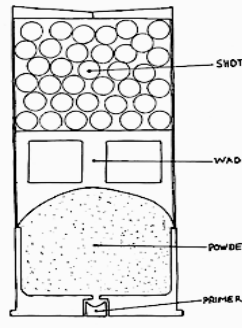
So propellant powder must be:

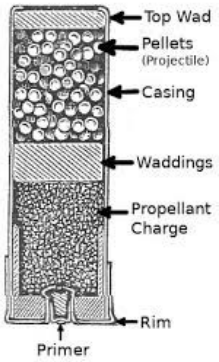
1. easily combustible.
2. release great quantity of gas on combustion.

Composition:

- **Black powder** (charcoal, sulphur, potassium nitrate) , One volume produces 300 ml volumes of gases.
- **Smokeless powder** (nitrocellulose with/without nitroglycerine), One volume produces 1300 ml volumes of gases.

3- The bullet





- it is Long or short with pointed tip or dome shaped (rounded) .
- Bullets may **be jacketed** (the Lead core is covered by some metal to Prevent formation of hazardous lead vapor.) or **non jacketed .**

- Ammunition of Service rifle cartridge

- Service rifle = long barreled, rifled, single missile firing
- **The case:**

1- Long, narrow & it has a shoulder.
2- Made of brass or copper.
3- In automatic SR: the base of the cartridge case is grooved.
4- In non automatic S.R: the base of the cartridge case is rimmed.
5- from the bottom , The base of the cartridge contains the percussion cap.

- **The bullet :**

1- Long with pointed tip or sometimes dome shaped (rounded).
2- All military rifled projectiles are fully jacketed, have a pointed aerodynamic shape because of the relatively long distances they must cover.

- Ammunition of short barreled rifled weapons

- **The Case :**

1- Short, narrow and it has no shoulder.
2- Made of brass or copper.
3- In automatic pistol, the base is grooved.
4- In revolver (old and new) the base is rimmed.

- **The bullet:**

1- Short and dome shaped.
2- Bullets of automatic pistol are fully jacketed.
3- Bullets of revolver may be jacketed (new revolver), or non jacketed (old revolver).

- Ammunition for sporting gun

*Sporting gun = non rifled, multiple missile firing.

- **Consists of cartridges (shells) with:**

1- pellets (shots),
2- wads
3- powder.

- **The cartridge (shell):**

1- Consists of a base made of brass and an upper part made of cardboard or plastic.
2- The centre of the base contains the percussion cap which is lined by the igniting powder (primer).
3- Above the base , a space is filled by the propellant powder, then the inner wad, followed by the pellets (shots) and lastly the outer wad.

4- Nowadays the inner and outer wad are replaced by a plastic cup Which has wings and Causes more damage.

Plastic cup

- **Pellets (shots)**

1- Are rounded,
2- Made of lead,
3- Of different sizes according to the gauge of the weapon.

What is the sample?

 -Complete cartridge of Service rifle (long because it has a neck) -automatic (the case is grooved)	 #Complete cartridge of Service rifle (long because it has a neck) #Non automatic SR (the case is rimmed)
 #Loaded cartridge #Short (no neck #Automatic pistol (grooved)	 • Loaded cartridge • Short (no neck) • Non automatic old revolver (the case is • rimmed) • Non jacketed bullet

 • Loaded cartridge • Short (no neck) • Non automatic new revolver (the case is rimmed)	 • Non rifled (sporting gun) • Non automatic • Loaded cartridge
 • Empty cartridge • Long (it has a neck) • Automatic SR (grooved)	 • Empty cartridge • Long (it has a neck) • Non automatic SR (the base is rimmed)
 • Empty cartridge • Short (no neck) • Automatic pistol (the base is grooved)	 • Empty cartridge • Short (no neck) • Non automatic , old or new revolver (the base is rimmed)

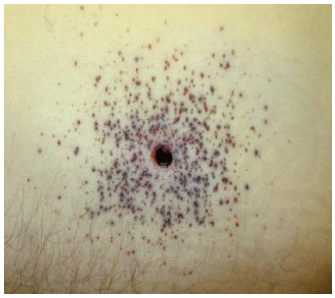
Notes :
- Empty case may be fired (has a dimple on percussion cap) or non fired.
- Bullets May be:
1.Fired (longitudinal oblique parallel grooves on its surface = primary rifle marks).
2.Extracted (transverse lines on its surface).
3.Non fired (smooth surface).

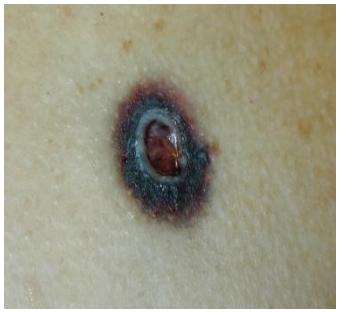
Effects of gunfire in rifled weapons:

- **Bullet »** tissue damage (loss of substance) and marginal abrasion
- **Gas »** eversion of edges of wound giving a cruciate shape (in contact firing)
- **Flame »** burning
- **Smoke »** blackening
- **Unburned powder particles »** tattooing
- **Lubricant effect »** grease ring
- **Metal effect »** gunshot residue
- **Muzzle effect »** muzzle imprint in contact firing
- **Carbon monoxide »** Carbon monoxide in the gases leads to increased amount of carboxyhaemoglobin and carboxymyoglobin in the tissues giving it a pink coloration .

Associates :

Burning , blackening , tattooing , pink coloration (co -carboxyhaemoglobin)





- **How do bullets produce tissue damage?**

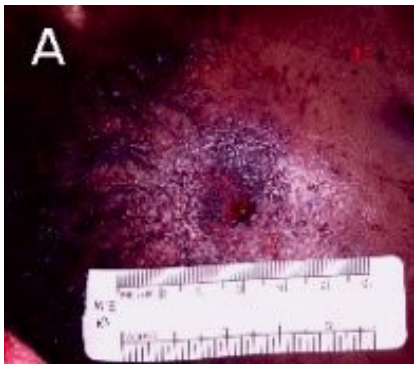
In three ways:

1- Laceration
2- Cavitation
3- Shock waves :compress the tissue and travel ahead of the bullet.

- **Factors affecting wounding with a bullet:**

1- Bullet velocity and mass
2- Bullet design
3- Distance of the target
4- Type of tissue
5- Tumbling of bullet

- **Wounds are in the form of:**



Inlet

(Small , associates , regular , inverted , loss of substance)

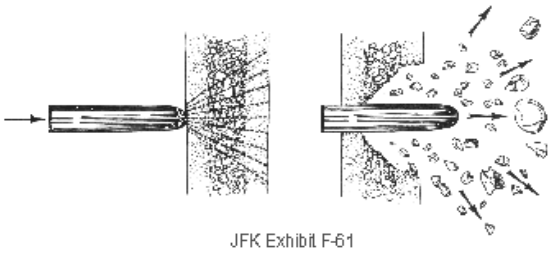
Exit

(Bigger , irregular , everted , no associates)

- **Gunshot wounds in bone:**

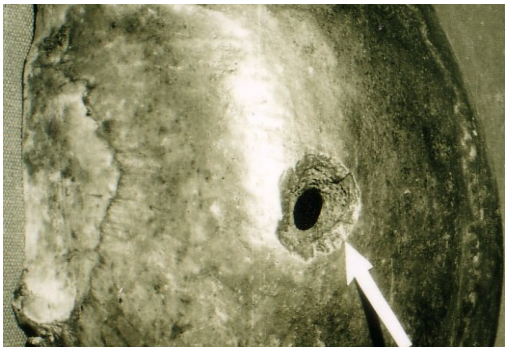
In flat bones (i.e. skull) :

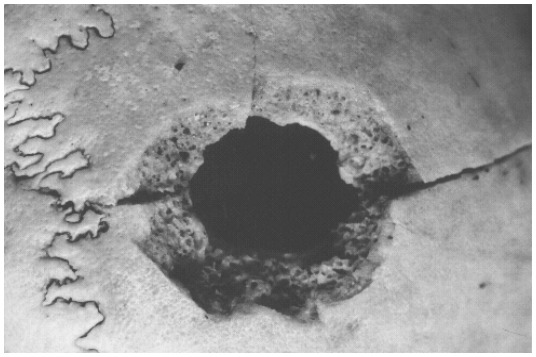
- entrance wounds are round with sharp margins and show internal beveling: (the inner of the skull is more eroded than the outer)
- Exit wounds may be more irregular and show external beveling (outer of the skull is more eroded than the inner table)



JFK Exhibit F-61

Both these pics are Exit Wounds





Range of firing of rifled weapons

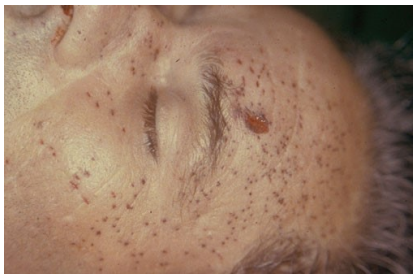
components of gunfire, present on the inlet, can help determine the approximate distance.

1.Contact Wound:

- Loss of substance
- Muzzle imprint
- Cruciate lesion if skin is over bone (e.g. forehead)

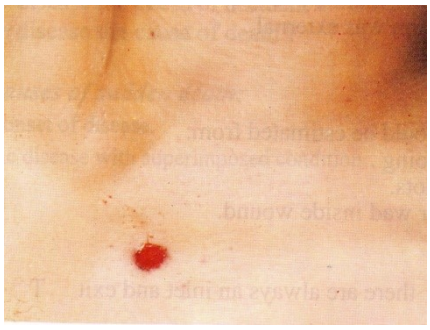
2.Close–range or Intermediate:

- Loss of substance
- Associates



3.Distant range wound:

- Loss of substance



Range of firing of non-rifled weapons:

1.Less than 2 meters :

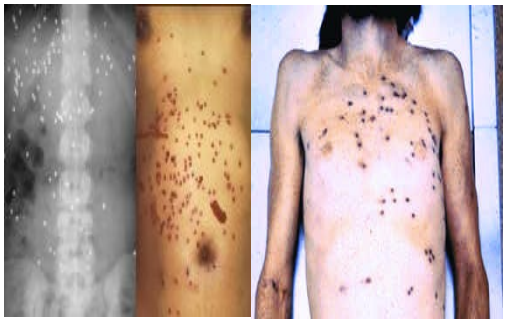
- Single circular entrance wound
- Associates
- Pink coloration of wound due to CO
- Wads or plastic cups in the wound

2. 2-4 meters :

- Central hole surrounded by dispersion .

3. more than 4 meters :

- Only individual pellet holes are seen (full dispersion)
- Central hole absent



NOTE:

It is uncommon to have exit wounds in non-rifled weapons **Except**

1- If pellets strike the body at acute angle and bones in the way
2- At near firing.

causes of death in firearm injuries : SHE IS

1- Shock
2- Hemorrhage
3- Embolism
4- Infection
5- Surgical complication

Investigations for firearms injury

- Is the case due to firearm?
- Is it an inlet or an exit?
- What is the type of weapon: rifled or non-rifled.
- What was the range of firing?
- What were the pattern of injury?
- What was (were) the cause(s) of death?
- Specify the causative weapon

How to differentiate between suicidal and homicidal firearms injury ?

- According to circumstances:

	Suicidal	Homicidal
Disturbance of furniture	**No**	**May be**
Dairy notes	**Excuse for suicide**	**May be something belonged to the assailant**
Door	**Closed from inside**	**Not usually**
Depression	**History of failure or trouble**	**History of quarrel**
finger print	**Not belonged to strangers**	**belonged to the assailant**

✓ According to assailant :

Powder on the hand and gun shot residues by chemical test

✓ According to Victim :

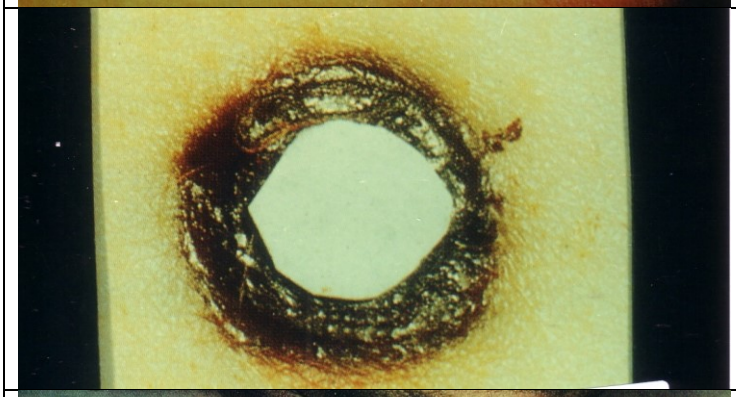
	Suicidal	Homicidal
Spasm (cadaveric)	**Present (catching weapon)**	**May be evidence from the assailant**
Signs of struggle	**Absent**	**Present**
Sex	**Male**	**Any sex**
Signs due to powder residue	**Present due to near firing**	**Not present**
Clothes (bare area)	**Usually in a bare area and clothes not torn**	**Any where and clothes may or may not be torn**

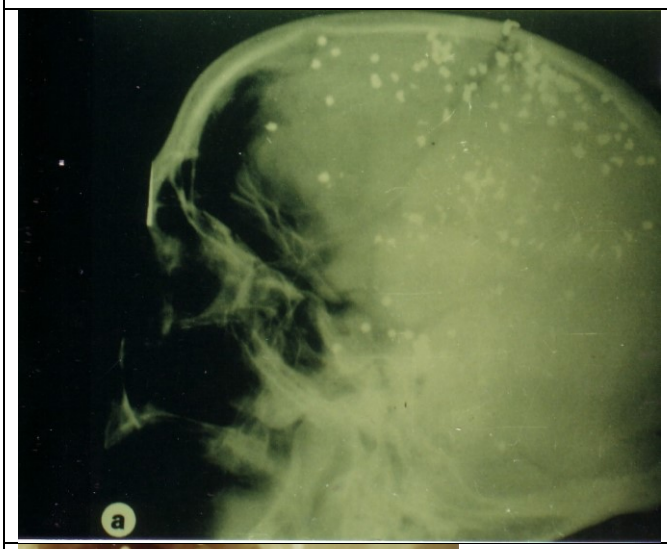
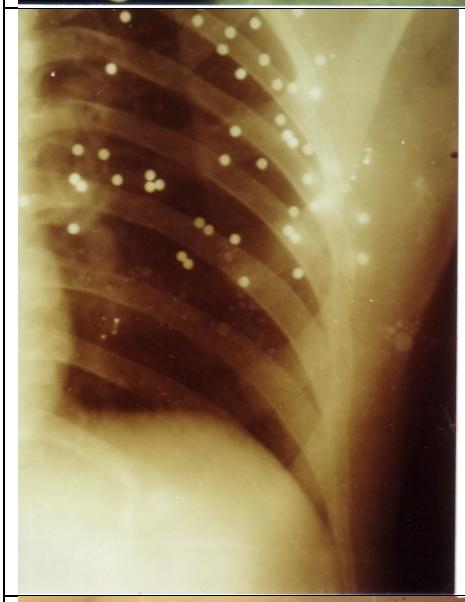
✓ According to Wound :

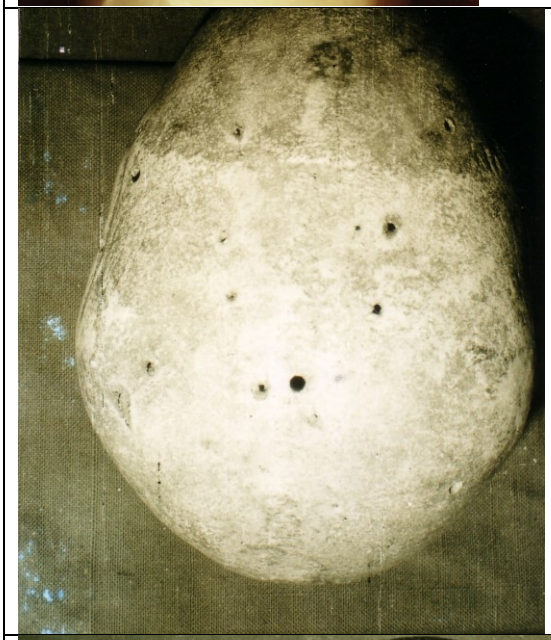
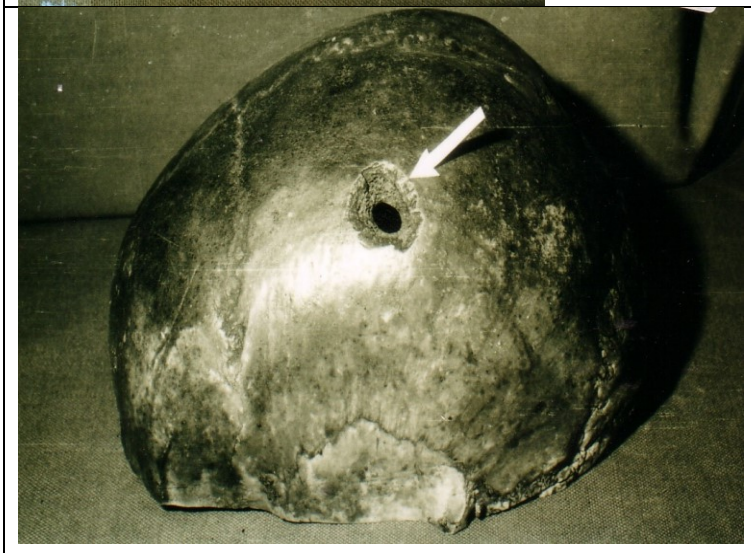
	Suicidal	Homicidal
Number	**Usually single**	**Multiple more than one**
Site	**Bared area + favorite site**	**Any where**
Shape	**Irregular lacerated**	**Any shape**
Direction	**Upward to the left**	**Any direction**
Distance	**Near distance**	**Any distance**

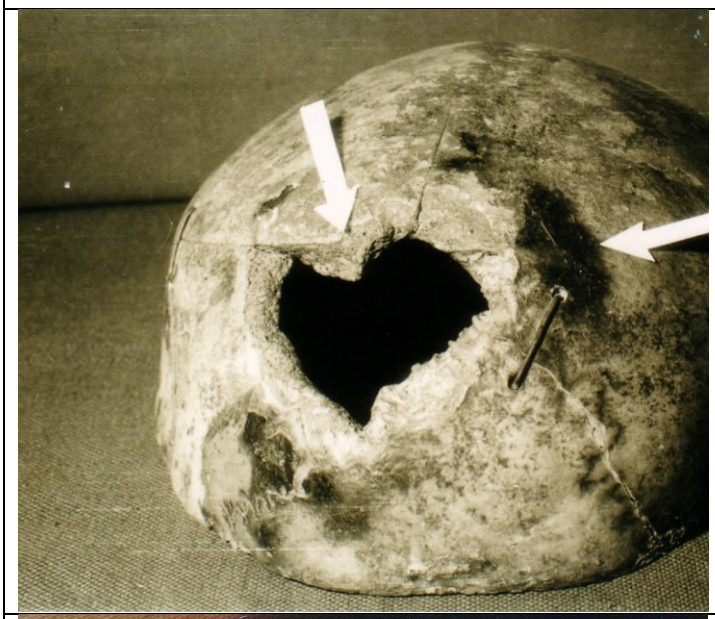
✓ Cases and Questions ?

Identify and describe the lesion in the given photo (or specimen)..What are the causes of death?

	• Area under the chin shows: • Loss of substance • Burning • Blackening • Distance: Near range of firing • Causes of death: • hemorrhage • Shock
	A piece of skin showing: • Loss of substance • Surrounded by burning Distance: near range firing Causes of death: • hemorrhage • Shock • Injuries specific to the site
	**Inlet of gunshot in the chest** Chest of a male showing: A large central circular wound with loss of substance surrounded by dispersion Distance: 2 – 4 meters Causes of death: • Severe acute hemorrhage • Shock • Rupture of heart • Rupture of lung
	**Inlet of gunshot in shoulder** Multiple wounds in the upper shoulder showing: #A small central wound with loss of substance #Multiple smaller surrounding wounds (pellets) Distance: 2 - 4meters Causes of death: hemorrhage Shock Fat embolism

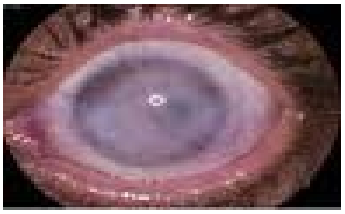
	**Plain X-ray of the skull** • **Lateral view showing multiple radio-opaque shadows of retained shots (pellets)** • **Distance: *(cannot be determined from X-ray)*** • **Causes of death:** • **hemorrhage** • **Shock** • **Brain laceration**
	**Plain X-ray of the chest** **Showing** • **multiple radio-opaque shadows of retained shots (pellets)** **Distance: (cannot be determined from X-ray*)*** **Causes of death:** • **hemorrhage** • **Shock** • **Rupture of heart** • **Rupture of lung**
	**Plain X-ray of the thigh** **Showing** **multiple radio-opaque shadows of retained shots (pellets)** **Distance: *(*cannot be determined from X-ray)** **Causes of death:** • **Severe acute hemorrhage** • **Shock** • **Fat embolism**

	**Plain X-ray of the knee joint** **Showing** **multiple radio-opaque shadows of retained shots (pellets) around the knee** **Distance: (cannot be determined from X-ray)** **Causes of death:** **• hemorrhage** **• Shock** **• Fat embolism**
	**Vault of a skull** Showing multiple small inlets of shots (pellets) Distance: >4 meters (full dispersion) Causes of death: • hemorrhage • Shock • Brain laceration
	**Vault of a skull** Showing exit of a high velocity bullet in the left parietal bone (external beveling) Distance: (cannot be determined) Causes of death: • hemorrhage • Shock • Brain laceration

	**Vault of a skull** **Showing** exit of a firearm weapon in the occipital area (external beveling) Distance: (cannot be determined) Causes of death: • hemorrhage • Shock • Brain laceration
	**Vault of a skull** Showing exit of a high velocity bullet in the frontal bone (external beveling), with radiating fissure fractures Distance: (cannot be determined) Causes of death: • hemorrhage • Shock • Brain laceration

Special Thanks to our college Raghad Alhaj Hassan for noting Doctors Records on this lecture Before

The Signs of Death & Post Mortem Changes



What We are Going to Cover…

Part I: Wrapping

1. Death: definition & types
2. Signs of Death
3. Brain Death
4. Postmortem Changes

Part II: Case Study

1- Death

Clinical death (somatic death):

A total permanent cessation of circulation and respiration as well as other vital functions.

N.B.: Clinically death is diagnosed if both circulation and respiration have stopped continuously for 5 minutes.

Medicolegal importance of clinical death determination:

1. Before burying any dead body, a death certificate must be officially written by a doctor.
2. During first aid measures or surgery, death may occur and subsequently it must be diagnosed before stopping the life saving measures or the operation.
3. In patients having irreversible cardiovascular and respiratory failures with extensive brain damage, when both spontaneous respiration and circulation have already been stopped. The doctor may decide to stop the machines that maintain respiration and circulation and terminate the life.

Diagnosis of clinical death:

(A) Examination of circulation:

- ✓ Absence of radial and carotid pulse.
- ✓ Absence of heart beats by palpation.
- ✓ Absence of heart sounds by auscultation.
- ✓ Contact the skin with hot object does not lead to congestion, reddening or flushing.
- ✓ On cutting a small artery, no spurting of blood.
- ✓ Webs between fingers become opaque on transillumination in a dark room (normally translucent and red due to the circulating RBCs).
- ✓ Injection of fluorescin does not lead to yellow coloration of distant skin and conjunctiva.
- ✓ Flat ECG.

(B) Examination of Respiration:

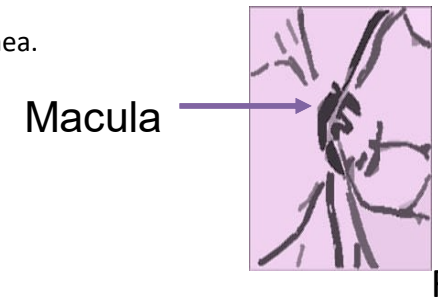
- ✓ Absence of breath sounds by prolonged auscultation over trachea and lungs.
- ✓ Absence of thoracic and abdominal respiratory movements.
- ✓ No condensation of water vapor while putting a mirror in front of the nose (no expiration).
- ✓ No movement of a feather put in front of the nose or lips.
- ✓ A basin containing water put on abdomen or chest remains stand still (no respiratory movement).

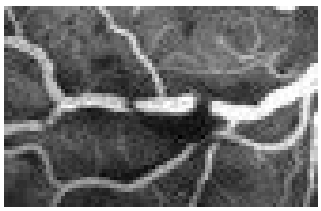
(C) Examination of nervous system:

1. Absent reflexes
2. Flat EEG

(D) Ocular signs:

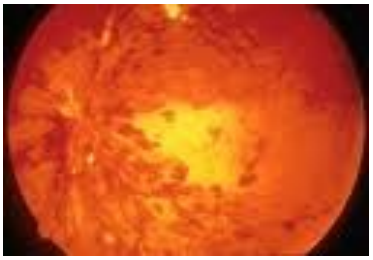
- ✓ No blinking, mucus is present over the cornea.
- ✓ Corneal dimness.
- ✓ Loss of corneal reflex.
- ✓ Eye Changes…
- ✓ Retinal Vein Segmentation
- ✓ Loss of light and accommodation reflex.





Retinal Vein Segmentation

✓ Unequal dilated pupils.
✓ Loss of intraocular pressure (softening of the eye) → traingular pupil.
✓ Fundus → pale empty arteries and segmented retinal veins (trucking sign).



E) Primary flaccidity:

Loss of tone of both voluntary and involuntary muscles all over the body → drop of jaw, dilatation of pupils and heart, loss of facial wrinkles

complete body flaccidity and loss of power of excitability to electric stimuli.

(F) Loss of skin and muscle elasticity (contact flattening):

In bodies kept in supine position → flattening of buttocks, calves and shoulders due to evacuation of blood by compression of veins and loss of muscle elasticity.

BRAIN DEATH

It is a special form of clinical death created to overcome the problem which occurred after the discovery of organ transplantation ,and its consist of :

I. Cortical death:

✓ When the higher levels of cerebral activity are selectively lost, either from a period of hypoxia, trauma, or toxic insult.
✓ the victim will exist in a "vegetative state", then the victim may be in deep coma but has a functioning brain stem → sustain spontaneous respiration and cardiac functions is not compromised.
✓ The victim can remain in deep coma for years. Debilitating complications as postural skin necrosis, muscle contractures and secondary chest infections may shorten life. Such vegetative patient is not considered dead.

II. Brain stem death (legal death):

It is the irreversible cessation of brain stem functions. At this stage arrangements may be made for organ and tissue donation.

Causes:

1. Primary lesions in CNS.
2. Increased intracranial pressure due to:
   Head injuries.
   Subarachnoid hemorrhage.
   Cerebral edema.
3. Hypoxic damage affect the brain as in:
   Heart attack.
   Respiratory distress

Mechanism:

✓ When the brain stem (specifically midbrain, pons, and upper medulla) is damaged → neuronal damage, loss of vital centers that control respiration, and of the ascending reticular activating system that sustains consciousness, cause the victim not only to be irreversibly comatosed but also incapable of spontaneous breathing = respiratory - motor system failure.
✓ The majority of brain stem dead patients suffer cardiac arrest within 2-3 days, while adequately oxygenated.
✓ Without medical intervention, cardiac arrest inevitably follows within minutes and then the usual progression of cellular death ensues.

Criteria for certification of brain stem death:

This is a clinical diagnosis (EEG is not required):

1- Patient must be in **deep coma** (not due to depressant drugs, metabolic, endocrine disorders or hypothermia).

2- The patient must be on **mechanical ventilation** due to absence or inadequate spontaneous respiration.

3- A firm diagnosis of the basic **pathology** must be available (e.g. head injury → irreversible brain damage).

4- **Rectal** temperature must be **above 35°C**.

5- All the brain stem **reflexes** must be **absent**:

✓ Pupils fixed and usually dilated (no light reflex).

✓ No corneal reflex.

✓ No gag reflex or response to tracheal suctioning.

✓ No vestibulo-ocular reflex (cold-caloric test).

✓ No motor response within the cranial nerve distribution after adequate stimulation of any somatic area.

6- ***No respiratory movements*** when the patient is disconnected from the ventilator.

7- **Two licensed physicians** who are **not** members of the **transplant team** must write in the progress notes stating that the patient has irreversible and total cessation of brain stem function. The note should give findings which led to this conclusion.

8- **Careful records** should be kept.

III. Cellular (molecular) death:

In a particular cell, death is defined as the point beyond which irreversible cessation of cell functions occur = point of no return.

Determination of cellular death:

Tissues vary in their tolerance to hypoxia: e.g. brain cell dies within seconds-minutes, while skin and bone could survive for several hours after hypoxia.

Cellular death can be diagnosed:

Microscopically: by light or electron microscopy.

Microchemically: by detection of the concentration of different chemical constituents inside the cell.

Physically: by determination of changes in intracellular viscosity.

✓ ***Molecular life:***

It is the time lapse between brain stem death and cellular death (molecular death). This allows organ donation from recently dead bodies.

2- Postmortem Changes
Postmortem Cooling

##Post mortem changes

✓ **Immediate or very early changes:** (immediately, within seconds or minutes). These include all sings of death (cardiovascular, respiratory, ocular ….).

✓ **Early changes:** (within hours or few days): Post mortem coolness, hypostasis, rigor mortis and autolysis (putrifaction).

✓ **Late changes:** (within several weeks or months): Adipocere formation and mummification.

##Postmortem coolness

✓ Immediately after death, the body temperature falls progressively until it reaches the atmospheric temperature within 12-18 hours.

✓ As an average, the body **loses 1.5°C/hour in 1st 6-8 hours and then 1°C/hour till reaching the atmospheric temperature from 12-18 hours**. We can determine the duration passed since death from the post-mortem coolness provided that:

✓ The body temperature was **normal** at the **moment** of **death**.

✓ The body cooling follows a **uniform repetitive** pattern.

Cadaveric temperature is measured:

1- High up in the rectum by special thermometer.
2- From liver and brain by microwave thermography.
3- From skin temperature by infra red monitor.

2- Postmortem Changes

Postmortem Lividity/Hypostasis

Postmortem hypostasis (livor mortis, postmortem lividity) :

It is bluish discolouration of the skin of the most dependent parts of the body, except the pressure points, after death

???

Please mention the position of the victim at death?

He dead Supine, or been dead in different position but layed supine after less than 2 hours from his death,
No hypostasis at the Higher portion of back

It is caused by gravitation and settling of the blood into the lax capillaries of the skin as they become dilated after cessation of circulation. The red blood cells are most affected, sedimenting through the lax capillary network.

Hypostasis is absent at pressure points due to mechanical compression of the vascular channels commonly, in the shoulders, against supporting surface.

Sequence of events:

1- Gravitation of blood (after cessation of circulation) → immediately after death.
2- Visible hypostasis (after filling of veins and capillaries) → 2 hours.
After Progressive expansion and gravitation of blood → 6-8 hours.

Importance of the Hypostasis :

1-Sure sign of death.
2- Can help in determination of time passed since death, from the extent of bluish discolouration.
3- It can help in determination of the position of the body after death depending on the degree of fixation (= true staining of tissue due to haemolysis of RBCs, it takes from 2-6 hours to be completed).

NOTEE:

if the dead body is moved before 2 hours → hypostasis will start in the new position → as the blood is not yet fixed in its initial position.

If the dead body is moved during 2-6 hours → hypostasis will be in two opposing sites → as blood may partially move to a new position. (Partial fixation).

If the dead body is moved after 6 hours → hypostasis will not coincide with the final position of the body and present only in the initial position →as blood is completely fixed

4. It can give idea about the cause of death:

- In hanging: hypostasis occurs in legs, feet and distal parts of arms. While in drowning it occurs in head and neck.
- Colour of hypostasis depends on state of oxygenation at death and may indicate the cause of death:

- **In Co poisoning → Cherry - Pink**
- **In cyanide poisoning → deep blue - pink**
- **In asphyxia → Dark blue**
- **In haemorrhage → ill-defined or absent**

- **In methaemoglobinaemia → Brownish.**
- **5.In forensic autopsy work, it is important to differentiate between organ hypostasis (e.g. in lungs, intestine, heart) from antemortem lesions**

Please mention the position of the victim at death?
This person got 2 different sites of hypostasis so he was moved after 2-6 hours of death so got 2 different hypostasis sites

2- Postmortem Changes
Postmortem Rigidity

Postmortem rigidity (Rigor mortis):

It is a progressive hardening (rigidity) of all muscles of the body (voluntary and involuntary) gradually replacing the state of primary flaccidity.

Mechanism:

In rigor mortis, the muscles are hardened due to physicochemical changes ATP depletion together with lactic acid byproducts accumulation inside the muscle →↑ acidity →↑ irreversible shortening of the muscle due to formation of the contractile substance (actomyosin) in the interdigitations, which is shorter than uncombined actin and myosin, that causes muscle rigidity

Sequence of events:

The process becomes manifest after about 2 hours starting in the small muscles of the face (e.g. eye lid, and lower jaw) and neck as smaller muscles are easily immobilized then spread down wards over the body to affect trunk, arms, abdomen, thighs and legs. It becomes complete after 12 hours and then start to disappear gradually in the same sequence to be replaced by secondary flaccidity (autolysis), after about 24 hours

Testing by:

Flexing and extending the joint.

Finger pressure on quadriceps or pectoralis → hard.

Medicolegal importance:

1- Sure sign of death.

2- May help in the estimation of time passed since death; the following is a reasonable "spot check" for use in average temperate conditions:

- If the body feels warm + flaccid → death < 3 hours.
- If the body feels warm + stiff → death 3-8 hours.
- If the body feels cold + stiff → death 8-36 hours.
- If the body feels cold + flaccid → death > 36 hours.

3- May help in determination of the causes of death as in convulsions (tetanus, strychnine poisoning) where rigor starts early and progresses rapidly.

4- Rigor mortis fixes the position of the body after death as it affects the agonists and antagonists at the same time

Rigor mortis in other tissues:

Iris → unequal pupils.

Heart → ventricular contraction.

Dartos muscle of scrotum → compress testis, epididyms and \ seminal vesicle that may lead to postmortem extrusion of semen.

Erector pili muscle → attached to hair → goose - flesh.

Cadaveric spasm:

It is a state of severe contracture **of a group of voluntary muscles** (usually hands) which are already in a state of **violent contraction** immediately **before death** due to **severe nervous stress**. The whole body except this group of voluntary muscles will be in a state of primary flaccidity. It continues until rigor mortis sets in. Cadaveric spasm disappears during autolysis (secondary flaccidity).

Causes:

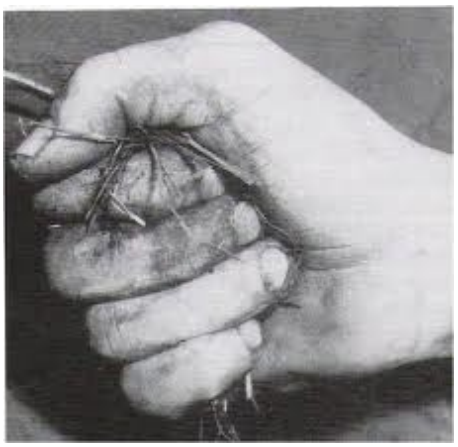
- *Suicidal:* In cut throat or firearm injuries the victim may be grasping the weapon in his or her hand (knife in cut throat and pistol in firearm).
- *Accidental:* In drowning, the victim may be grasping mud, sand or gravel.
- *Homicidal:* Victim's hand firmly grasping hair, clothes or skin of assailant.

Circumstances	Rigor mortis	Cadaveric spasm
Nature of the process	Physicochemical	Severe nervous stimulation
Circumstances of death nature	No special circumstances	Death proceeded by extreme nervous stimulation
Types of affected muscle	All types of muscles	Only a group of voluntary muscle
Start of appearance	After 2 hours of death	At the moment of death
Proceeded by	1ry flaccidity	Extreme nervous stress before death
Followed by	2ry flaccidity	Rigor mortis

What are the conditions replacing rigidity?

1- ***Cold Stiffness***

2- *Heat Stiffness*



Cadavaric spasm

Contact Flattening

Cold Stiffness

Heat Stiffness

2- Postmortem Changes
Decomposition/Putrefaction

Decomposition :

It is the process of disintegration of soft tissues of the body leaving nothing but bones.

It follows the arrest of the biochemical process which preserves the integrity of the cellular and subcellular membranes and organelles.

During decomposition, the tissue component break up, hydrolytic enzymes are released from the intracellular lysosomal sacs, Bacteria and other microorganisms thrive on the unprotected organic components of the body

Accordingly***, two parallel processes of decomposition*** have been distinguished:

Autolysis:

It is the process of self-dissolution by breaking down of complex protein and carbohydrate molecules of the body into simpler chemical forms. This is achieved by the action of digestive enzymes released from disintegrated cells.

The earlier autolytic changes occur in organs rich in enzymes such as: pancreas, gastric mucosa and the liver.

Putrefaction:

It is complete digestion of tissues by proteolytic bacterial activity and fermentation with the production of large amounts of foul smelling gases and liquids leaving nothing but bone (skeletonization).

Putrefaction is the major component of decompostition. Putrefactive anaerobic organisms as B.coli, non-haemolytic streptococci, clostridium welchii and proteus, most are normally present as commensals in gasterointestinal tract, and the rest are pathogenic bacteria.

Mechanism of skin changes in putrefaction:

The mal-odourous gases resulting from putrefaction as H_2S, SO_2, Co, CO_2, NH_3 are released within blood vessels causing their distension and greenish-black discolouration of the skin.

##Sequence of events in Putrefaction:

After one day in summer and two days in winter:

the first visible changes in putrefaction is greenish discoloration of the skin in right iliac region (where the caecum is relatively superficial) due to the formation of sulph-haemoglobin as a result of large amount of faeces accumulates → rapid multiplication of saprophytic putrefactive bacteria and production of gases react with Hb → rapid distension and green discoloration of cutaneous blood vessels in this area

Greenish Discoloration in Lower Quadrants

After four days in summer (about one week in winter)

1- the greenish discolouration (Marbling phenomena) (arborization = distinctly visible dilated cutaneous blood vessels) spread all over the face and body. Face is swollen

2- Distended Abdomen and scrotum.

3- Dark coarse froth with bad smell is seen at the mouth and nostrils due to decomposition of lungs and air passages.

4- protrusion of eye globe and tongue due to internal gas pressure.

5- Expulsion of the contents of large intestine and gravid uterus. The gases accumulate under the skin → putrefactive bullae.

3- P

After one week in summer (about 2 weeks in winter)

- The abdomen bursts and the viscera ® dark greenish doughy material with putrid odor. The most resistant organ to putrefaction is the prostate, which may survive for many months.
- The skin becomes dark green to black with peeling of epidermis (from ruptured bullae)
- Falling of hairs and nails.
- Eggs of flies hatch at the body orifices exposing larvae.

1- Skin Slippage/Peeling

2- Bursting of the Abdomen

After about 6 months: All soft tissues disappear leaving only bones, cartilages and ligaments .

After one year: ligaments and cartilages disappear leaving nothing but loose bones.

What are the conditions replacing putrefaction?

Estimation of postmortem interval:

1- Measuring **body temperature** (post-mortem coolness).
2- Stability and extent of **hypostasis**.
3- Extent of appearance and disappearance of **rigor mortis**.
4- Extent and progress of **putrefactive changes**.
5- Extent of **adipocere** formation or **mummification**.
6- **Maceration** of dead **foetus** in utero

7- **Entomology of cadaver**: the identification of the species of insects and their larvae at the body orifices → determination of the proper post mortem interval (by the chronological study of the life cycle).

8- **Biochemical changes**:

- Glucose level in blood.
- PM serum proteins.
- Evaluation of liver functions.
- Estimation of cholesterol.
- Estimation of enzymes in blood and other tissues.
- Estimation of minerals

The most important method is the estimation of potassium in vitreous humor:

It is the most popular calculation for estimating the time passed since death. K increased in the vitreous in a regular fashion → average rate of increase was 0.17 mEq/hour.

The most recent formula for calculating the post-mortem interval is:

PMI (hours) = 5.26 X K concentration mEq (L) - 30.9

9. Estimation of **post-mortem interval** using **DNA** and **RNA** degradation rate.

Case Study(not solved)

Two dead bodies were found in a deserted area. After medicolegal examination, the medical examiner reported that the first dead body was for a 21 years old male while the second body was for a 16 years old female. The following photos were illustrating the postmortem findings observed in the dead bodies.

Please, answer the following questions:

1- How did the medical examiner identify the sex and age of the dead bodies?

2- What is the medicolegal importance of these ages?

3- On medicolegal examination of the deceased male, the medical examiner found the following pm purplish discoloration of skin of the male victim:

- State the name of this pm change.
- List the medicolegal importance of this pm change.
- Mention why this deceased was in this posture.
- State the mechanism of this posture.
- What would be the pm interval of this dead body?
- What would be the temperature of this body?

4- On medicolegal examination of the deceased female, the medical examiner found the following pm findings:

- What is the name of the existing sign?
- What is the mechanism of formation?
- What is the medicolegal importance?
- What would be the preceding changes prior to this sign?
- What are the factors that would affect this pm change?
- What would be the pm interval of this dead body?

L7 : drowning and Asphyxia

1-ASPHYXIA

VIOLENT ASPHYXIA

Definition:

- Lack of tissue oxygenation
- means cessation of respiration. *Violent asphyxia* is a cessation of respiration as a result of mechanical interference of respiratory mechanism due to violence. It
- Asphyxia is used as being equal to "lack of oxygen" or "hypoxia".
-

Gordon's classification:

Anoxia is classified into 4 types:

I) Anoxic anoxia:

This means defective oxygenation of blood in the lung and due to:

1- Absence of oxygen .
2- Obstruction to respiratory passage
3- Obstruction to respiratory movements
4- Depression of respiratory centre

II) Anemic anoxia

↓ O2 carrying capacity of the blood: hemorrhage and CO poisoning.

III) Stagnant anoxia:

Inefficient circulation through the tissues, as in: Shock and heart failure

IV) Histotoxic anoxia:

Inability of the tissues to utilize oxygen delivered to them, cyanide poison

Stages of asphyxia

1- Stage of dyspnea:

Cyanosis, rapid deep breathing with acting extraordinary muscles of respiration. Rapid pulse and high blood pressure.

2- Stage of convulsions:

Cyanosis becomes deeper. Breathing becomes difficult and spasmodic. Congestion and edema of lungs and other organs. Petechial hemorrhages in skin, lungs, heart and brain. Convulsions occur.

3- Stage of apnea (respiratory paralysis):

- Unconsciousness occurs.
- Breathing becomes shallow,infrequent and gasping,…….then apnea occurs.
- Pulse becomes weak and BP is reduced.
-

PATHOPHYSIOLOGY = (mechanism) OF VIOLENT ASPHYXIA

In all types of violent asphyxia, O2 starvation will occur, that interferes with pulmonary ventilation, results in circulatory failure.

Mechanism of physical signs

- A person with obstructed air entry :

1- Increase efforts to breathe SOOO facial congestion & starting cyanosis.
Froth at mouth & nostril
2- Deep respiration &the chest is not free to move SOOO cyanosis & congestion & petechiae
3- Loss of consciousness , convulsions , evacuation of bladder , Vommiting
4- Respiration becomes shallow & ceases
5- Pupils dilate
6- Death

PM Signs of asphyxia

1. **Visceral congestion: as** O_2 starvation in violent asphyxia results in capillary dilation.
2. **Congestion, oedema of face : due to back-up of venous drainage from compression of neck veins or obstructed venous return to heart.**
3. **Cyanosis:** in **head & neck,** tip of nose, nail beds, hand, feet and dependant parts**: due to failure of oxygenation of venous blood (reduced Hb)** in stagnant capillaries.
4. **Petechial hemorrhages :**

✓ They are present everywhere externally as well as internally.

✓ They are most observed in the serous membranes, particularly in the pleurae and they are called Tardieu spots and visceral pericardium.

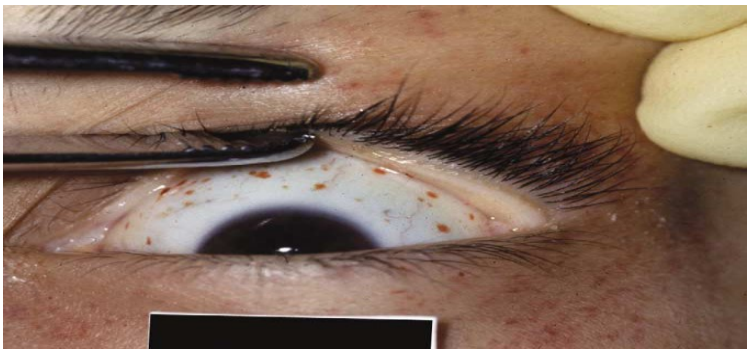
✓ They are due to:

1. increased intra-capillary pressure as a result of mechanical obstruction of venous return .

2. escape of blood into tissue space: due to increased capillary permeability as a result of anoxia.

Petechial hemorrhage in skin & eyes , especially upper eyelid , conjunctiva , sclera , skin of face , lips , behind ears

*** appear within 15 – 30 seconds**



5. Postmortem lividity (hypostasis) : deep blue and extensive.

6. PM blood fluidity : blood is dark fluid :
due to fibrinolysin & no coagulability

7. Structural changes:

a- **Heart:** greatly dilated right side of heart due to cardiac failure. Blood is more fluid and dark.

b- **Respiratory system:** congestion and petechiae in all respiratory tracts. The lungs are congested and edematous with **Tardieu spots** and **silvary spots** (due to ruptured air vesicles).

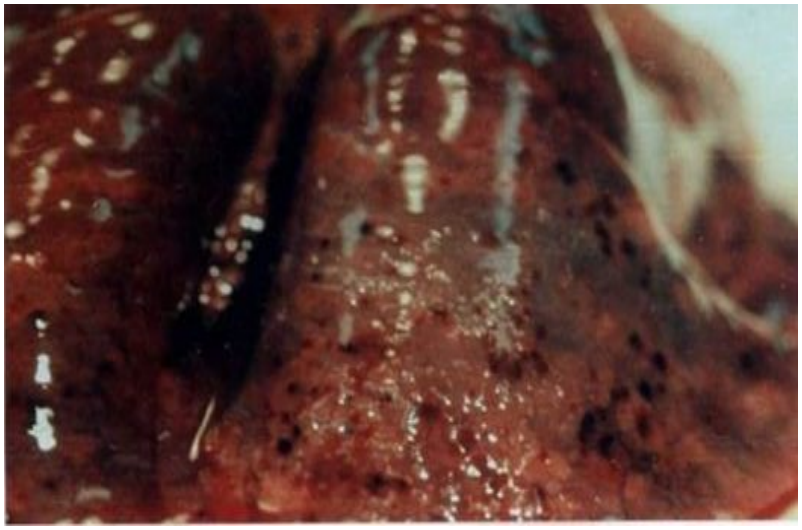
c- **Central nervous system**: hyperemia and scattered petechiae in the brain.

Respiratory :

✓ **Congestion**

✓ **Petechiae on pleural surface of lungs : Tardiue spots (sign of congestive death)**

✓ **Silvery spots : due to rupture of air vesicles**



External Postmortem (PM) picture

1- Petechial hemorrhages:

Sites of formation**:**

Mechanism of formation

2-**Postmortem hypostasis is well-developed and dark in color**

3- Cyanosis

4- Rigor mortis is rapid

5- Putrefaction is rapid.

Types or causes of violent Asphyxia

1- Hanging

2- Ligature strangulation

3- Manual strangulation (Throttling)

4- Smothering

5- Choking

6- Traumatic asphyxia (Crush asphyxia)

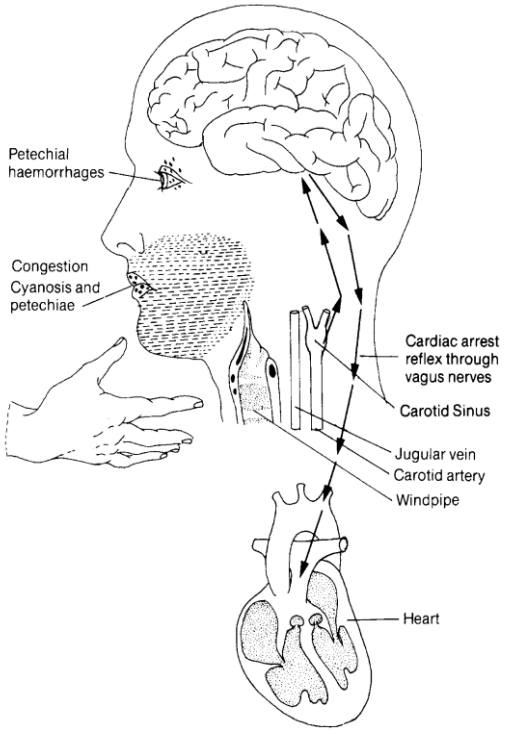
Effect of pressure on neck:

jugular vein → brain congestion

carotid a. → Cerebral anaemia

carotid sinus → cardiac arrest

air passages → Asphyxia



Effects of pressure on the neck
1 Carotid sinus pressure – vagus nerve stimulation – cardiac arrest
2 Carotid artery blockage – unconsciousness
3 Jugular vein blockage – congestion and haemorrhages
4 Airway blockage – oxygen lack

TYPES OF AXPHYXIA:

1- TYPES OF AXPHYXIA: 1-Hanging

✓ It is Asphyxial death caused by suspension of the body by a ligature around the neck, the constricting force being the weight of the body.

A) It may be either complete (feet not touch the ground) or partial (partial suspended body).

B) It may be either typical (ligature mark not running along the whole circumference of neck or atypical.

Typical and atypical hanging

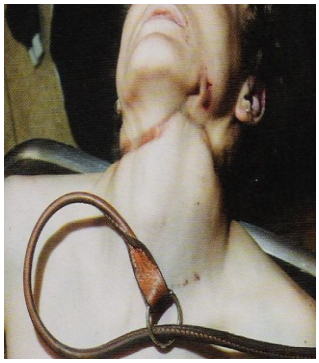
Incomplete hanging

Mechanism of death:

1. *Cerebral anoxia*
2. Cerebral congestion.
3. Asphyxia:
4. Reflex vagal inhibition

Causes of death

1- Occlusion of air passages by backward displacement of tongu
2- Venous congestion of brain
3- Brain anaemia : carotid a.
4- Pressure on vagus or carotid sinus : reflex
5- In judicial hanging : fracture dislocation at atlanto-occipital r

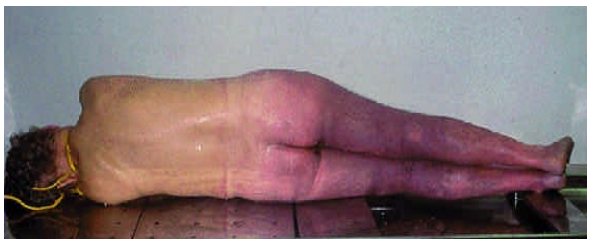


Fixed knot and running noose

Externally:

1- The neck is stretched**.**
2- The face is pale or bluish swollen.
3- Eyes : prominent , protruded tongue
4- Froth at mouth & nostril
5- Hypostasis: is most marked in the legs, hands and feet.
6- Saliva may be seen dripping from the mouth**(It is a vital sign and is present only in hanging but not in postmortem suspension).**

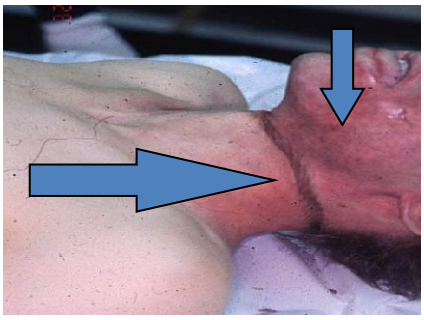
Hypostasis in Hanging



Typical Ligature mark:

- ✓ **Not running around full circumference of neck (*incomplete.)***
- ✓ **The mark rises to a peak pointing to this junction (node)**
- ✓ **High:** is situated above the thyroid cartilage
- ✓ **oblique**
- ✓ ***The pattern of the ligature:***

Is imprinted on the neck as a pressure abrasion.



Internally (Internal signs):

- ✓ **Petechial hemorrhage and ecchymosis** of the subcutaneous tissue under the ligature, but never in postmortem suspension. It appear externally as a thin line of blue color in the front and along the lower edge of the brown mark.
- ✓ **Under rope mark: echymosis and tissues are compressed**
- ✓ **Carotid a. : laceration of intima & media**

It **is a valuable** sign pointing to suspension during life.

- ✓ **Posterior pharyngeal wall : contusion** caused by the backward displacement of the tongue.
- ✓ **Hyoid & thyroid : may fracture**

Is it suicidal, homicidal, or accidental hanging?

Suicidal: (most common):

- ✓ Circumstantial evidence (history of failure).
- ✓ Absence of signs of struggle.
- ✓ Presence of signs of previous suicidal attempts.
- ✓ Suicidal note, chair, table.

Other circumstances:

- ✓ ***Legal hanging: (Judicial hanging):***

○ It is the method of execution in Jordan

- ✓ ***Post mortem suspension:***

It is more common than true homicidal hanging. It is done after other types of murder had been committed to conceal the real crime.

TYPES OF AXPHYXIA: 2- Ligature strangulation

DEF: A violent Asphyxial death caused by constricting the neck by a ligature.

Mechanism of death:

- ✓ Asphyxia: from compression of air passage
- ✓ Cerebral congestion or apoplexy:
- ✓ Reflex vagal inhibition
- ✓ Cerebral anoxia:

Autopsy appearances:

Externally:

- ✓ The face is either pale or bluish and congested. The rest of the body is cyanosed.
- ✓ The tongue may be protruded, swollen and bitten.
- ✓ Bleeding from ears and nose may be seen.

Ligature mark:

- ✓ Shape: as in hanging.
- ✓ Situation: At the level of thyroid cartilage or below.
- ✓ Symmetrical
- ✓ Transverse and
- ✓ complete (this is the usual).
- ✓ A postmortem swelling of the neck associated with exaggeration of
- ✓ skin folds or any
- ✓ clothes worn around the neck may produce depressed marks. All these look like ligature mark. Neck dissection can differentiate




Ligature marks of strangulation

Suicide, homicide, or accidental:

- ✓ Newborns strangled by the umbilical cord.
- ✓ Children playing with ropes
- ✓ Adults strangled by the neck tie caught in moving machinery.

Methods commonly used for homicidal strangulation:

1- **Mugging**: by compressing the victim's neck against the forearm.

2- **Garroting**: attacking the victim from behind and grasping his throat or throwing a ligature over the neck and tightening it quickly.

3- **Bansdola**: compressing the neck between 2 sticks

Differences between hanging and strangulation:

- ✓ **Rope marks: T. , low, Circumstantial**
- ✓ **Signs of resistance**
- ✓ **No stretched neck**

Point	Strangulation	Hanging
Force	From outside on the ligature itself.	Weight of the body
Hypostasis	Anywhere	In lower limbs
Blood oozing	From ear, nose and mouth.	Not seen
Neck	Not	Stretched and elongated
Saliva	Not present	dribbling from the mouth
Ligature mark	Complete/T. /Low	Incomplete\Oblique\high
Hyoid bone	not injured	May be injured
Thyroid cartilage	May be torn	Process of thyroid cartilage is torn
Carotid artery	Not torn	Intima and media are torn
Retropharyngeal bruises	Absent	Present
Spinal column	Not common at all	**May be fractured**
Signs of resistance	present	**Absent**
Circumstances	More homicidal	**More suicidal**

Post mortem signs:

1. Non specific general pathological changes

2- General external examination:

- ✓ Presence of signs of resistance in the form of finger nails abrasions and contusions.
- ✓ Congested face, protruded eyes ,the conjunctivae are congested with subconjunctival hemorrhages. The tongue may be protruded. Fine blood tinged froth sometimes is found at the mouth and nostrils.
- ✓ Blood oozing from ear, nose and mouth is commonly seen.

3 - Special examination of the neck:

External examination:

a. The ligature mark:

Pattern: pressure abrasion

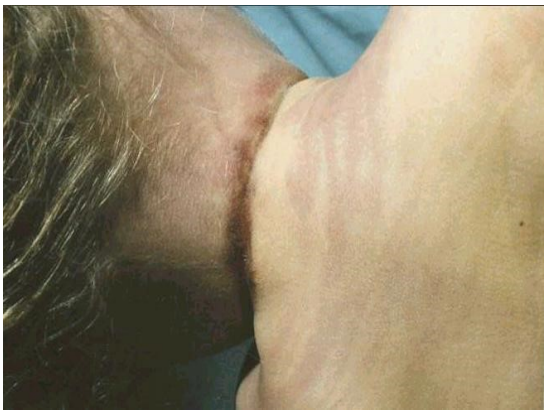
Course: usually **encircles** the **neck completely** and is directed transversely across the neck.

Position: usually present at the level of the **thyroid cartilage**.

b. Abrasions and bruises are commonly found in the surrounding skin caused by the hands of the assailant or the hands of the victim in an attempt to release the pressure.

Internal examination

- Bruising and laceration of the **neck muscles are common.**
- **Fractures** of **hyoid bone** are **unusual**, while **fractures** of **thyroid cartilage** at the level of the **ligature** may occur **unless** the victim is **young** and the **cartilage** is **elastic**.



TYPES OF AXPHYXIA: 3- Manual strangulation (Throttling)

- **caused by constricting the neck by the hand.**

Mechanism of death:

- **Autopsy appearances:**

When death occurs as a result of vagal inhibition, Asphyxial signs will be absent.

- **Suicide, homicide, or accident:**

1- **Suicide**: A case was recorded and it was due to cadaveric spasm.

2- **Homicide**: (most common)

- Circumstantial evidence.
- Presence of signs of struggle.
- Evidence of drink or drugs, or the victim is young or weak.

Post mortem signs:

1.Non specific general pathological changes

2- General external examination:

- **Cyanosis** of the **face** and **lips**.
- **Multiple petechial hemorrhages** in the skin of the face, eyelids, scalp, and ear drums and in conjunctivae .
- **Bruises** and **abrasions around** the **nose** and **mouth** and are resulted from the attempts of the assailant to prevent the victim from crying or as signs of resistance in an attempt of the victim to remove the assailant's hands.

3 - Special examination of the neck:

- **External examination:**

Injuries on the neck:

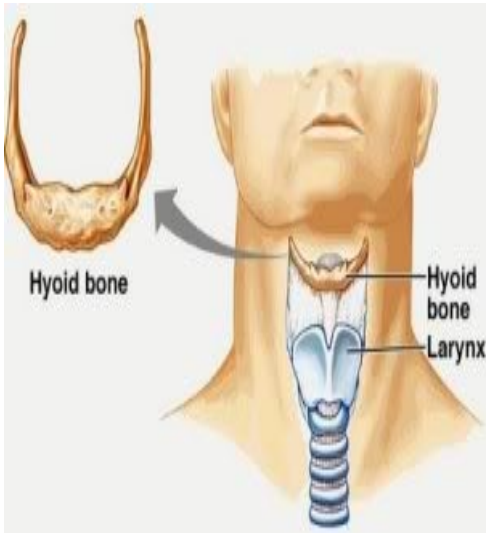
- Abrasions (caused by finger nails).
- Contusions (caused by finger pads).
- Both are found on the front and sides of the neck

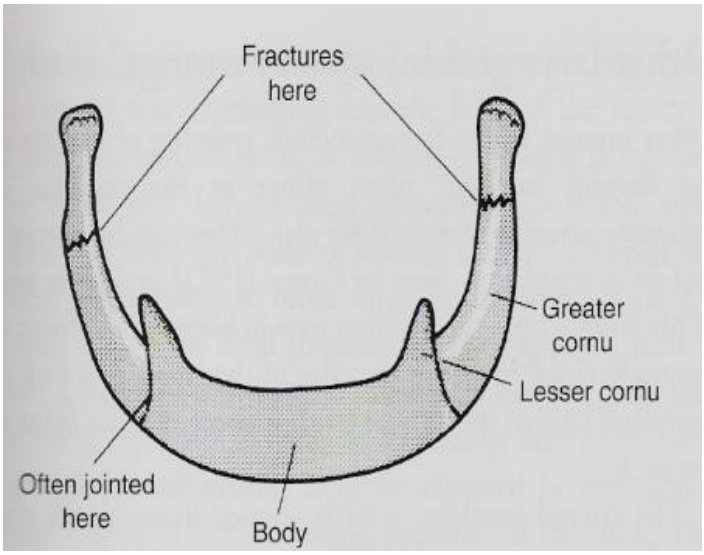
- **Internally**

1- **Extensive bruises are usually found** in the deeper layers of skin, fascia, muscles of the neck, as well as in the substance of the thyroid gland.

2- **Fractures of the hyoid bone are commonly found** in throttling and are accompanied by hemorrhage at the site of fracture. **Fractured hyoid bone is a diagnostic sign for throttling even in a putrefied body.**

3- **Fracture of other laryngeal cartilages occurs** depending on the **hand's grip** and age of the victim.





TYPES OF AXPHYXIA: 4- Smothering

Caused by mechanical occlusion of the eternal respiratory orifices from outside (i.e. the mouth and nostril) by hand or by any object.

PM picture

1- Asphyxial signs will be present except in case of plastic bag suffocation.

2- Abrasions and contusions on the skin of the face around mouth and nose (Absent if a soft material, such as a pillow, is used).

Suicidal, homicidal, or accidental:

1- **Suicide** By hand is impossible.
(Tying a plastic bag over the head is rare).

2- ***Accident: (most common)***

- In children playing with plastic bags.
- An alcoholic adult who rolls over (during sleep) and his face in the pillow.

Post mortem examination

1. Non specific general pathological changes.

2. Special pathological changes:

Externally:

Abrasions and contusions are found around nose and mouth related to assailant's hand. Nose may be distorted from continuous compression. Signs may be minimal with non resistant victims as infants and alcoholics.

Internally:

Bruises and contused wounds may be found on the inner aspects of the lips and cheeks and are caused by pressure upon the jaw and teeth. Some teeth may be found loose or even broken.

41 White pressure marks around the mouth, on the nose and around the eyes of a boy who had been smothered with a pillow. Note the pressure marks of the teeth on the upper lip. These indicate firm pressure on the face resulting in the lip being pressed hard against the teeth.

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41 White pressure marks around the mouth, on the nose and around the eyes of a boy who had been smothered with a pillow. Note the pressure marks of the teeth on the upper lip. These indicate firm pressure on the face resulting in the lip being pressed hard against the teeth.

TYPES OF AXPHYXIA: 5- Choking

Caused by mechanical occlusion of the air passage from inside.

Mechanism of death:

Asphyxia, due to either complete occlusion of air passage, or partial occlusion that is completed by spasm, edema and mucus secretion.

Accidental: (most common)

May arise from:

- **Inhalation of irritant fumes.**
- **Impaction of foreign material, such as food or denture.**
- **Inhalation of dust and sand in falling of houses.**
- **Inhalation of vomit or blood during operations.**
- **Falling back of the tongue epileptic fit.**
- **Café coronary (sudden death after meal): food bolus in larynx that stimulate the vagal inhibition**

Postmortem Findings

There **is severe congestion of face** due to struggle to get foreign body out .

Local examination:

1- Bruises and abrasions of the air passage are found especially if the foreign body is a solid one.
2- presence of foreign body is confirmatory evidence.
3- In delayed death, pathological changes in the lungs will be apparent e.g. consolidation, lung abscess etc...

TYPES OF AXPHYXIA: 6- Traumatic asphyxia (Crush asphyxia)

Resulting from trauma to the chest or pressure on the chest and abdomen which prevent respiratory movements

e.g. run-over car accident ✈ fracture of ribs ✈ restriction of respiratory movements from the severe pain occurring during respiration.

- **Pressure on the chest and abdomen due to:**

3- Burial in earth following house collapse.
4- Crushing by a crowd, as in case of a fire.

TYPES OF AXPHYXIA: 7- Drowning (Immersion)

It is a form of violent asphyxia in which death results from submersion of mouth and nostrils of a living person under water

Classification (types) of drowning:

1- Typical (wet) drowning:
2- Dry drowning: Water in the larynx ✈ laryngeal spasm ✈ asphyxia
3- Secondary drowning (Near-drowning).

***Delayed cause of death or secondary drowning* or post-immersion syndrome.**

person may survive but subsequently suffer complications or die from the delayed effects of inhalation of water e.g.

- Inhalation pneumonitis.
- Bronchopneumonia.
- Pulmonary edema.

Causes of death in drowning

A. Rapid death:

1. Asphyxia of drowning.
2. Electrolyte disturbances. .
3. Hypothermia may develop rapidly in cold water. Sudden unexpected immersion into cold water can cause death by: -Cardiac failure due to rises in venous and arterial pressures. -Ventricular fibrillation.
4. Inhalation of water due to respiratory distress.
5. Laryngeal spasm or **dry drowning**
6. Fatal head injuries during diving into the water.

C. ***Delayed cause of death or secondary drowning*** or post-immersion syndrome.

Postmortem submersion

Bodies may be thrown into water after being killed by other means. Heavy objects are tied to the body to keep it under water for a long period. Sure signs of drowning are absent. Other cause of death is found e.g. strangulation, head injuries etc....

Physiopathological changes:

- **In fresh water** ✈ hypervolemia, hemodilution, hemolysis ✈ hypoxia and potassium excess…..VF. In 3-4 min.
- **In salt water** ✈ pulmonary edema ✈ hypovolemia, hemoconcentration, myocardial anoxia and circulatory shock (HF). Asystole in 8-12min.

PM picture of drowning:

These are signs of asphyxia unless death occurred from
1- shock,
2- syncope
3-concussion.

External appearances

1. Signs of immersion:

These are found in any body found dead in water (whatever the cause of death).

1- Coolness of the body.
2- Goose-skin the skin is wrinkled.
3- Washerwoman-skin: the skin is sodden.
4- Peeling of the epidermis in the form of gloves and stockings.
5- Hypostasis.

2- Sure external signs:

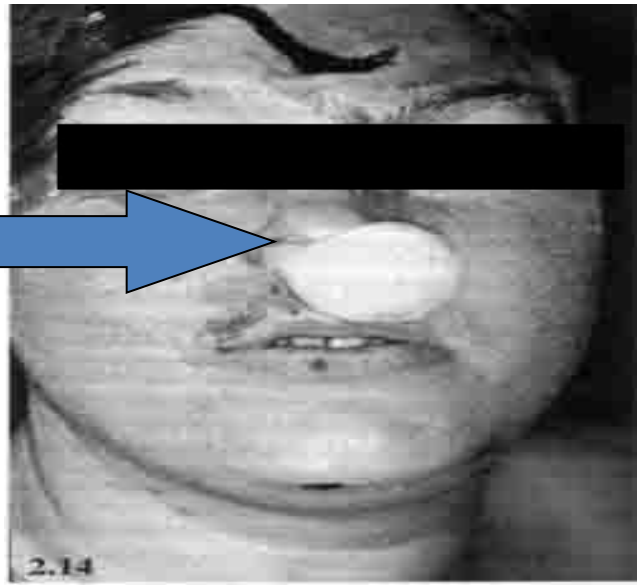
A-Froth:

(Fine – White – Odorless _ increase)

B-Cadaveric spasm

of the hands on weeds, mud, sand, etc.

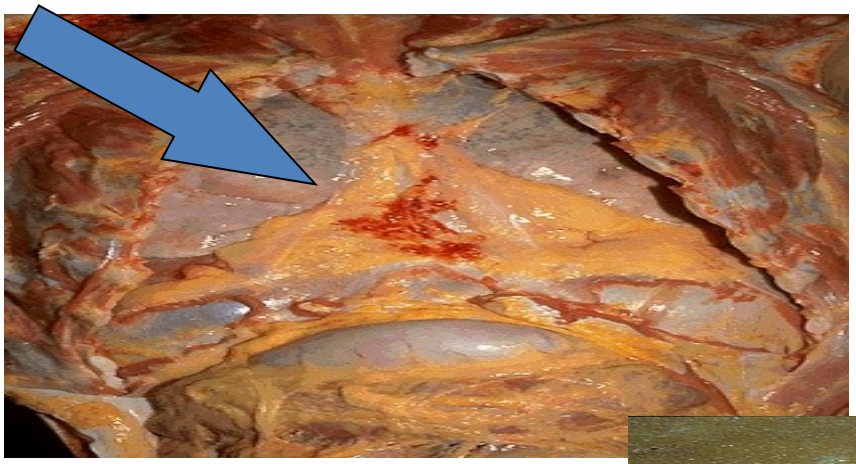
FROTH



Internal appearances:

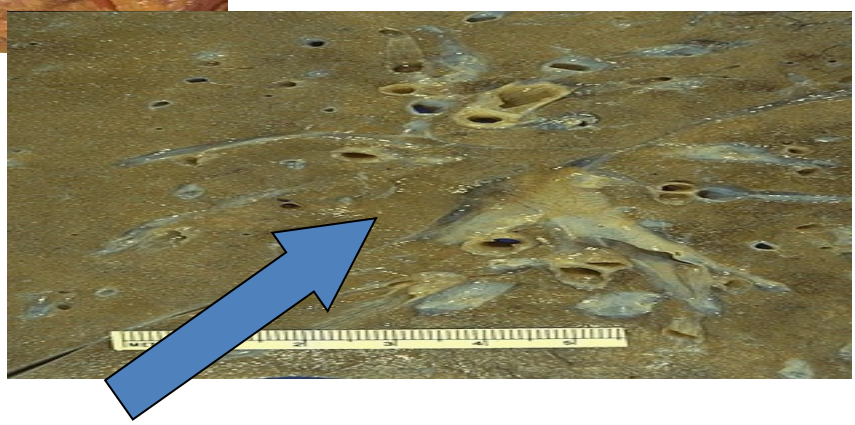
lungs (emphysema aquosum) are ballooned and overlap the pericardium. Being loaded with water they pit on pressure and rib markings are usually present. They are pale in color.

- Voluminous lungs
- Respiratory passages contain froth (having the same characters of that found externally at the mouth and nostrils),
- foreign material (weeds, mud, sand,.).



A normal pink aerated appearance with minimal anthracotic pigmentation

Diffuse alveolar damage in which the lung is diffusely firm and rubbery



DIATOMS

These are microscopic, unicellular algae, found in fresh as well as salt water.

- When a **live person** is drowned in water, they penetrate his alveolar membrane and pass with the circulation to distant organs.
- But when a **dead body** is thrown into water, the absence of beating heart prevents circulation of diatoms to distant organs.

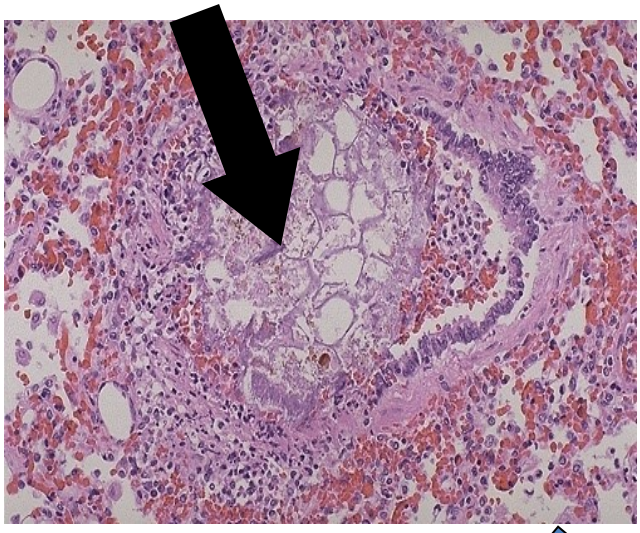
The medico-legal (ML) importance of diatoms:

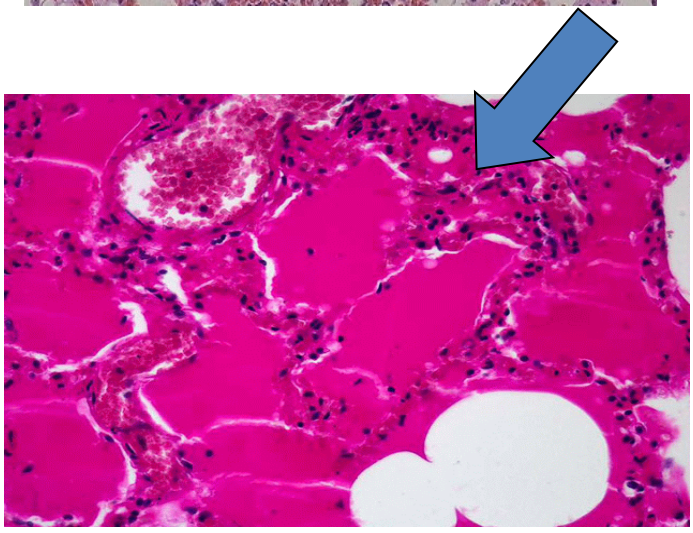
1- Sure signs of drowning,
2- Could still be identified in putrefied bodies,
3-Could give an evidence of the site of drowning (fresh or salt water species).

How to know that death was due to drowning:

1-Froth at mouth and nostrils: fine, white, odorless, abundant.
2.Cadaveric spasm on weeds, mud or sand.
3.Lungs: voluminous, edematous with indentation marks of the ribs.
4. Diatoms in the tissues.

some of the plant material in the water was aspirated into a bronchus.





Only diatoms could be identified
In putrefied bodies:

L8-Identification (ID)

What does "identification" mean?

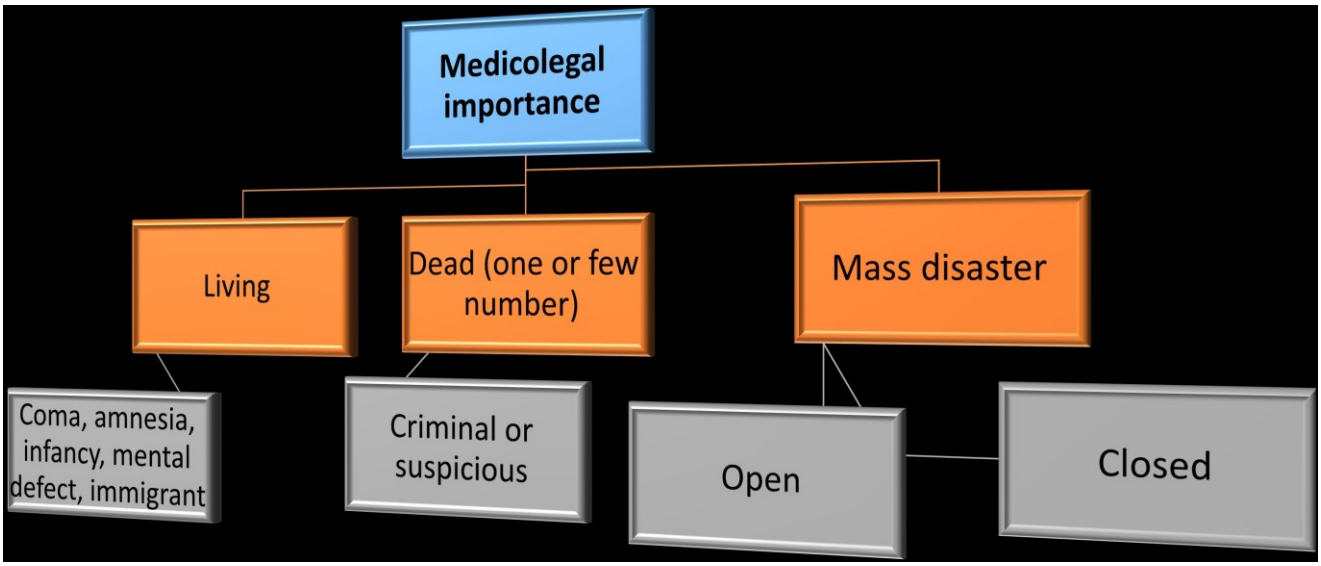
- Is the act of **establishing the identity** through **characteristic features** that differentiate a person from others.
- It may be easy simple , difficult or may be impossible

In this picture , the ID is simple because of the obvious general appearances, intact bones and connective tissues on face and whole body, Organs not damaged ….

In these pictures the ID id difficult or hard , because of damages appearances or organs, not intact or in mass graves and airplane or ship crashes (got multiple bodies,bones,..)

Why is it important?

- ✓ **Obtaining death certificate شهادة الوفــاة**
- **• allow access bank account,**
- **• insurance benefits to next of kin,**
- **• remarriage of the other partner.**
- ✓ **Identification of bodies for burial purposes.**
- ✓ **Identification of offenders.**
- ✓ **Age determination in criminal liability**
- ✓ **Interchange of newborn babies in hospital**

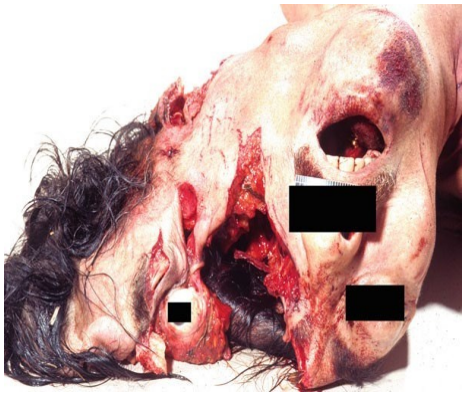


Method of ID of the dead:

1) Visual identification: by relatives

- ➢ **Disadvantages:**

I. Lost or distorted features:



II. Emotional stress.

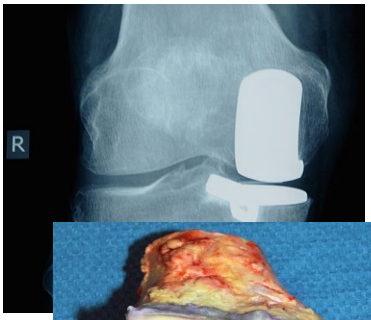
II. Should be confirmed by other means.

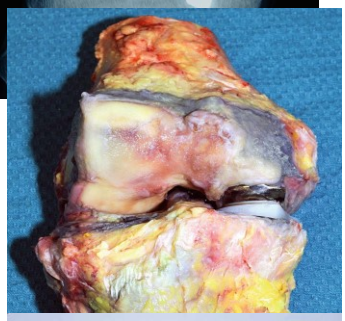
2) Clothing, jewelry, glasses, or even paper found on the individual can provide clues to the individual's identity.

3) Social status: from care of hair, nail, and skin

4) Medical records: it is compared with scars, or diseases leave permanent effect.

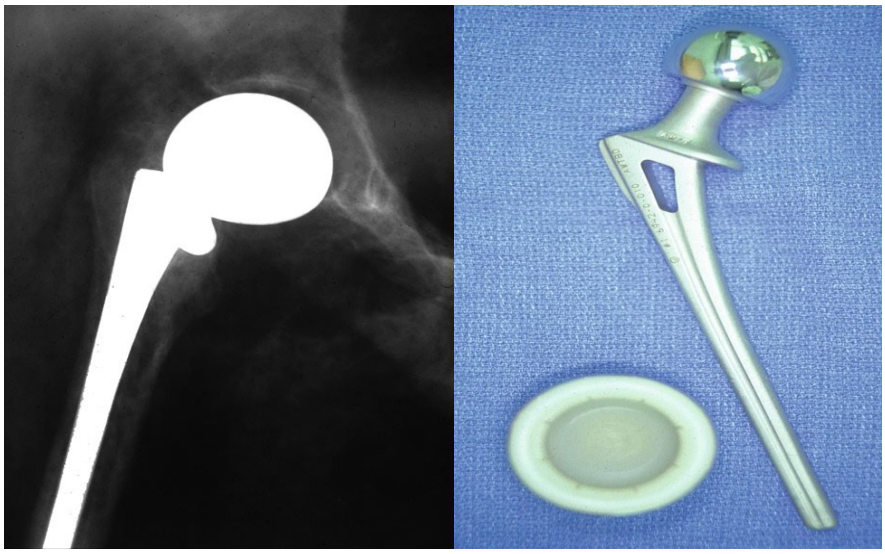
- **Internal physical examination and medical appliances :-**
- **Underlying disease.**





X-ray of the whole body may reveal :-

1. old fracture.
2. Prosthesis e.g. plates or nails in joints and bones.
3. Pacemakers implanted: manufacturer and serial number and hence personal identification.
4. Artificial Valves.



5) Congenital anomalies: as cleft lip, extra toe.

6) Tattoo marks: It may help in identifying name, age, address, religion.

(a)

(b)

7) Dental identification:

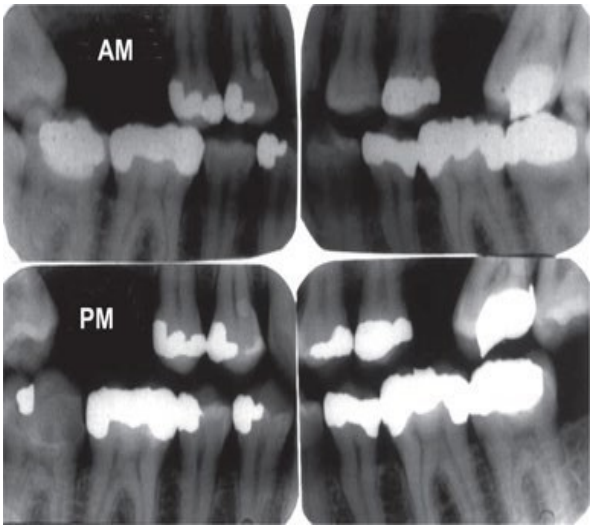
✓ teeth are **highly individualistic**, it is

✓ **accurate**, **cheap**, **rapid method**

but in the absences of previous ***DENTAL RECORD***, it can't help too much.

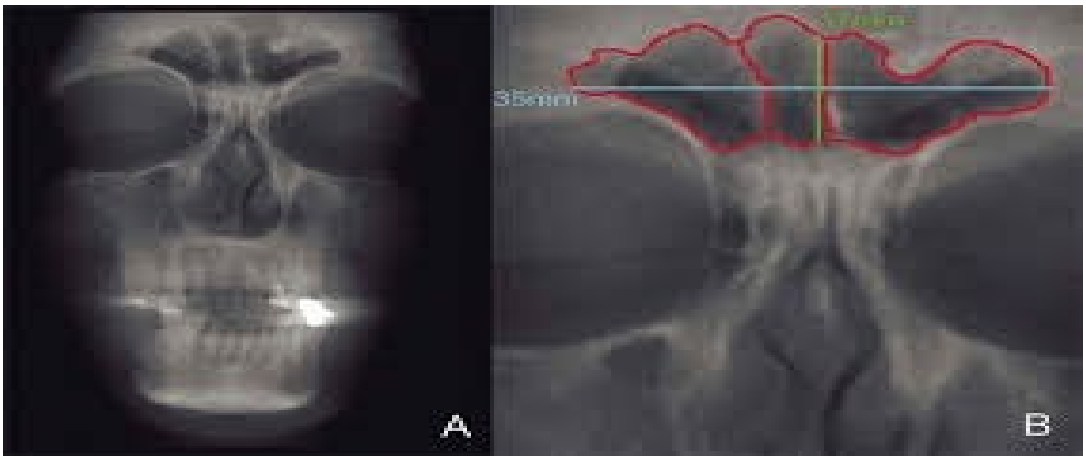
✓ We can compare AM with PM records :

- Dental charts (a record of a patient's dental history and treatment).
- X-ray.
- Dental fillings and models



8) X-ray: different bony areas are unique:

- Frontal sinus.
- Sella tursica.
- Skull suture pattern and vascular grooves.

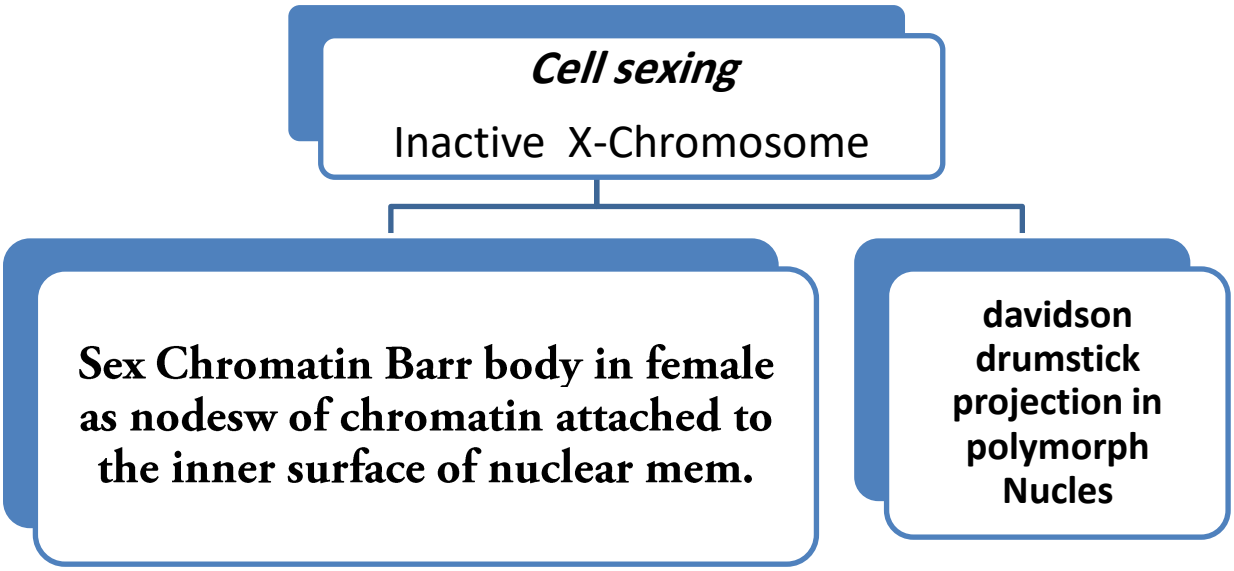


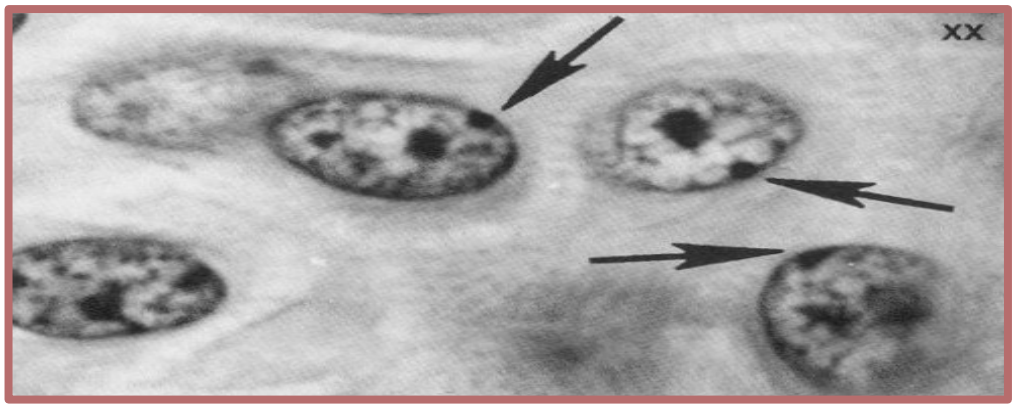
9) Prints: unique features used for individual ID:

- ❖ Fingerprints. (Palm prints-Sole prints)
- ❖ DNA fingerprint.
- ❖ Iris print.
- ❖ Ear print.
- ❖ voice print.
- ❖ Lip prints. Frontal sinus, palatal rugea And others

10) Sex:

- ❖ External features.
- ❖ Internal organs in advanced putrefaction (uterus, prostate).
- ❖ Barr bodies.

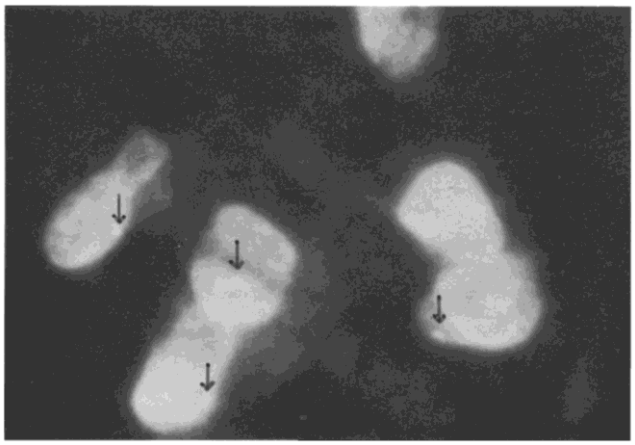




Sex cell characters. Female cell showing "Barr bodies" of chromatin under cell-membrane.

- **The Y chromosomes of the male cells can also be visualized (by using a fluorescent microscope and quinacrine stain) in the cells of hair sheaths , nerve cells and dental pulp.**

Y chromosome in hair root by fluorescent stain



11)age estimation

estimated with variable range of accuracy according to age group:

AGE GROUP		
Intrauterine	**Birth-25 y**	**Above 25y**
• Weight • Length • Organ development • Ossification centers	• The most accurate • General appearance • Teeth • Xray	• Less accurate.

age estimation Methods:

1- Appearance of ossification centers:

During intrauterine life:

- **At 5 months: Calcaneus**
- **At 7 months: Talus**
- **At 9 months: Cuboid**

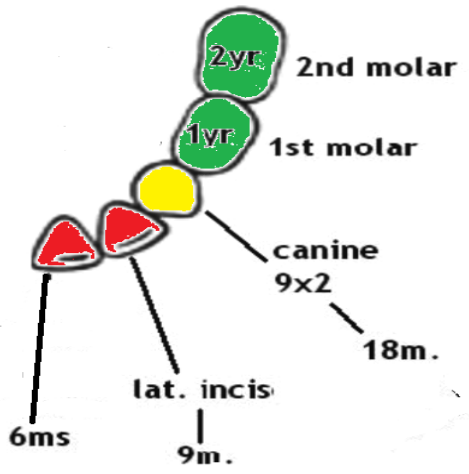
2- **Mandible:**

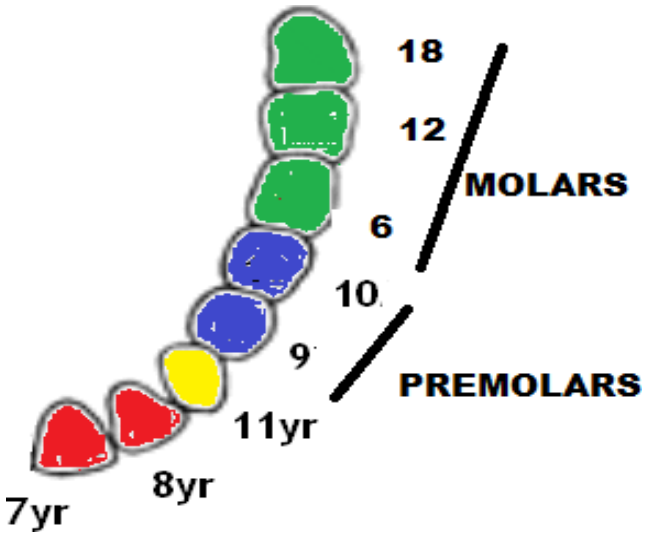
The angle between the body and ramus is obtuse in infants, right in adults and obtuse in old age

3- Dental examination:

teeth eruption is used for age estimation.

- Everyone has 2 sets of teeth that erupted at certain age.
- Deciduous or milk: 20 in number, 2 incisors, 1 canine, 2 molars.
- Permanent teeth: 32



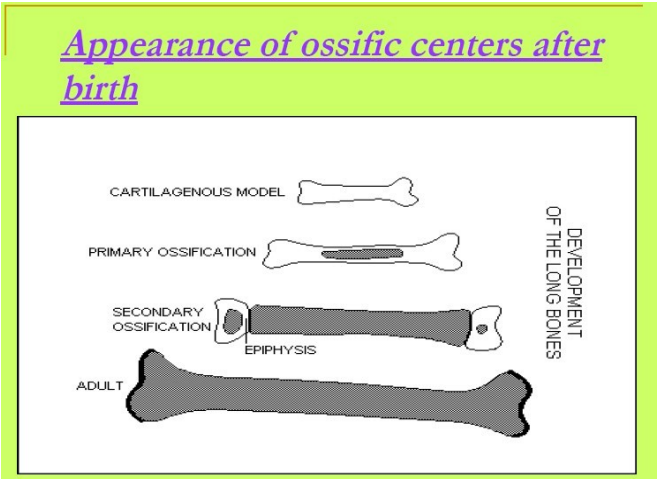


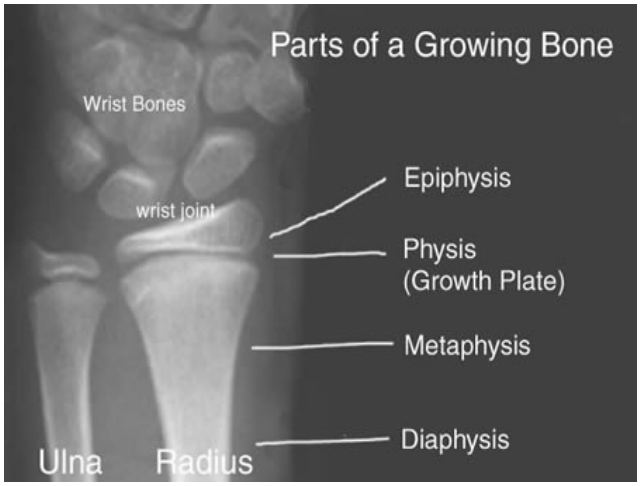
4- X-ray of bones;

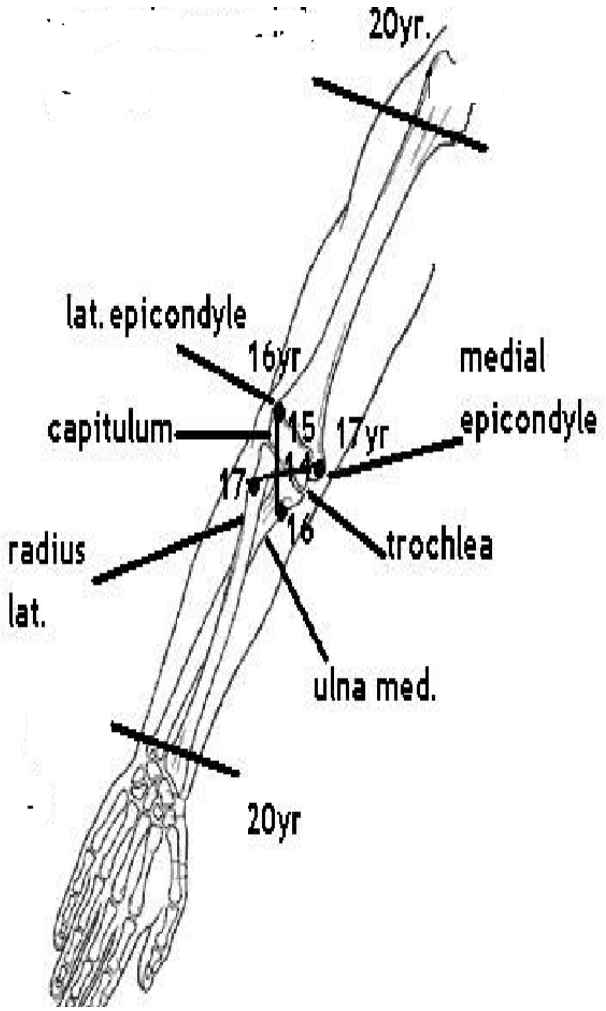
union of epiphysis with metaphysis of bone occurs at certain age.

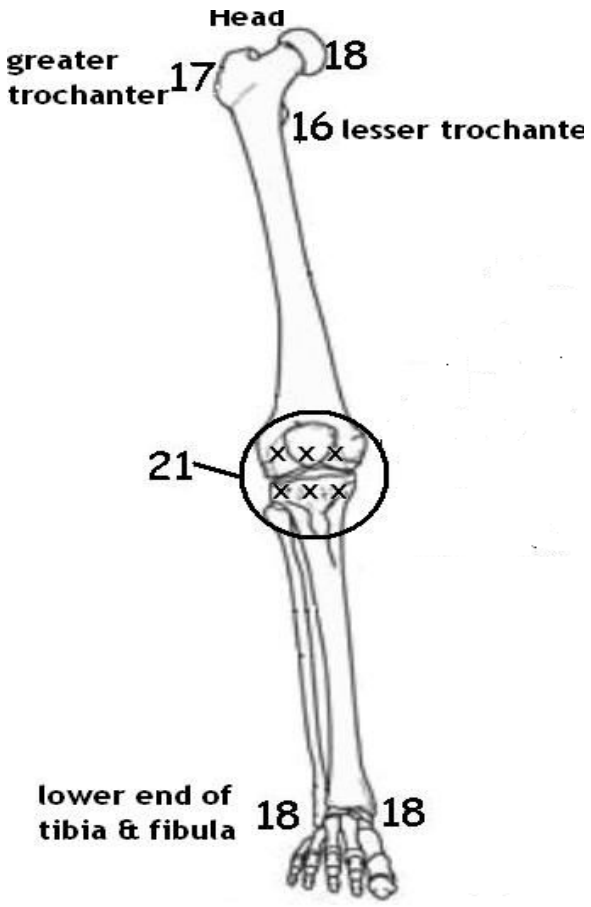
Estimation in males is 2 years Older than females

Example : the diaphysis and metaphysis at wrist joint in male are fused at 20 yearsm so in female are fused at 18 years old

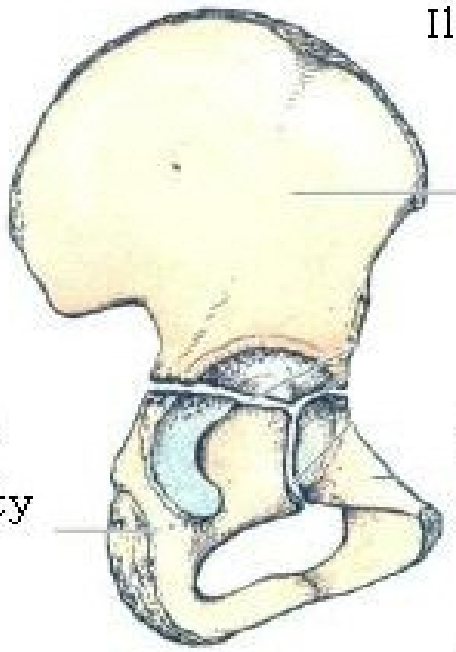








UPPER AND LOWER LIMBS AGE ESTIMATION



Fusion of :
the 3bones at
acetabulum(at
puberty)
the pubic&ischial
rami(6y)

5- Closure of fontanels:

• Posterior fontanel at birth
• Anterior fontanel at 18 months
• Above **25** years old:
✓ less accurate
✓ The basiocciput fuses with the basisphenoid at 23 years.
✓ - The sagittal suture starts fusion at 25 years and is complete at 30 years.
✓ - The coronal suture fuses at 40 years.
✓ - The lambdoid suture fuses at 50 years.
✓ Change of teeth could be used (Gustafson's formula (scoring system for changes of teeth).
• N.B. The frontal suture fuses completely at 3 years.

Method of ID in case of collection of bone: (Human Remains)

- **Hard and difficult**
- **Compare bones m pares and individuals, left and right**
- **DNA and methods of ID**

NOW ANSWER THESE QUESTIONS?

1- Are they human or animal?
- **Shape and anatomical features**
- **Precipitin test.**

2- One or more person?
- **Repetition of single bone.**
- **Different age and sex in bone collection.**

3- Male or Female?
- **Pelvis, skull, sternum, sacrum can differentiate male from female**

4- What is the race?
- **Negroid skull can be differentiated from non Negroid one**

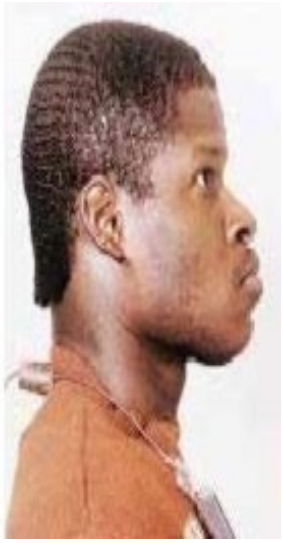
5- Stature?
- **Femur 25% of the height Humerus 18% of the height.**

6- Cause of death?
- **Traumatic: fracture, firearm beveling, hyoid bone in asphyxia.**
- **Pathological: TB, neoplasm.**
- **Toxic: toxin could be detected in bone.**

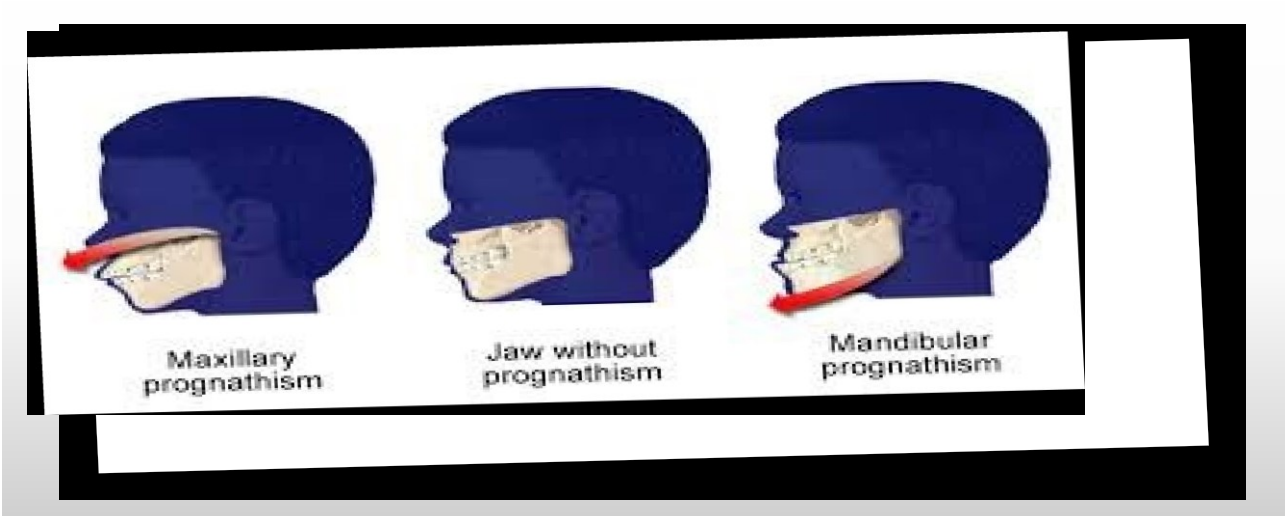
Identification of Race:

In Negroid race the skull has specific characters:

- The shape of the skull is elongated (dolichocephaly).
- The alveolar margin of the maxilla is protruded forming a prognathism.
- The hard palate is flat
- The nasal orifices are wide.
- The frontal suture is persistent and does not fuse.



Dolichocephaly **prognathism**

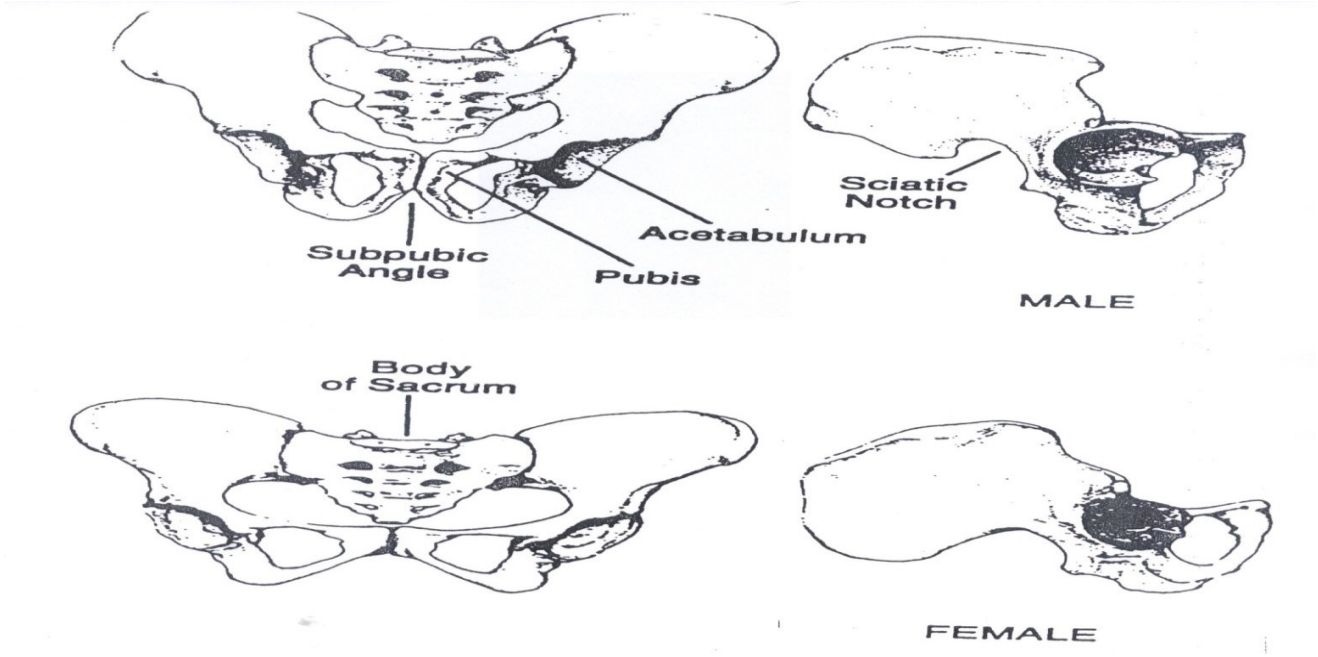


Identification of sex from bones:

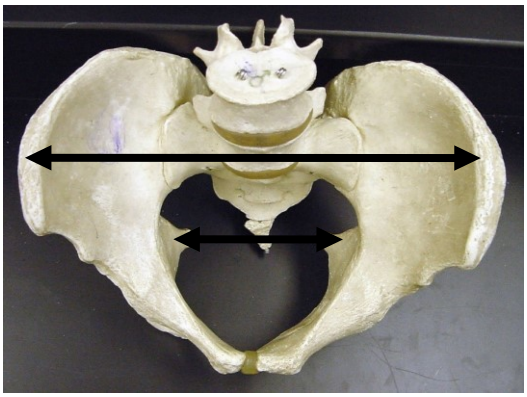
- The **pelvis, sternum and skull** are the main bones that help in identifying sex as they show definite differences between males and females.
- However, by applying some measurements, the sex of the **femur** and **humerus** can be determined.

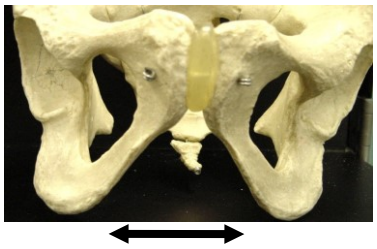
1. The pelvis:

The pelvis of the a female is generally wider and shorter than that of a male.



Male **Female**





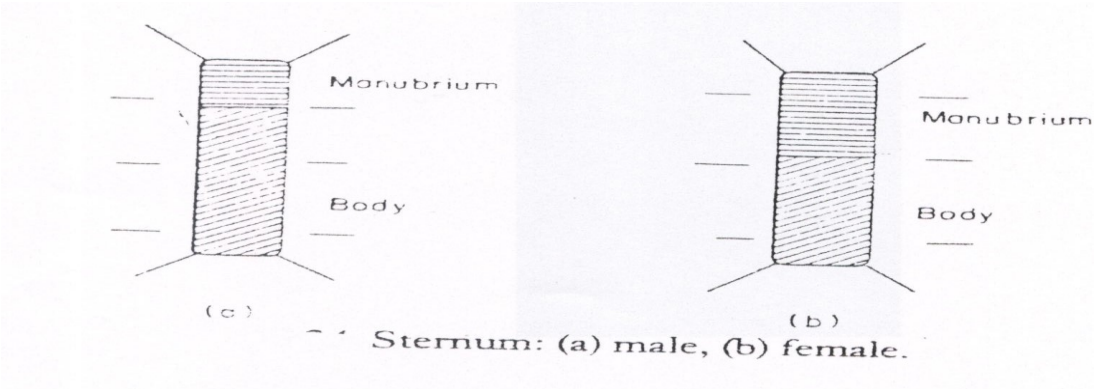
	Male Pelvis	Female pelvis
Bones	Bones are massive , rough and heavy	Smaller , lighter and smooth and generally wider.
Bones of pubis - ***Pupic arch (subpubic angle.)**	Triangular **Acute angle i.e. less than 90°** **Deep and narrow**	Quadrangular **Obtuse i.e. more than 90°** **Shallow and wide**
- **Greater Sciatic notch**	Oval	Smaller and more triangular
- **Obturator foramen**	**Absent**	**Well defined especially in multipara**
- **Preauricular sulcus**	**Prominent and highly curved**	**Less prominent , less curved**
- **Iliac crest**	Highly Arched	Low
- **Pelvic cavity**	**Deep , Straight walls**	**Shallow , wide wall curved outwards**
- **Iliopectineal line**	**Rough and prominent**	**Smooth , less prominent**
- **Acetabulum**	Wide , looks laterally	Narrow , looks laterally and forwards
- **Pubic /ischium ratio**	Less	Greater
- **Sacrum**	**Long, narrow, homogenous curve**	**Short , wide , curved only at lower end**
- **Articulation surface of sacrum**	2½ segments	1½ segments

2. The Skull

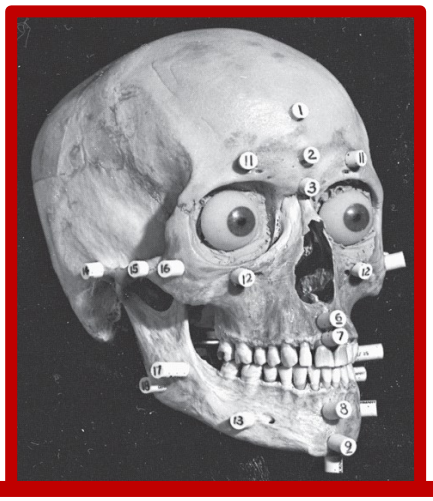
	Male Skull	Female Skull
***size and weight**	Bigger and heavier	Smaller & less weight
***Superciliary arch**	Marked	Less marked
***Fronto-nasal junction**	Angular	Rounded and smooth
***Parietal and frontal emimences**	Prominent and rough	Less prominent and smooth
***Mastoid process**	Bulky and rough	Smooth and less marked
***Muscle attachments**	Rough	Smooth
***Condylar facets**	Long and narrow	Short and wide

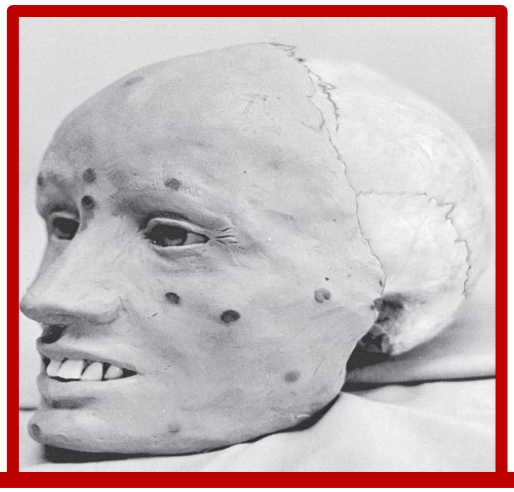
3. The Sternum

The **female** sternum is **short** and **broad**. The **body** is **less than double** the **manubrium**. The **male sternum** is **long** and **narrow**. The **body** is **more than double** the **manubrium**. The junction between the body and the manubrium is angular or prominent.



Sternum: (a) male, (b) female.

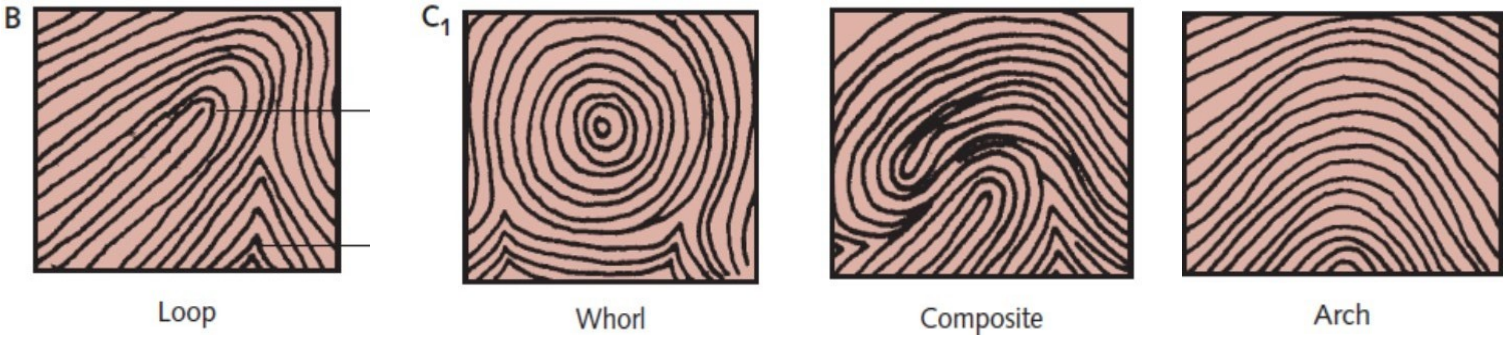




Facial reconstruction: First picture: Use of tissue depth marker guides in preparation for clay facial reconstruction. In the Second one A skull with clay molded to tissue marker depths to exhibit facial features

Fingerprints

- alternating ridges and valleys in the palmar surface of hand and foot.
- Skin is coated with mix of sweat and oils -Any time you touch a surface, a trace amount of sweat/oil is left behind taking the shape of finger ridges (fingerprints).
- A fingerprint is an individual characteristic. No two people have the same fingerprint.
- Twins do NOT have identical prints -Genetics does NOT determine your exact prints
- A fingerprint pattern will remain unchanged from 4th month intrauterine and for the life of an individual.
- Its main function is to force hand grip.



Types of Fingerprints:

1. **Patent prints**: visible prints (left because someone's hand had blood, ink, etc. on it).
2. **Latent Prints** : hidden prints that become visible only when fingerprint powder or other special techniques are used. Composed of sweat and body oils.
3. **Plastic Prints** : fingerprint indentations (3D) left in a soft material such as clay or wax

Latent FPs

Patent FPs

Forensic Odontology: Medicolegal importance of teeth examination

1. Age and sex estimation.
2. Personal identification (dental print): from teeth examination and X- ray.
3. Bite mark:

• Human bite: are 2 curved rows of abrasions and bruises. It is considered as a **print** could help in identification of the assailant.
• Animal bite: 2 parallel rows.

1. Diagnosis of poisoning

• Chronic heavy metal toxicity: (**lead**, **mercury** and **cupper** make **blue**, **grey** and **green** line in the gums respectively:
• **Dirty yellow** teeth from **tetracycline**.

Medicolegal importance of Hair Examination

• Criminal cases:
    1. Rape: pubic hair used for identification of the assailant
    2. Cadaveric spasm: for identification of the assailant
    3. differentiate Cut from contused wound
    4. Firearm injury: differentiate inlet from exit
• diagnosis of poisoning: ex. arsenic poisoning
• personal identification and Disputed paternity: by DNA print from hair root.
• Examination of tip indicates time of hair cutting.
• Examination of hair root indicates if hair fallen by itself or pulled.
• Identification of race: from the form of the hair

Medicolegal importance of Nail Examination

✓ Intrauterine age: at 8th month the nails reach the tip of the fingers, at 9th they become above the tip of the fingers
✓ Sex: from length and shape
✓ Social status and occupation: from care and dying
✓ Blood under nails: for identification of the assailant
✓ Color of the nail: indicate the cause of death e.g. blue in cyanosis, pale in hemorrhage, red in red asphyxia
✓ Toxicity: drugs could be detected in nails.
✓ Chronic arsenic toxicity: Mee's line.

Ages of Medicolegal Impotence

7 years:

- The age of discrimination; the child can differentiate between right and wrong.
- Below this age he is never convicted or punished.
- Permanent central incisor.
- Ossific center in lower end of radius reaches 2/3 breadth of epiphysis

15years:

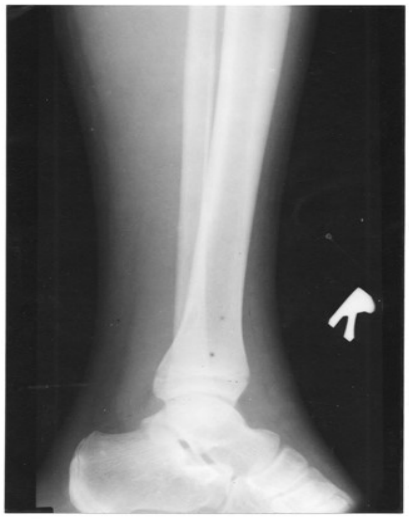
- ✓ Age of partial criminal responsibility
- ✓ The age of marriage of girls.
- ✓ No execution of criminal if he/she is below 15
- ✓ In rape of female less than 15 , the assailant will be executed.
- ✓ Disappearance of y shaped suture in acetabulum.

18 years:

- ✓ Age of full criminal responsibility; below that age conviction is in front of a juvenile court.
- ✓ Age of free consent in rape.
- ✓ Age of getting a driving license.
- ✓ The age of civil rights and responsibility.
- ✓ Getting a job in the government.
- ✓ Age of marriage of male.

CASES

Above 17 Union of all epiphysis with metaphysis



X-ray of leg and ankle showing that the age is below 18 due to nonunion of the distal ends of tibia and fibula

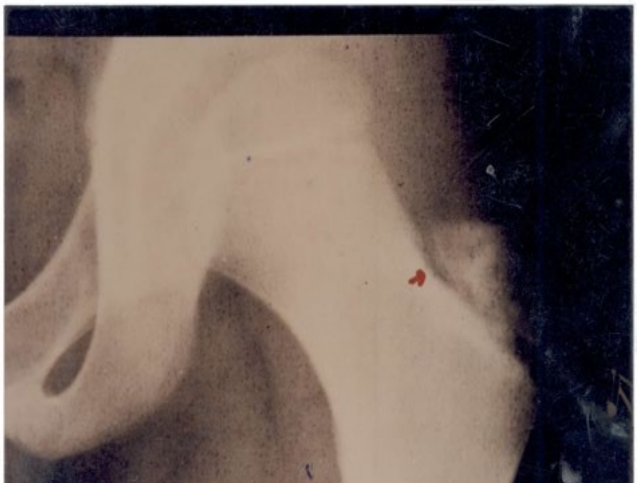
X-ray of knee showing that the age is below 21 years due to nonunion of the distal end of femur and nonunion of proximal ends of tibia and fibula

X-ray of forearm and wrist showing that the age is below 18 due to nonunion of the distal ends of metacarpals

X-ray of wrist and forearm showing that the age is above 20 years due to union of the distal ends of radius and ulna

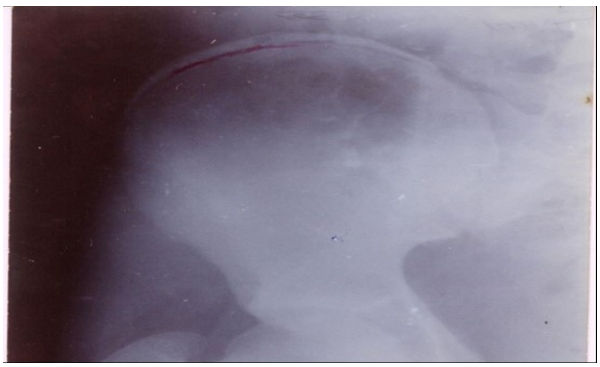
X-ray of the pelvis showing that the age is below 6 years due to nonunion of the inferior ramus of the pubic bone with the superior ramus of the ischium

X-ray of pelvis showing that the age is above 6 years due to union of the inferior ramus of pubis with the superior ramus of ischium , and below puberty due to nonunion of the 3 bones (pubis , ischium and iliac bones) together at the acetabulum



X-ray of pelvis showing that the age is below 17 years due to nonunion of the geater trochanter

X-ray of knee showing that the age is below 21 years due to nonunion of the distal end of femur and nonunion of proximal ends of tibia and fibula



X-ray of pelvis showing age less than 23 due to non-union of iliac crest of hip bone

X-ray of forearm and wrist and of the leg and ankle showing that the age is below 18 years due to nonunion of the distal ends of tibia and fibula

X-ray of leg and ankle showing that the age is below 18 due to nonunion of the distal ends of tibia and fibula

L9-Sexual Offences

Def: Actions that are against the human nature and can cause effect to the person himself or to his partner, these actions could be illegal or legal.

Sexual Offences	
Unnatural	**Natural**
1. Buccal Coitus	1. Rape
2. Sexual Asphyxia	
3. Sodomy	
4. Bestiality	
5. Sadism & Masochism	2. Incest
6. Tribalism	
7. Paedophilia	
8. Necrophilia	

I. Natural

-***Incest:*** *زنا المحارم*

-***Rape*** *الاغتصاب*

II- Unnatural sexual offences

1. ***Sodomy*****. (Homosexuality), Named after (قوم لوط) سدوم**
2. ***Bestiality*** *الزوفية:* sexual act by a human being with a lower animal, either by anus or by vagina. Sheep are commonly used by males, and dogs and cats by females. Severe injuries may occur.
3. ***Necrophilia****:* sexual activity with dead body. Usually seen in graves and in morgues.
4. ***Tribadism – Nymphomania – Lesbianism****:* gratification of sexual desire of a women by another woman = female homosexuality.

Under our laws, we punish sodomy but not lesbianism as the latter cant be proved.

5. ***Sadism*** *السادية:* Infliction of pain on partner for sexual gratification.

This may cause severe injuries or death. This can be sexual or a social characteristic. Named after Marquis de Sade.

6. ***Masochism:*** sex enjoyment by receiving pain. his can be sexual or a social characteristic.

7. ***Buccal coitus (Oral Sex)*** *:* intercourse through the mouth. Faint teeth marks and abrasions may be seen on the penis. Can be a problem if ejaculation in the mouth occurred and caused aspiration.

8. ***Sexual asphyxia****:*

It is self-inflected, sexual pleasures induced by Hypoxia.

This type of asphyxia can cause "accidental hanging", during masturbation, to achieve fast orgasm the person decreases the oxygen supply by wearing a plastic bag or using a rope. If he losses consciousness it might cause accidental hanging. These cases are Usually Naked or wearing Feminine clothes, In front of Mirror using rope.

9. **Paedophilia**: Sexual Relationship/attraction with Children (Anyone Under the age of 18) - this is subjected to the laws of each country-.

Virginity

Signs of virginity:

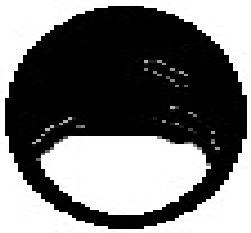
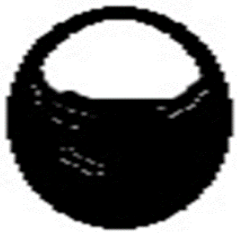
- Hymen is intact.
- Posterior commissure is intact.
- Labia majora are firm, round and completely closing the vaginal orifice.
- Vagina is narrow with a rugose mucosa.
- Breasts are firm, hemispherical with small nipple and areola.

What Is the HYMEN?

It is a thin moderately **elastic mucous membrane** about **1mm thick** with connective tissue core and stratified squamous epithelium on both surfaces, **partially suspended across the vaginal entrance**

- Embryological remnant –

There are several types according to it SHAPE.

			
Posterior opening	**Anterior opening**	**annular**	**Fimbriate** **مشرشرة كتير**
			
Cribriformزي المنخل	**Dentate** **مشرشرة**	**Septate** **مقسوم من النص**	**Imperforate**

• **Causes Of Rupture Of Hymen:**

1- Sexual intercourse.
2- Car accidents.
3- Diseases: ulceration of vulva & polyps.

• **Medicolegal conditions in which a female is examined for signs of virginity are:**

1. Female alleged **rape**.
2. Female alleged **impotence** of the husband.
3. Male alleged **non virginity** of the wife (the husband asks for compensation; sometimes it is due to elastic hymen).
4. **Imperforate hymen.**

• Types of Hymen That May Cause Medico-Legal Problems:

			
Elastic annular hymen – Fleshy Dilatable hymen .	**Imperforate**	**fimbriate**	**dentate**
does not rupture in widening (wedding) night.	causes hematocolpos which simulates pregnancy.	**simulate ruptured hymen**	

- **Differences between the Torn Hymen and Dentate or fimbriate Hymen:**

Torn hymen	Dentate or Fimbriate hymen
Serrations *usually* reach vaginal wall.	*Never* reach vaginal wall
Dentations are irregular and asymmetrical	Symmetrical on both sides
Width of the opening admits 2 fingers to pass through easily.	Admits the tip of the little finger
Transillumination shows opaque scar tissue after healing of tear.	Translucent tissue without scar

Fimbriate

Ruptured dentate

Natural SO:

1- *Incest: زنا المحارم*

sexual intercourse by a man with a woman whose their degree of blood relationship prohibits their marriage e.g. mother, daughter, sister or grand-daughter.

- **Consent is not accepted.**
- **This is considered "Natural" as some populations like the amazons consider it normal. However, it is forbidden "Offence" in religions and due to the fact that it causes many diseases.**

2- Rape

- **Definition:**

It is unlawful sexual intercourse of a woman by a man other than her husband against her will, without her consent and by force.

- **WHO Definition**:

Sexual Relationship with a female against her will.

- It is considered to be a "natural offence" due to the fact that when humanity started, there was no awareness to the concept of consent.

- **Conditions of consent**

1- **She must not be under the age of 18 years.**
2- **She should be sane and not mentally retarded.**
3- **She must be conscious, not be under anesthesia or asleep.**
4- **She must not be under the effect of drugs.**
5- **She must not under fear, violence or physical and mental threats.**
6- **She must not under fraud i.e. the male partner may impersonate the husband during sleep of the wife.**

- **Examination of a case of rape**

(A) ***Examination of the victim.***

(B) Examination of the suspected assailant.

- **A. Examination of the victim:**

1- **A written consent** for examination of the victim or her guardian.
2- **A detailed history** of the crime heard from the victim.
3- **Age determination.**
4- **Blood sample (drugs, venereal disease, pregnancy).**
5- **The examination should be made in the presence of a third person** (e.g. a nurse).

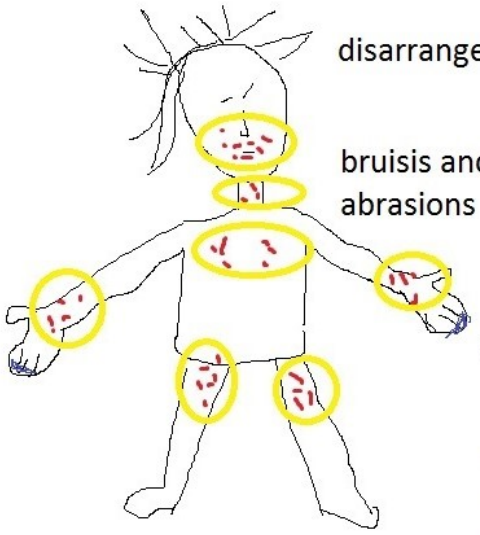
- **Marital status & date of last sexual intercourse + Number of children if present; Married women show more signs of resistance than virgins (physical signs > Local Signs), due to extreme fear in the latter.**
- **Repeat the questions several times in different forms.**
- **Collect all clothes in a bag, label them and send them to the lab for analysis.**

The findings may be :

(1) **Clothes:** tears, marks of mud or grass, stains (blood or semen) particularly of the underwear.
(2) **Behavior**, manner of speech and gait.
(3) **Smell of mouth**.
(4) **Mental faculties** observation during the interview or examination.
(5) **General body examination:**

- **Physical development and body built.**
- **Wounds as *signs of general violence* on the body. The *age of the wounds* must be correlated with the suspected time of the crime.**

- **General Examination**



- **Signs of general violence**

(6) Local genital examination:

- The victim is put in the lithotomy position in good direct light fully exposed.
- Fear and shame from examination is more evident in virgins.

Local Examination may reveal:

A. **Wounds as signs of local violence:**

1. Abrasions or contusion of vulva.
2. Hymnal tears in virgin victim. Here, we must differentiate between recent and old tears.
3. Lacerations and tears in vagina and vulva, and perineal tear.

B. **Assailant's pubic hair** may be found on the victim genitalia.

C. Seminal or blood stains of the assailant may be found on victim's clothes , pubic hair or inside the vagina.

D. Plucking the females pubic hair as it may Have a seminal stain.

Recent hymnal tears	Old hymnal tears
-Painful, swollen, edematous.	-Painless, not edematous.
-Hyperemic and bleed on touch.	-Neither hyperemic nor bleed on touch.
-***May not reach*** the vaginal wall.	- ***Reach*** the vaginal wall.
- Translucent.	- Opaque.

(7) Nails:

for the presence of skin epithelial tags of assailant.

(8) Delayed examination of body and genitalia

for the detection of venereal diseases (after 7 days for gonorrhea and after 2-4 weeks for syphilis).

C- Examination of the accused:

1- His ***consent*** *for examination* is essential.

2- His ***story***.

3- His ***age*** is estimated ⇨ below 14 years incapable of rape.

4- His ***mental condition*** is noticed.

5- His ***physical condition (Body Built)*** is noticed for the possibility of overpowering her.

6- Signs of ***general violence***.

- Abrasions and bruises (bites) ⇨ age = date of the crime.
- Clothes: tear or lost buttons.

7- Signs of ***local violence***:

- Abrasions and bruises on the genitalia.
- Victim's pubic hairs & blood stains.
- Venereal diseases: gonorrhoea & syphilis

8- ***Impotence***: Lack of erection may be alleged by the accused as a defence for the crime.

9- We ask if he knows the female or not as it will affect the course of action during investigations.

•After effects of Sexual Assault /Rape

Physical, mental, reproductive and sexual health consequences including:

- **Physical injuries**
- **Depression**
- **Post-traumatic stress disorder**
- **Suicide attempts**
- **Substance abuse**
- **Unwanted pregnancy**
- **Gynaecological disorders**
- **Sexually transmitted infections**
- **Increased HIV/AIDS risk.**
- **Relationship difficulties.**

II. UNNATURAL SEXUAL OFFENCES

1-Sodomy

•Definition:

Sexual intercourse per anus by a man who is usually the active partner with a passive partner that may be a man (homosexual, sodomy) or a woman (heterosexual sodomy).

•Indications of medicolegal examination for sodomy:

1. **The two partners of sodomy may be arrested during the act.**
2. **The passive partner may accuse the active partner of doing the act of sodomy against his will (e.g. in children).**
3. **A wife may ask for divorce alleging that her husband is a sodomist.**

•Examination of the passive partner: more signs

- Consent should be taken before examination.
- History of the crime.
- **Clothes**: tears, stains (blood or semen).
- **Behavior**: manner of speech and dressing, gait and response to anal examination must be observed.
- **Anal examination**: under adequate light in the knee elbow position.
- **Detection of blood and seminal stains.**
- **Signs of recent sodomy.**
- **Determination of manifestation of habitual sodomy.**

•Signs of recent sodomy

1. **Anal examination of the victim of recent sodomy reveals that the anal orifice is tender under touch , and edematous. -Trauma**
2. **Zone of bruising may be seen around it.**
3. **Recent tears may be found with bleeding. – Eversion Of Tissue**

•Manifestations of habitual sodomy of passive partner

(A) The person usually takes the knee elbow position without shame.

(B) Anal examination:

1. Inspection:

- Fat substances are absorbed from continuous pressure → anus is **funnel or conical** in shape.
- Loss of usual mucosal folds → **smooth mucous membrane**.
- **Presence of fissures.**
- **Thickening of anal mucosa due to chronic irritation.**
- **Evidence of any venereal disease.**

2. Palpation (digital examination):

- **Loss of elasticity and tone and absence of pain when introducing the finger.**
- Anus is **lax and patulous**.
- ***Loss of anal sphincter reflex*** : normally; scratch skin near anus lead contraction of anal sphincter.

3. Rectal examination:

- old or recent tears and
- swabs must be taken from rectum for detection of semen and venereal diseases. Or evidence of Lobes can be found if ejaculation doesn't happen.

L10- Abortion

- ***The medicolegal definition of abortion is:***

"The expulsion of any contents of the gravid uterus at any time 28 week of gestation".

- ***Medicolegal circumstances***

There are certain circumstances of medico-legal importance in which a physician is asked to examine a woman to prove that she has had an abortion:

1. ***When abortion is alleged to have followed a blow or a quarrel***
2. ***In road traffic accidents that result in abortion, the woman may ask for compensation.***
3. ***In criminal abortion procured by anyone especially when fatal result issued.***
4. **A woman wishing to conceal abortion after being charged with it.**
5. **A woman notifying that a medical man procured abortion in her or giving her abortifaciant drug.**

- **10% of Abortions are Spontaneous and 90% of them are Induced (therapeutic, Criminal,..)**

1- *SPONTANEOUS ABORTION*

A. Maternal causes

1- ***General diseases that hastens the mother's health e.g. severe fevers, diabetes mellitus, nephritis.***

2- Local pathologic conditions in the genital tract e.g. fibroids, tumors, incompetent cervix, uterine displacement.

B. Fetal causes

e.g. congenital anomalies, vesicular mole, polyhydramnios, placental defect.

2- INDUCED ABORTION

- **Induced abortion may be therapeutic or criminal.**

A. Therapeutic abortion (justifiable, legal):

- **This is performed to preserve the life of the mother, when the continuation of pregnancy endangers her life.**

- **Indications of therapeutic abortion**

A) Disease of mother:

1- Uncompensated heart diseases.
2- Uncontrolled hypertension.
3- Uncontrolled diabetes mellitus.
4- Chronic nephritis.
5- Apical bilateral TB of lungs.
6- Cancer breast.

B) Diseases of pregnancy: if medical treatment fails e.g. eclampsia, severe haemorrhage, hyperemesis gravidarum.

NOTE: Before any doctor procures a therapeutic abortion he should follow certain regulations.

- **Legal precautions before therapeutic abortion:**

1) **A written consent of the woman and her husband should be obtained.**
2) **Written reports from two specialists should include the woman's condition and should state that the continuation of pregnancy endangers her life.**
3) **The operation should be performed only in a hospital.**
4) **The operation should be performed only by a specialist i.e. obstetrician.**
5) **Reports and details of all what was done should be kept in the files of the hospital.**

B. Criminal abortion (unjustifiable, illegal)

- **When there are no medical indications for induced abortion, it is a criminal abortion, whether done by the woman or anybody else.**

Methods of procuring criminal abortion

1. General violence

It is a popular belief that abortion is easily precipitated by violence and the pregnant woman must not be exposed to any undue exercise. Therefore women try general violence to get rid of pregnancy e.g. by jumping, carrying heavy object, horse riding or cycling. However, violence of severe degree may fail to disturb any pregnancy; on the other hand serious body injuries may occur.

2. Local violence

The objective is to dilate the cervix or to separate the membranes. Every woman is using instruments or materials within reach of her hands and they differ with her standard of living and her level of education. Local violence may be applied to

- ***Vagina***

Insertion of vaginal plugs of irritant substance e.g. arsenic or mercury.

- ***Cervix***

Alternating hot and cold douches.

Insertion of foreign bodies e.g. cotton stick, Elmbark, knitting needle, curette, catheter.

- ***Uterus***

Mechanical separation of the membranes and placenta by:

Injection of soap and water or glycerine (syringing).

Surgical procedures differ according to the duration of pregnancy: In the first trimester; dilatation and evacuation is done by curettage (D&E or D&C). In the second trimester rupture the membrane by a sound then packing the cervical canal and vagina. In the third trimester a gum elastic bougy is used between the membrane and the uterine wall.

3. Abortifacient drugs

- **Drugs acting directly on the uterus (Ecbolics):**

They cause contraction of the uterine muscle and expulsion of the fetus e.g. ergot, quinine, lead, pituitary extract.

- **Drugs acting reflexly on the uterus (Drastic purgative) through their effect on the intestines leading to pelvic congestion and reflex uterine contraction. e.g. purgatives as jalap, castor oil, croton oil.**
- **Protoplasmic poisons acting on the ovum or the fetus leading to its death e.g. metals as lead, antimony, arsenic, mercury.**
- **Prostaglandins:**

The mechanism of its action is through dilatation of the cervix producing uterine contraction.

- **Hormones e.g. contraceptives.**
- **Abortifacient pills:**

mifepristone (anti progesterone) followed, some 36 to 48 hours later, by misoprostol (prostaglandin: stimulate uterine contraction), to induce abortion within nine weeks of pregnancy.

❖ *Dangers and complications of criminal abortion*

The procedure of criminal abortion is usually done by incompetent people , in a hurry and in the dark i.e. hidden, therefore it is usually followed by complications. Dangers occur also due to ignorance of the woman of her anatomy or due to uncleanliness of instruments or materials used.

1) **Neurogenic shock may occur from vaginal douche or from vigorous dilatation of the cervix which is a trigger zone.**
2) **Hemorrhage: Primary hemorrhage occurs from the site of the placenta due to retention of some parts of placenta. Secondary hemorrhage occurs due to sepsis.**
3) **Uterine perforation leading to hemorrhage and shock.**
4) **Infection of any part of the genital tract e.g. cervicitis, endometritis, salpingitis, oopheritis, parametritis. Infection may extend to the peritoneum i.e. peritonitis and may lead to septicaemia.**
5) **Air embolism when air is introduced in open sinuses with vigorous manipulations.**
6) **Thrombotic embolism when a thrombus is lodged in open sinuses.**
7) **Acute poisoning when drugs are used.**

❖ Diagnosis of abortion

A)- In the living :

1- The patient consent for examination is essential .
2- Complete story about the case.
3- General examination of the female for :
a- Signs of pregnancy e.g. breast , abdomen and biological pregnancy tests.
b- Signs of general violence e.g. bruises may be present on her abdominal wall.
4- Examination for:
a)- Uterus : Is enlarged and show signs of metritis .
b)- Cervix :
• Recent cervical dilatation.
• Bloody discharge.
• Abrasions of volsellum marks.
c)- Vagina may show lacerations and bruises.
d)- Foreign bodies in the vagina or cervix .
e)- Embryonic tissues in the vagina or cervix .
5- Products of abortion :
• Precipitin test to show human or not.
• Macerated or not.
• The age of fetus is estimated .

6-Investigation :

1) Ultrasonography to detect the size of the uterus .
2) Pregnancy test still + ve 2 weeks after abortion.

Cont for investgations….

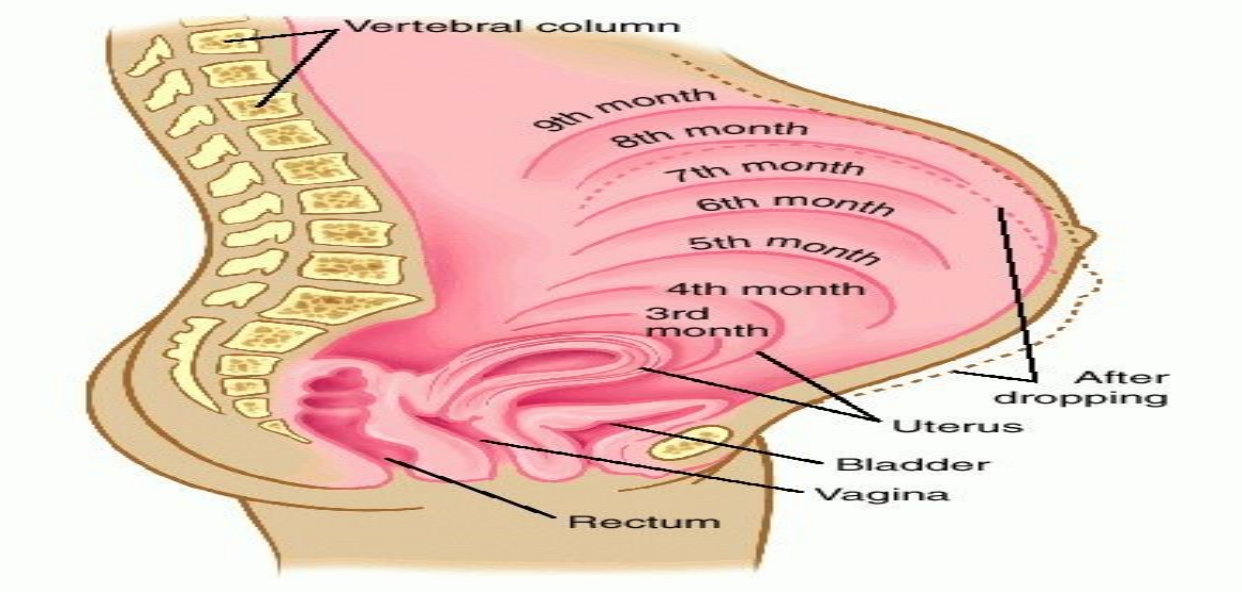
3) Blood is serologically examined for some diseases as which may lead to spontaneous abortion .
4) urine is examined for chronic nephritis.
5) Evidence of abotifacient drug in blood , urine or stool.

Duration of pregnancy:

This can be reached by examining the size and condition of the uterus.

- **In the non pregnant state the uterus is pear-shaped and 3 inches in length, 2 inches in width and 1 inch in thickness.**
- **There is slight enlargement in the first 2 months of pregnancy.**

Traumatic rupture of uterus (in criminal abortion)	Rupture of uterus due to obstructed labour	Pathologic rupture of uterus
-The site of rupture is usually in the fundus.	-The site of rupture is in the lower segment.	-The site of rupture is anywhere.
-It is longitudinal and taking the shape of instrument.	-It is transverse	-There are degenerative changes in uterine muscles .



L11- *Crime Scene Investigation CSI*

DEF: The scene of a crime is ...the area in the immediate ..vicinity of the occurrence within which evidence might be found…

- **1887 Arthur Conan Doyle published the first Sherlock Holmes story in Beeton's Christmas Annual of London.**

Primary & Secondary Crime Scenes.

In some cases there may be a primary and one or more secondary crime scenes.

Classification based on type of crime committed:

From the crime scene we can make many scenarios and suggestion and this goes according to estimating all of the circumstantial the place, signs on the dead person, signs and founding on the place, the killing weapon any written notes or diaries, psychosocial circumstances, etc…

Crimes Types:

1- **Homocide**
2- **Robbery**
3- **Sexual Assault**
4- **Fraud**
5- **Kidnapping**

Location of crime scene:

Location of crime can tell a lot about the crime typem or evidences m that place could be a Indoor or out doorsm river, vehcle, forests,etc…

PRINCIPLE OF EXCHANGE:(-EVERY CONTACT LEAVES ITS TRACES)

the crime scene may offer evidence of the offender, and the offender may have taken evidence from the crime scene with him

when do the investigation begin?

Once boundaries have been placed and guarded, the investigation will begin. It is imperative that the crime scene is investigated "insitu".

Recording The Scene

- **Overview of entire scene including each wall area if indoor**
- **Overview of surrounding area**
- **Points of exit and entry**
- **Rooms adjacent to crime site**
-

Methods of recording :

1) PHOTOGRAPHY:

2) SKETCHES : It should include

- **accurate depiction of dimensions.**
- **show location of all objects with bearing.**
- **distance on sketch must be accurate and drawn to scale.**

3) *NOTES*

Other Methods for Recording The Scene

- **Video recording.**
- **Tape recorded notes**
- **Computer programs for sketching scenes**

Collection of evidence

Not all evidence is evident

- **Things such as weapons, clothing or documents can be easily seen once identified. Other things such as hair, fluids, dust, dirt and skin are more difficult**.
- **Evidence to be collected** :
- **Liquid evidence**
- **Dry evidence**
- **Impressions**

1- Liquid evidence:-

- **Blood, semen, saliva, vaginal, and urine stains.**
- **Alcoholic beverages and suspected poisoned materials.**
- **Flammable liquids.**

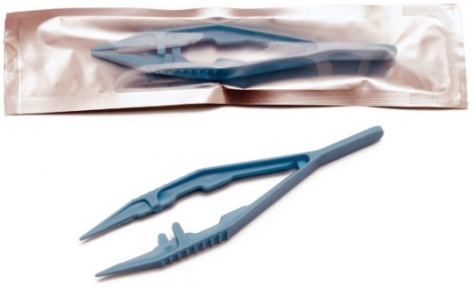
2- Dry evidence:-

- **Dried blood, hair, Fibers and Threads.**
- **Broken Fingernails**
- **Weapons, bullets and explosion fragments**
- **Gun shot residue swabs.**
- **Dust, soil, rocks, minerals. glass and paint.**
- **Questioned documents.**

3- Impressions:-

- . **Evidence Prints: Finger, palm, toe, sole, lip**
- **Fingernail abrasions.**
- **Bite marks.**
- **Footwear impression.**
- **Tire marks.**
- **Tool marks.**

Collection Utensils

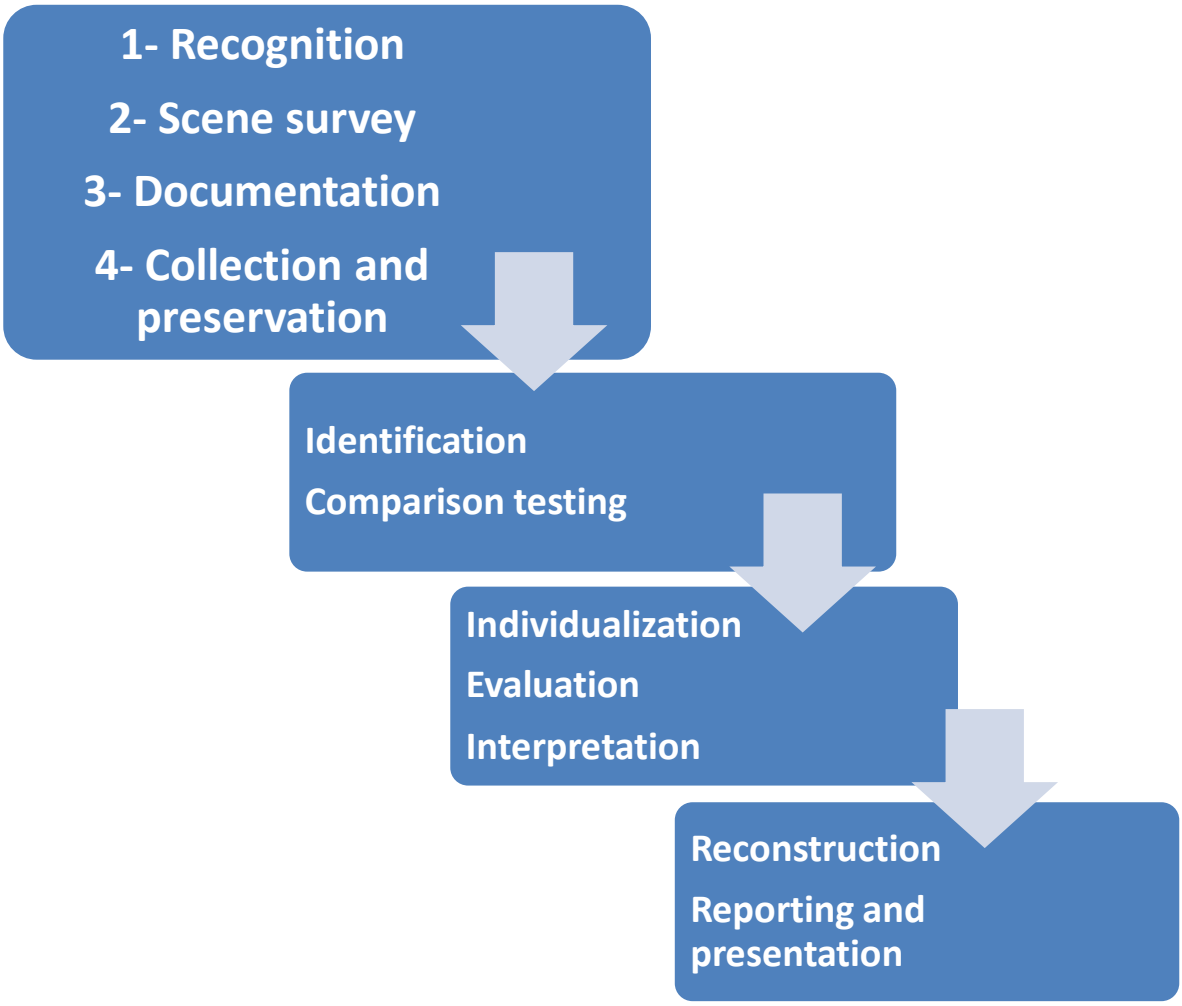


Packaging of Evidence

Chain of Custody

Chain of Custody is a legal term that refers to the ability to guarantee the identity and integrity of the specimen from collection through to reporting of the test results.

Steps to the scientific examination of a crime scene



L12- death Certificate

Death Certificate

Death certificate should be issued once the cause of death is definitely established .It is issued by medical practitioner **without charged fee.**

Refusal to issue a death certificate is a punishable offense except 2 cases

1- No death certificate should be issued in cases of children born before the age of viability (7 months)

NB ::: If a child is born dead after the age of viability or a stillborn , a death certificate should be issued .

2 - suspicion of foul play

- **Certain catergories of deaths need reporting to the coroner**

1- Suspicion of foul play.

1. **Accident**
2. **Suicide**
3. **Violence**
4. **Neglect**
5. **Industrial deaths**
6. **During operation**

- **Importance of death certificate**

1- Medical certificate enables the family to register the death

2- Permanent Legal record of the fact of death

3- Enables family to arrange disposal of the body

4- Information allows measurement of contributions of different diseases to mortality

5- To recognise priorities for medical research and designing public health interventions, and planning health services

6- Family have a permanent record of their family history

Death :

Cause of death: disease or injury that initiated the events that led to death, and the proximate causes of death are (Respiratory failure , Cardiovascular failure , Brain centres failures)

Circulatory failure	• **CVS disease** • **Bleeding** • **Pulmonary embolism** • **Septic shock**
Respiratory failure	• **Respiratory disease** • **Primary T. Metastasis**
CNS failure.	• **CNS disease** • **CNS bleeding** • **Coma** • **Hepatic or renal F**

Mechanism of death: Physical abnormality produced by cause of death that is incompatible with life.

Manner of death: natural,accidental , homicidal , suicidal

Death can be natural or unnatural :

1- Natural as :

- **Etiology**
- **Pathology**
- **Death**

2- Unnatural as:

- **Accident**
- **Violence**
- **Poisoning**

How to write a death certificate?

1- Write the direct cause of death

2- Write the complications caused that

3- Write the disease related to this cause and complication

يعنني نكتب : 1- السبب المباشر للوفاة أولا (توقف التنفس، هبوط حاد بالدورة الدموية و القلب، فشل مراكز المخ الحيوية ...)

2-المضاعفات التي حصلت و ادت لهذا السبب المباشر

3-المرض المباشر او المزمن المرتبط بهذا السبب و المضاعفات

نموذج لشهادة الوفاة

المملكة الأردنية الهاشمية
وزارة الداخلية
دائرة الأحوال المدنية و الجوازات
تبليغ عن واقعة وفاة
لمن له قيد / لمن ليس له قيد

الجزء الأول : بيانات خاصة بالمتوفى
الجزء الثانى: الجزء الطبى الخاص بسبب الوفاة
الجزء الأول

الرقم الوطنى للمتوفى:..... الجنس..... الجنسية .....
الإسم:.....
مكتب القيد المدنى:.....رقم القيد: .....
مكان الوفاة:.....اللواء.....المحافظة.....الدولة.....
تاريخ الوفاة:..../..../..... وقت الوفاة/ الدقيقة.....الساعة.....
التاريخ بالأحرف.....
الحالة الاجتماعية .....الديانة.....اسم الأم.....
تاريخ الولادة .....مكان الولادة.....اللواء.....
مكان الإقامة : المدينة/ القرية .....اللواء.....المحافظة.....ت/.....

غير ذلك□منزل □ عيادة خاصة □ مركز صحى □ مستشفى خاص □ مستشفى عام □تمت الوفاة فى :

لا تم تعبئة هذا النموذج حسب قناعتى الطبية معتمدا فى ذلك على :□ نعم □هل تم إبلاغ الجهات القضائية :
الملف والتقارير الطبية□ تشريح الجثة □ مشاهدة الجثة بعد الوفاة □معاينة المتوفى قبل وفاته □
اسم الجهة التى تمت بها الوفاة.....
اسم الطبيب.....التوقيع.....الخاتم الرسمى.....التاريخ .../../.....
الرقم الوطنى للمبلغ .....الإسم.....
صفة المبلغ.....التوقيع.....التاريخ../.../.....
وثيقة إثبات الشخصية : نوعها:.....رقمها.....مصدرها.....التاريخ../.../.....

اسم المحكمة.....رقم القرار.....التاريخ ../../.....

اسم وتوقيع
الموظف
و
الخاتم

القبول.....أمين المكتب.....مدخل البيانات..... المدقق.....
توقيعه توقيعه توقيعه توقيعه

مكتب الواقعة .....رقم الواقعة.....التاريخ ..../..../.... اسم وتوقيع الموظف

ملاحظة : يجب التبليغ عن الوفاة خلال أسبوع وأى تأخير يغرم عشرة دنانير

Sample 1

A 20 years old male had rheumatic fever was admitted to hospital with severe dyspnea and palpitation, he had generalized edema and marked cyanosis. Echo was done revealing aortic stenosis. Treatment started but he died. Write death certificate

السبب المباشر للوفاة : هبوط حاد بالدورة الدموية

الحالة المرضية : ضيق في الصمام الأورطى وهبوط بالقلب

المرض الأصلي حمى روماتزمية

Sample 2

Diabetic female was admitted to hospital complaining of severe pain in her left calf muscle.the condition was diagnosed as deep vein thrombosis. Suddenly she was cyanotic and dyspnic and was transferred to ICU at once, resuscitation measures was given but she died.write death. Certificate.

.

السبب المباشر للوفاة توقف التنفس

الحالة المرضية إنحذاف رئوي

المرض الأصلي جلطة بأوردة الساق العميقة.

أحوال مرضية أخرى مرض البول السكري

Sample3

A cardiac patient with a history rheumatic heart . He was admitted to ICU in coma. CT was asked , revealing brain infarction. Treatment was started but the patient died.

السبب المباشر للوفاة توقف مراكز المخ الحيوية

الحالة المرضية إنحذاف جلطة بالمخ

المرض الأصلي روماتزم بالقلب

أحوال مرضية أخرى

L13 - **Toxic gases and CO**

Toxic gases are classified into:

- ***Simple asphyxiant***: such as carbon dioxide, methane, helium, nitrogen and propane. These are nonpoisonous inert gases that displace oxygen from the inspired air and deprive tissue of oxygen causing hypoxia.
- ***Chemical asphyxiant***: such as carbon monoxide, hydrogen sulfide and hydrogen cyanide. They act by alteration of oxygen carrying capacity and biochemical changes of respiratory enzymes.
- ***Irritant gases***:

- Gases with immediate toxicity such as ammonia, chlorine, and sulphur dioxide
- Gases with delayed toxicity such as phosgene and nitrogen dioxide.
- is a clear, odorless, tasteless and non irritating gas. Cause rapid loss of conscious

Carbon monoxide(the silent Killer)

is a clear, odorless, tasteless and non irritating gas. It is lighter than air.

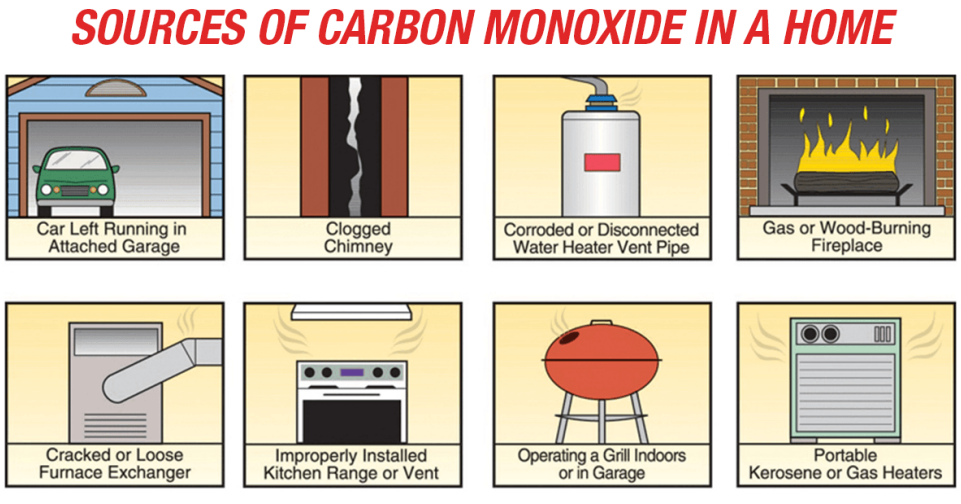
Sources:

A-Endogenous:

It is produced in the body as a byproduct of the degradation of heme

B- Exogenous:

It is produced by incomplete combustion of any carbonaceous material as gasoline, natural gas, kerosene, oil or propane.



Cir

- **circmstances of poisoning:**

1- Accidental:

- Automobile exhaust or faulty domestic appliances as water heaters, in fire victims and fighters (smoke inhalation), in heavy tobacco smokers may reach COHb saturation of 20%
- Policemen on traffic duty may develop high concentration of COHb.

2- Suicidal: e.g. by breathing the exhaust fumes in closed garage

3-Homicidal: It is rare, may be as a method of infanticide.

- **Toxicokinetic:**

Carbon monoxide is readily absorbed from the lungs and rapidly bound to hemoglobin. Elimination is mainly through respiratory system, only 1% is metabolized to carbon dioxide. Its half life is about 4-5 hours.

- **Pathophysiology:**

1. Carbon monoxide combines to hemoglobin producing carboxy- hemoglobin (COHb). It has an affinity to hemoglobin 200 to 250 times greater than oxygen. This will lead to decrease oxygen transport by blood causing tissue hypoxia.
2. High concentration of COHb shifts the oxyhemoglobin dissociation curve to the left, making oxygen less available to tissues by decreasing the ability of hemoglobin to release its oxygen content to the tissues.
3. CO binds to myoglobin with an affinity 60 times greater than oxygen producing carboxymyoglobin which may cause myocardial impairment.
4. CO can bind to cytochrome oxidase leading to inhibition of the respiratory function of the cells which will increase cellular hypoxia.

- **Clinical picture:**

Clinical picture:

Non specific …..not correlate with the severity of toxicity

Clinical grading of CO poisoning:

- **Mild**: Slight headache, nausea, vomiting, dizziness, malaise and fatigue

- **Moderate**: Throbbing headache, confusion, ataxia, impaired judgment, visual disturbances, muscle weakness, tachypnea, tachycardia.

- **Severe:** with severe exposure, the patients may develop

✓ Hypotension, syncope, arrhythmia, cardiac ischemia with ECG changes
✓ Convulsions, disorientation, coma and brain changes on CT.
✓ Pulmonary edema, Palpitation, dyspnea, and chest pain.
✓ Lactic metabolic acidosis.
✓ Rhabdomyolysis may occur with resulting myoglobinuria and renal failure.
✓ Skin bullae may result from pressure necrosis or direct toxic effect of CO on the dermis.

- **Death usually occurs with COHb level above 70%.**

Laboratory investigations:

1-Determination of COHb level by oximeter (normal level is from 0- 2.3% in non smokers)
2- Arterial blood gases.
3- Blood glucose.
4- Electrolytes level to diagnose metabolic acidosis.
5- ECG
6- Computed tomography (CT) or magnetic resonance imaging of the brain to diagnose brain lesions.
7- Chest X - ray.

Long term Sequalae of CO poisoning:

- Patients may recover from acute CO poisoning and develop later delayed neurological manifestation 2 to 40 days from the original exposure. These may be in the form of apathy, lack of concentration, memory disturbances, Parkinsonism, cortical blindness, peripheral neuropathy, movement disorders, aphasia, incontinence, dementia, psychosis or manic depression.
- These may be due to damage to the basal ganglia, white matter or cerebellum. These complications may persist months to years, and may resolve spontaneously.
- The incidence of delayed neurological sequelae is correlated to the initial level of consciousness and duration of coma.

Differential diagnosis:

1- Other asphyxiant gases.
2- Influenza.
3- Gastroenteritis.
4- Food poisoning.
5- Cerebrovascular accidents.
6- Myocardial infarction
7- Ethanol intoxication

❑ Treatment:

- ❑ Remove the patient from the source of exposure to fresh air.
- ❑ Maintain respiratory function and stabilization of cardio-respiratory status.
- ❑ The antidote is 100% oxygen inhalation by mask or endotracheal intubations if the patient needs artificial air way.

Oxygen therapy must be continued till the patient is asymptomatic or COHb level is below 15%.

Hyperbaric oxygen (100% oxygen at 3 atmosphere pressure) will reduce the half life of COHb to 23 minutes. It may also prevent the neurological sequel. It is indicated in:

(Pregnancy, Coma, Myocardial ischemia or arrhythmia, Presence of neurological symptoms).

- ❑ Correct hypo or hyperglycemia.
- ❑ Management of cerebral edema by mannitol or steroids.
- ❑ Treat convulsions.

L14- Acohol

❑ What are alcohols?

an organic compound in which the hydroxyl functional group (-O H) is bound to a carbon atom.

❑ Give examples?

* Ethyl alcohol (C_2H_5OH).
* Methyl alcohol (CH_3OH).
* Isopropyl alcohol (C_3H_7OH).
* Ethylene glycols ($C_2H_4(OH)_2$.

❑ The main action ?

CNS sedation is the main effect of all alcohols.

❑ Types :

1- Drinking- Ethyl Alcohol

2- Poisonous (Methyl Alcohol \ Isopropyl Alcohol\Ethylene glycol)

Ethyl alcohol (ethanol)

Introduction:

✓ the most commonly used and abused drug in the world.

✓ At alcohol shortage, the alcoholic may ingest an alternative (methanol) with much more toxic effect.

✓ produced by fermenting carbohydrates, such as sugars or starches; So it may be produced postmortem.

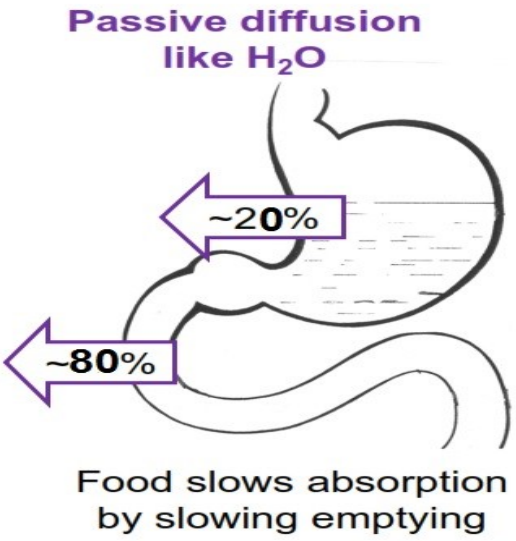
✓ Chemistry: Colorless, odorless; highly water soluble and highly lipid soluble.

✓ Ethanol toxicity may be acute or more commonly chronic.

✓ usually taken with other drugs that may increase the toxicity e.g.: barbiturates.

Sources :

Alcoholic beverage	***Manufacturing***	***Concentration of alcohol***
Beer	***Fermentation of Barley***	***2-5%***
Wine	***Fermentation of fruits***	***10-15%***
Whisky, vodka and Brandy	***Fermentation then instillation***	***>30%***



Kinetics:

Absorption: 20% from stomach; 80% from intestine.
80–90% of an ingested dose is fully absorbed within 60 minutes.
Metabolism & Excretion

Metabolism & Excretion

- ***90% Liver***
- ***10% unchanged in urine, breath, sweat***

Toxicokinetics:

A. Absorption
- After oral ingestion, alcohol is absorbed almost at each site it comes in contact with, even oral mucosa
- It is absorbed completely from the stomach and duodenum

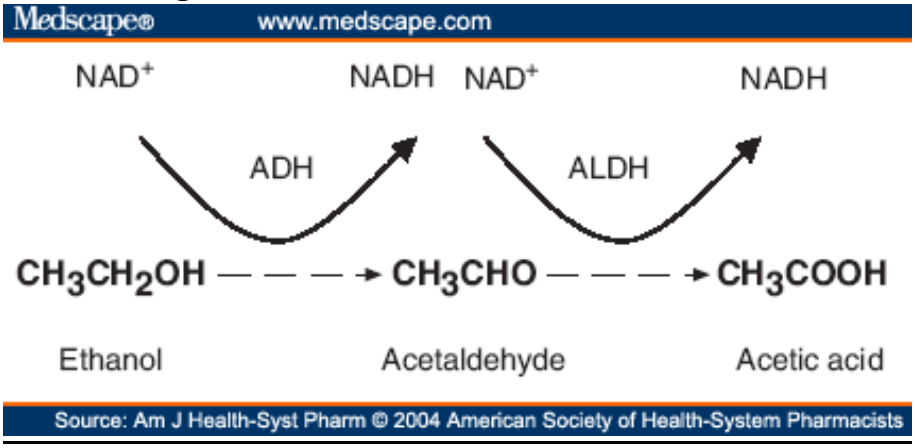
B. Distribution
- The distribution of alcohol is into total body water.
- It is distributed to all body tissues

C. Metabolism

Metabolism of alcohol occurs primarily in the liver by the alcoholic dehydrogenase enzyme which also occurs at the wall of stomach

D- Elimination

alcohol is excreted unchanged in urine, sweat and breath.



Action:

- ✓ No specific receptor for ethanol.
- ✓ Theories.
- ✓ Membrane Theory: as a solvent it fluidize the neuronal plasma membrane lipid bilayer.
- ✓ Protein Theory: through specific binding sites on the protein. Examples of theses proteins:
  - Increases GABA A receptor
  - increase glycine activity.
  - inhibits L-type Ca channels reducing CNS excitability
  - Inhibits glutamate activity (excitatory neurotransmitter).

Fatal dose

It varies markedly, but Levels of blood alcohol above 500mg% are considered to be probably fatal.

❑ Why it varies?

1- Tolerance:

2- Stomach state

3- sex

4- race : in Japanese or Chinese, there is increased incidence of flushing, vasodilatation, tachycardia (acetaldehyde syndrome)

5- Liver disease

6- Concentration of alcohol beverage : 10 – 20% are absorbed rapidly than low or high alcohol.

Acute alcohol intoxication

result from a high level of alcohol in the bloodstream leading to drunkenness.

- **Causes**

The condition is found in

1- Young people who are being exposed to commonly available alcoholic beverages like beer, wine, and distilled liquor for the first time, and don't know their limits

2- People suffering from alcoholism who ingest much more than they usually do.

Legal BAC limits by country

filter table | reset table
Last updated: 2018-10-26

Download filtered data as: CSV table | XML (simple) | JSON (simple)
Download **complete** data set as: CSV table | Excel | CSV list | more...

Country	Year	Legal blood alcohol concentration (BAC) limits[i]		
		General population	Young/novice drivers	Professional/commercial drivers
Israel	2016	0.05%	0.01%	0.01%
Italy	2016	0.05%	zero tolerance	zero tolerance
Jamaica	2016	0.08%	0.08%	0.08%
Japan	2016	0.03%	0.03%	0.03%
Jordan	2016	0.08%	0.08%	0.08%

1. **Sobriety or low-level intoxication: (0.01-0.05%)**

the person's behavior will be normal with no visible signs of intoxication, such as slurred speech or delayed reaction time.

2. **Euphoria (0.05-0.12%)**

Some symptoms include:

- an increase in chattiness and confidence
- a delayed reaction time
- decreased inhibitions

3. Excitement (0.12-0.25%)

At this time, a person will begin to experience emotional instability and a significant loss of coordination.

Other symptoms include:

- Loss of muscle coordination
- Ataxia
- Slurred speech
- Hiccough
- Diplopia
- No behavior control
- Vomiting and drowsiness
- Altered sensations and perceptions.
- McEwen's sign (constricted pupil when the lower eyelid is pinched it dilates)

4. Confusion (0.25-0.3 %)

This stage of intoxication is marked by emotional outbursts and a major loss of coordination. The person may not be able to stand up, may stagger when walking, and will likely be extremely confused about what's going on.

5. Stupor (0.3-0.4%)

- no responds to the things happening around or to them.
- A person won't be able to stand or walk. They may completely pass out or lose control over their bodily functions, becoming incontinent or vomiting uncontrollably.
- They may also experience seizures or have blue-tinged or pale skin. Their breathing and gag reflexes will likely be impaired.

6. Coma & death > 0.4%

Investigations:

1- Expired air ethanol analyzer:

- Also called as alcometer, intoximeter or drunkometer or breath analyzer.
- Breath analyzer serve as on-spot test for police.
- Alcohol is eliminated via breath.
- Main idea is ethanol is oxidized by oxidizing agent with change of color.

2-Blood alcohol level

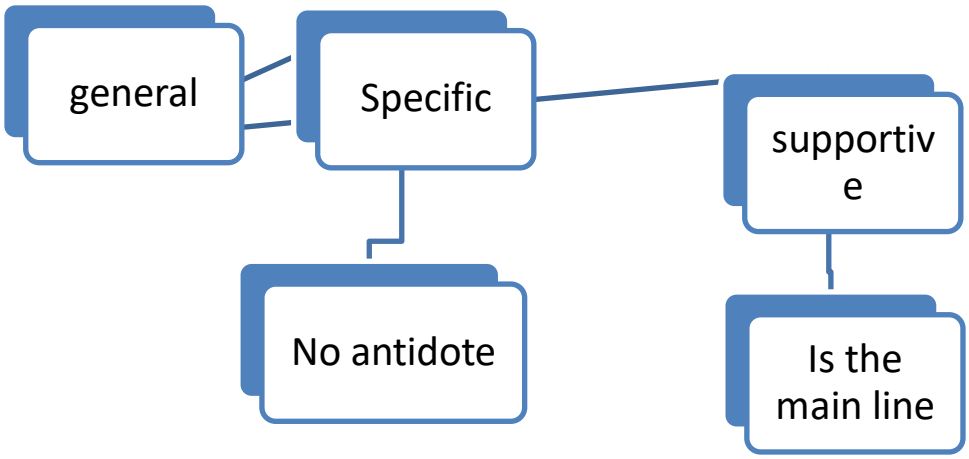
3- ABG and blood pH

4- - Blood glucose level

5- - Liver function test

6- - ECG

Treatment



1- General:

general speaking that gastrointestinal decontamination is rarely, if ever, indicated for toxic alcohols because of their rapid absorption and limited binding to activated charcoal.

1- **Emesis:** It is rarely indicated in the acutely intoxicated adult, especially in the setting of depressed mental and/or consciousness state.

2- Gastric lavage:

- Not effective due to rapid absorption.
- Indicated in concomitant ingestion of toxic agents.
- Done by Na bicarbonate or tape water.

3- Activated charcoal: It is not effective as alcohol is poorly adsorbed by it. It is indicated only in concomitant ingestion of other toxic agent.

4- Haemodialysis: It is indicated in:

- Extremely high alcohol level.
- Severe acid base and/or electrolyte disturbance.

Supportive and symptomatic treatment

Respiratory care

- Patent air way, O2, mechanical ventilation.

Shock

- By fluid IV.

Altered mental status

- Correct hypoglycemia by dextrose 50%. * Naloxone: 1-2mg IV

Metabolic disorders : alcoholic ketoacidosis

- Fluids, glucose, Ca and other trace elements

Other measures

- Thiamine, folic acid (prevent encephalopathy and improve mental status) & **warmth**.

At home

- If they're unconscious, gently turn the person on their side to prevent them from choking on vomit.
- If they're conscious, encourage the person to lay on their side in a safe place until help arrives.
- If they're able to swallow, encourage the person to drink water.

It's a myth that a person can recover from alcohol intoxication by sleeping, taking a cold shower, going for a walk, or drinking black coffee or caffeine. In fact, doing these things can put an intoxicated person at greater risk of injury and death.

A chronic, progressive disease characterized by tolerance and physical dependence to ethanol, and pathologic organ changes

Chronic Alcoholism

❑ **Definition**

Alcohol dependence or continued consumption of alcohol in spite the negative consequences produce on an individual's health and social relationships.

❑ **Alcohol dependence is characterized by:**

-Tolerance
-Physical dependence
-Withdrawal symptoms

❑ **Clinical picture**

General Appearance :

1- Hand Tremor

2- Excitability, Irritability, Nervousness

3- Dermatitis (dry, red, itchy skin)

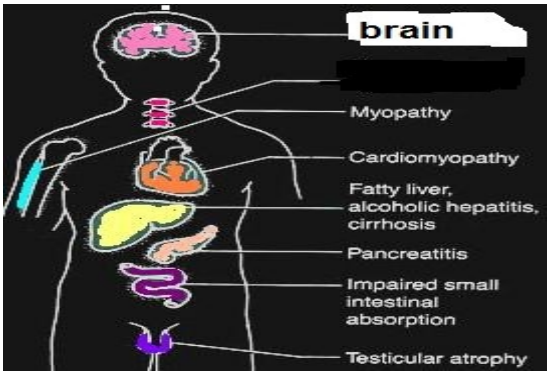
4- Parotid Swelling

5- Finger Clubbing

6- Rhinophyma ("Drinker's Nose")

Red swollen and bumpy nose accompanied by rhinorrhea . Recently alcoholism does not cause rhinophyma but may worsen it.

❑ **A chronic, progressive disease characterized by tolerance and physical dependence to ethanol, and pathologic organ chang**



1- Effect on CNS and PNS :

CNS

Peripheral

1- peripheral neuritis(S more than M).

2- course tremors of hands.

* Pachymeningitis hemorrhagica (chronic subdural hematoma).

* Wernicke-Korsakoff syndrome.

* Bilateral and symmetrical visual

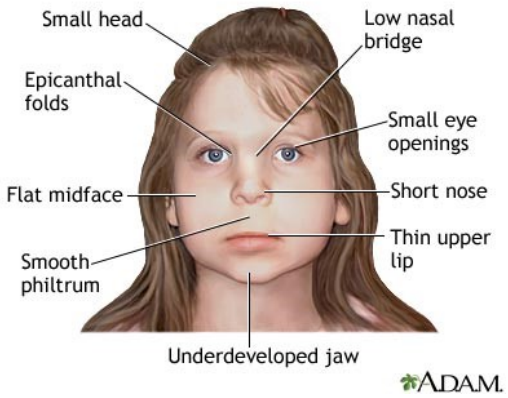
2- Effect on Liver

is the most frequent clinical complication of chronic ethanol abuse.

Fatty liver, alcoholic hepatitis, cirrhosis, cancer.

❑ Fetal alcohol syndrome

Fetal exposure to alcohol can impair the development of the corpus callosum (the main connection between the right and left hemispheres of the brain), reduce the size of the basal ganglia and damage the cerebellum and cerebral cortex.



❑ **Compared to normal babies, babies born with FAS have:**

2- **smaller heads and brains**
3- **some degree of mental retardation**
4- **poor coordination**
5- **hyperactivity**
6- **abnormal facial features**

❑ **The syndrome is due to:**

1- **Hypoglycemia**
2- **Acetaldehyde**
3- **Ethanol itself**

Acute alcohol withdrawal

❑ **Definition:**

- Alcohol withdrawal refers to symptoms that may occur when a person who has been drinking too much alcohol every day suddenly stops drinking.

- The withdrawal usually occurs within 5 - 10 hours after the last drink, but it may occur up to 7 - 10 days later.

❑ **Clinical picture :**

- **Mild-to-moderate psychological symptoms:**
  - ***nervousness**
  - ***Anxiety**
  - ***Irritability or easy excitability**
- **Mild-to-moderate physical symptoms:**
  - ***Headache (general, pulsating)**
  - ***Sweating (especially the palms of the hands or the face)**
  - ***Nausea and vomiting**
  - ***Insomnia**
  - ***Rapid heart rate**

***Dilated pupils**

***Involuntary, abnormal movements of the eyelids**

***Clammy skin**

***Tremor of the hands**

- **Severe symptoms:**

***Delirium tremens (a state of confusion and visual hallucinations (**

***Convulsions**

❑ Treatment

***Hospitaliztion**

***Sedatives**

***No alcohol is allowed during this time.**

***Antipsychotic medications (uncommon).**

***Treatment for other medical problems**

*** Rehabilitation for alcoholism is recommended**

❑ Drugs used in acute withdrawal

Patients should ideally be nursed in quiet surroundings.

➢ Benzodiazepines : Be careful of possible dependence to benzodiazepines - advise short courses at lowest necessary dose.

➢ Vitamin B complex : Intravenous therapy with vitamin B complex is the treatment of Wernicke-Korsakoff syndrome.

➢ Naltrexone

➢ Psychosocial interventions

➢ **Disulfiram (Antabuse)**

✓ Irreversibly and specifically blocks aldehyde dehydrogenase

✓ This leads to a build up of acetaldehyde which results in an unpleasant reaction, thereby the patient will be unkeen to take alcohol.

✓ Side effects may include :

Garlic taste , rotten egg odor, dermatitis and psychosis.

✓ treatment of disulfiram side effects :

- oxygen
- ephedrine sulphate
- ascorbic acid 500 mg IV
- antihistaminic
- -phenothiazines and fluids.

✓ Dose of Disulfiram : initial 500 mg once daily for 7-10 days then 125 – 250 mg/day orally.

❑ Circumstances of poisoning of ethyl alcohol:

1- **Ingestion of alcoholic beverages**

Acute alcohol intoxication, or alcohol poisoning, occurs after the ingestion of a large amount of alcohol. But in unexperienced drinkers or those sensitive to alcohol may become acutely intoxicated and suffer serious consequences after ingesting smaller amounts of alcohol.

2- **Industrial exposure**

3- **Accidental**

by children after drinking alcohol or taking chocolates containing liqueur

❑ Medico-legal Aspect of alcohol poisoning;

1- Road traffic accident

Due to lack of coordination, concentration reduced visual perception & alertness to external clues.

2- Crimes

Alcohol can be associated with a wide variety of crimes ranging from minor offences which are anti-social by nature, through traffic offences, minor assaults through to serious assaults and murder.

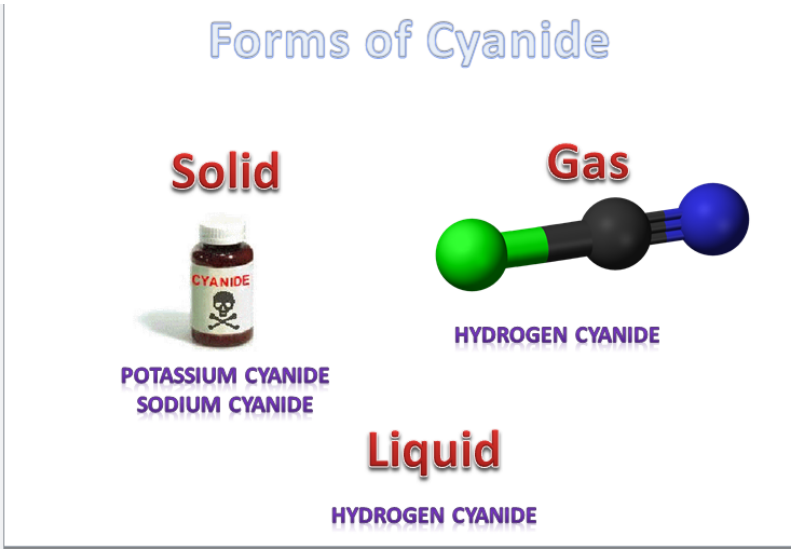
3- Trauma

Alcohol causes muscle in-coordination, and this leads to ataxia and unstable gait. Patient is unable to control his movements and is liable to fall out during his walk. This makes him most liable for head injuries and other traumas.

L15- Hydrocyanic Acid (HCN)

History

- In 1782, a Swedish chemist isolated hydrogen cyanide. He died in 1786 from cyanide poisoning.
- World War II, it was used as a genocidal agent (Zyklon B) by the Nazis.
- **"Russian Monk Russpotin"** escaped death despite of taking an amount of KCN that was enough to kill a hoarse. `` why!



facts:

- Colourless gas with smell of bitter almond.
- 35 times more toxic than CO.
- 40% of population can not smell its odour due to genetic abnormality.
- HCN is one of the most catastrophic and rapidly acting poisons ever known.
- Sodium and potassium cyanides are changed to HCN by the action of gastric HCL to be toxic.

Mode of poisoning:

1- **Accidental**: -It is the most important form of poisoning, which may occur in the following fields:

- Fire: Cyanide production in a fire , Hydrogen cyanide is produced by incomplete combustion of nitrogen and carbon containing substances (-C≡N)

- Natural Fibers (wool, silk, cotton, paper)
- Synthetic polymers (nylon, polyurethane)
- Synthetic rubber
- Melamine (resins for molding, laminating, etc.)

- Drugs : **Laetrile or amygdalin: anticancer** , **Na-nitroprusside**
- Industry (Photography \Electroplating \ laboratories)
- Plants: apple seeds m almonds, cassava, wild cherries)
- Agriculture

2- **Suicidal:**

It is not common, but reported among persons who can get it e.g. **chemists and pharmacists**

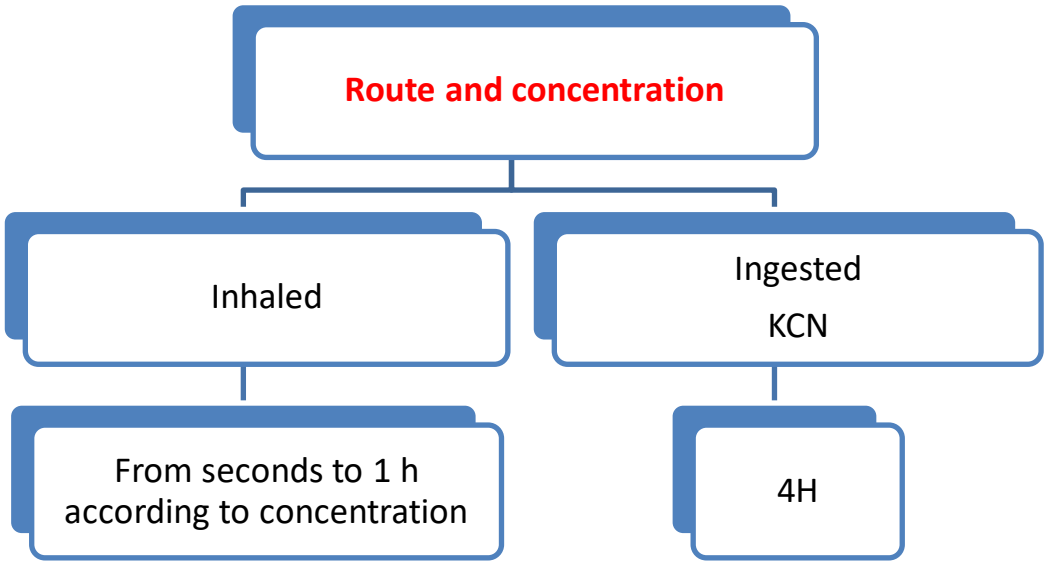
3- **Homicidal:**

-It is **very rare** because ?.

-Gas chamber: It is a method of legal execution in some states of USA.

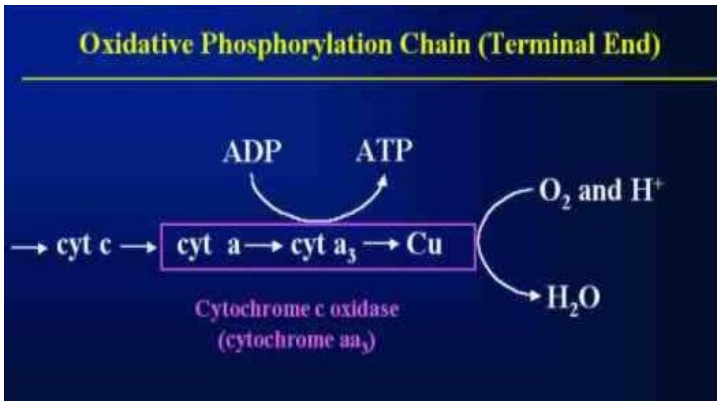
•Fatal Period:

HCN is one of the most catastrophic and rapidly acting poisons ever known



•Mechanism of action:

They unit with the ferric ions of cytochrome oxidase respiratory enzymes and cause paralysis of these enzymes, the result is the failure of the tissues to absorb their oxygen demands from the oxy-Hb of the arterial blood lead to cellular hypoxia.



End result

- **No generation of ATP; cessation of all processes dependent upon ATP**
- **No extraction of O_2 from blood; decreased AV O_2 difference**

•Clinical picture

1- CNS

– Headache
– Dizziness
– Seizures
– Coma

2- Cardiovascular

– Hypertension early , bradycardia
– Hypotension, later in course
– Cardiovascular collapse

3- Pulmonary

– Dyspnea
– Tachypnea
– Pulmonary edema
– Apnea
– Gastrointestinal
– Nausea, vomiting
– Caustic effects

•Diagnosis

• points are of major diagnostic importance:

(1) The **sudden onset** and catastrophic course.

(2) The characteristic **odour** of bitter almond.

(3) The bright **red colour** of the skin.

(4) Knowledge of the patient **occupation** and/or suicidal tendencies.

•Treatment:

It is a condition of serious medical emergency that requires treatment at the scene of exposure for life saving.

Treatment base on the following facts:

Cyanide has affinity to

I- Cobalt .

II- met-Hb forming cyno-met-Hb

Cobalt containing drugs:

i. **Hydroxocobalamin, or (Vitamin B12) Dose: 4-5g IV**

ii. **Dicobalt EDTA: Kelocyanor 300mg IV over l minute.**

Methaemoglobin forming drugs:

i. **Amyl nitrite;**

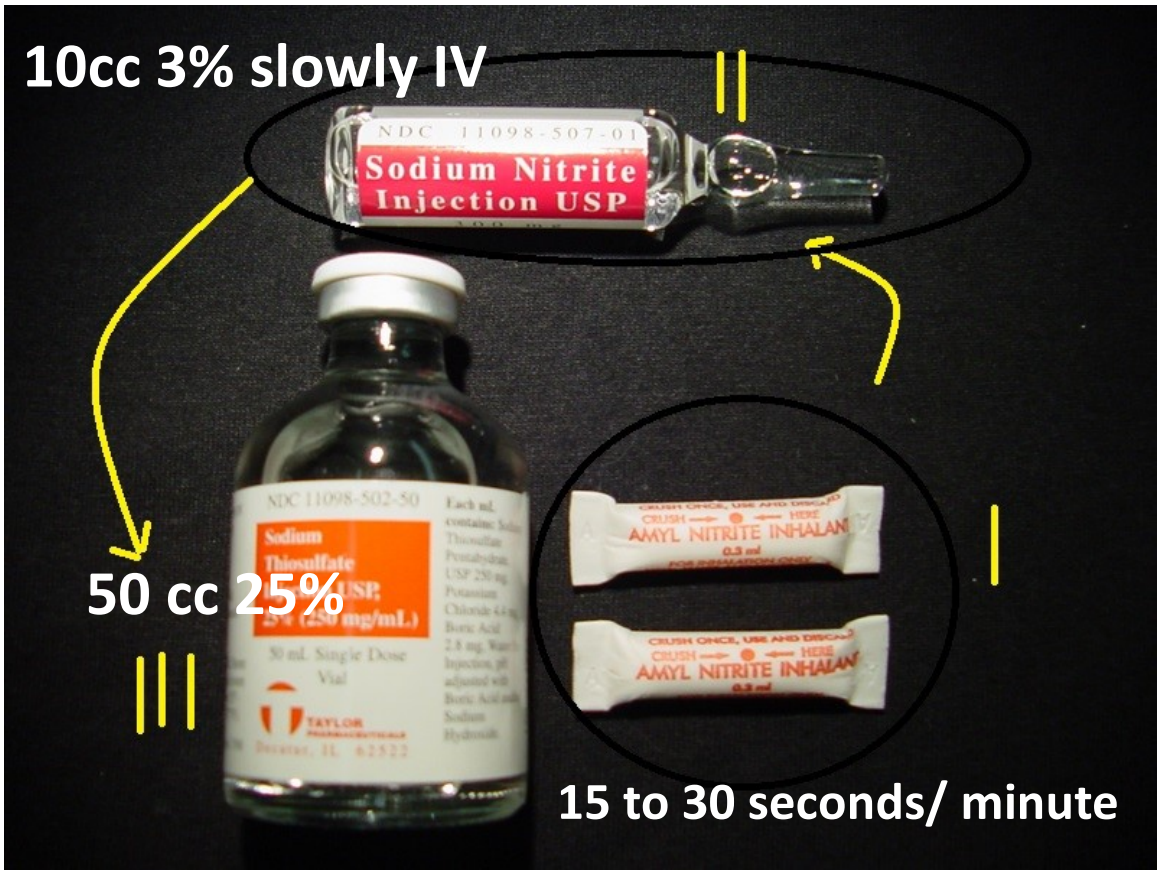
ii. **Sodium nitrite, or;**

iii. **4-dimethylaminophenol (4-DMAP): 3.25 mg/kg IV**

Followed by sulfar donor thiosulfate to form thiocyanide to urine

•Cyanide kits

- ***Hydroxycobalamine:*** (Vitamin B_{12}) Dose: 4-5g IV.
- ***Cobalt ethyline diamine tetracetate (Cobalt EDTA)*** = Kelocyanor 300mg IV over l minute.
- ***DMAP (Dimethylaminophenol***) 3.25mg/kg IV.
- **Hyperbaric Oxygen (HBO**) : in severe cases or when antidotes fail .

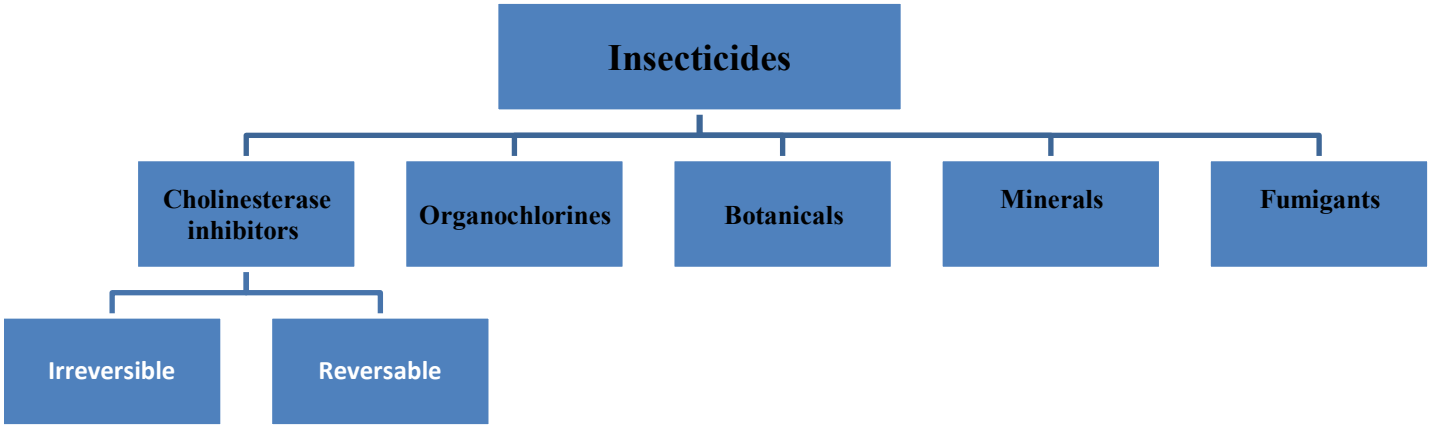


L16- PESTICIDES (Insecticides)

- ❑ **PESTICIDES are :**
- **2- Insecticides**
- **3- Herbicides**
- **4- Rodenticides**

1- Insecticides

are a major group of pesticides used to eradicate insects and undesirable pests.



A-Synthetic organic insecticides

*** Organochlorines**:

e. g DDT (dichloro diphenyltrichloroethane), toxaphene

*** Cholinesterase inhibitors**:

Organophosphorus compounds (irreversible inhibitors) e.g parathion, malathion.

Carbamates (reversible) e.g. Baygon.

B- Metals:

e. g Arsenic , mercury , antimony ,
phosphorus .

C- Insecticides from botanical source:

Pyrethrins , nicotine , rotenone .

D- Biological insecticides.

Organophosphorus (OP) insecticides

Circumstances of poisoning:

- **Accidental**

By inhalation or dermal exposure during agricultural use or by oral ingestion of contaminated food .

- **Suicidal**: by oral ingestion of the insecticide.
- **Homicidal**

Absorption, metabolism and excretion:

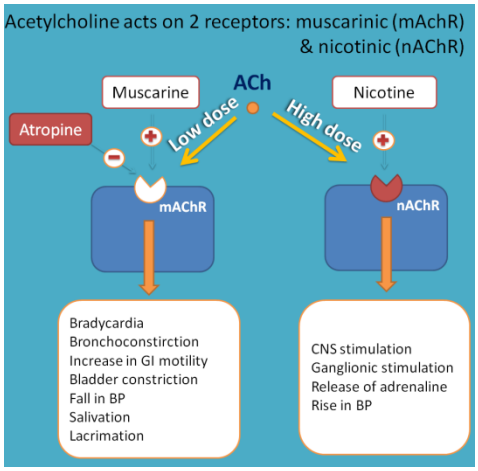
- Absorption of OP compounds Via GIT, skin , conjunctival and respiratory routes.

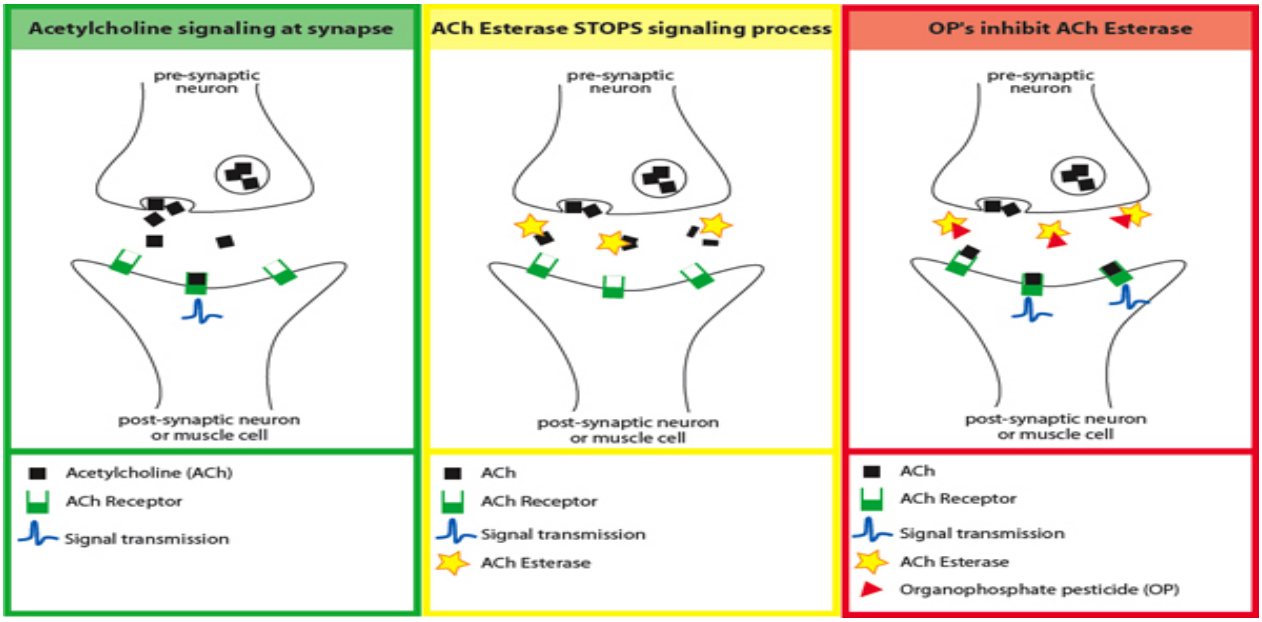
After absorption, they are metabolised by oxidation and hydrolysis by esterases. Hepatic activation is important for the conversion of indirect acting OP insecticides to their active toxic form (e.g Parathion------->.paraoxon).Thus parathion intoxication may not manifest until 6 to 24 hours after exposure.

- Elimination of OP insecticides occurs via urine and faeces. Fat soluble compounds persist in the fat stores for long periods with continuous risk of toxicity for weeks .

Pathophysiology:-

- The toxicological effects of OP insecticides are almost entirely due to the inhibition of acetyl cholinesterase in the nervous system and myoneural junction.
- The resulting excess of acetylcholine initially excites then paralyzes neurotransmission.





Clinical picture :

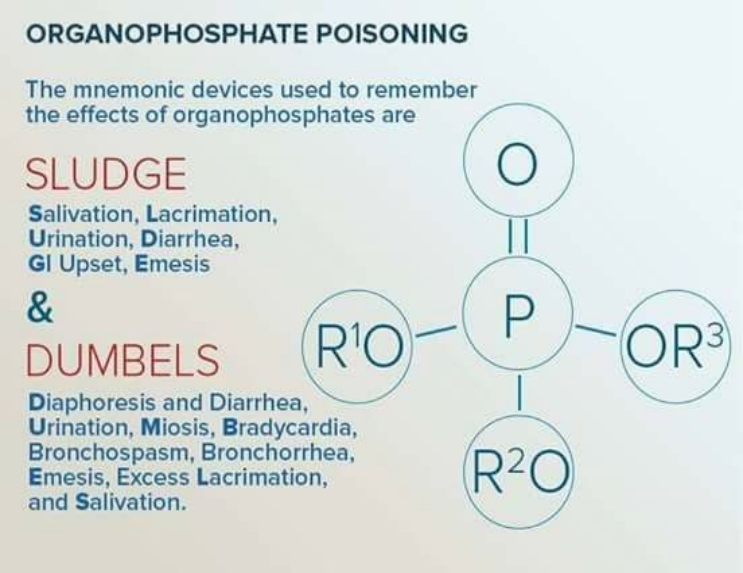
- ❑ The signs and symptoms are related to the effects on three separate areas of the cholinergic nervous system:

i.e muscarinic, nicotinic and central nervous system effects.

I-Muscarinic effects:

Muscarinic stimulation produces what is commonly called " **wet findings** " due to excessive secretions.

1. **Sweat glands ……Sweating**
2. **Lacrimal glands…….lacrimation**
3. **Salivary glands……...Salivation**
4. **Respiratory system…… Excessive secretions, wheezes , crepitation up to pulmonary edema**
5. **GIT……Cramps, vomiting, diarrhea.**
6. **Urinary bladder……Urinary incontinence**
7. **CVS……Bradycardia, hypotension**
8. **Pupils……Constricted(sometimes pin point with blurred vision)**



II-Nicotinic effects :

- ❑ Neuromuscular junction → muscle fasiculations, cramping, weakness and paralysis . Diaphragmatic weakness may result in respiratory failure.
- ❑ Preganglionic sympathetic stimulation ----→ dilated pupils, tachycardia and hypertension.

III-Central nervous system effects:

Initial stimulation occurs followed by depression, leading to anxiety, restlessness, ataxia, psychosis, convulsions, coma and death due to cardio-respiratory failure.

Management of OP insecticide poisoning:

Means 1. Investigations
2. Treatment

1. Investigations :

- ❑ Assay of **cholinesterase** (**ChE**) enzyme activity by erythrocyte or plasma (pseudo) ChE activity levels.
- ❑ **Erythrocyte ChE** is more accurate as it represents the enzyme found in nervous tissue and red blood cells while pseudo ChE inspite of being affected by OP insecticides it may be disturbed by other diseases.
- ❑ **The toxicity may be graded according to ChE inhibition as follows:**

1. 20-50 **%** of ChE activity…….. Mild toxicity
2. 10-20% …… Moderate toxicity
3. Less than 10% ……Severe toxicity

2. Treatment

1- A- B- C

- ❑ Patent air way is mandatory with frequent **suction of secretions** and adequate ventilation and oxygenation .
- ❑ I.V fluids should be given early and adequately to avoid dehydration due to excessive loss of secretions.

2- Decontamination :

- ❑ **Dermal decontamination**: by removal of contaminated clothes by hospital personnel wearing protective gloves and masks. Then the skin is washed first with soap and water and finally with ethyl alcohol and water to prevent further absorption.
- ❑ **GIT decontamination:**

1- Syrup of ipecac is used to induce emesis in conscious patients.

2- Gastric lavage is done in indicated cases after endotracheal intubation to avoid aspiration which is especially serious when petroleum distillate is the carrier with risk of chemical pneumonitis.

3- Antidotal therapy :

A- Atropine :

- ❑ It is a competitive antagonist of acetylcholine at the muscarinic receptor sites. It crosses the blood brain barrier thus may have an effect on CNS toxicity of OP insecticides. Atropine has no effect on nicotinic receptors.
- ❑ The use of atropine is highly important for drying excessive secretions especially bronchorrhea. Proper oxygenation and cardiac monitoring are essential during atropine therapy .

Cont to Atropine….

- It is given initially as 2 mg I.V and repeated every 10 -15 minutes until atropinization known by drying of tracheobronchial secretions.

B- Oximes :

- They antagonize both the muscarinic and nicotinic effects of OP insecticides.

e.g Pralidoxime (2 PAM), obidoxime (toxogonine).

- It can reverse the phosphorylation of the acetyl cholinesterase and so reactivate the enzyme.
- Because its efficacy is time dependant, and it must be given in the first 24-48h post-exposure (critical period) {before aging of the enzyme} so it should be administered as soon as possible in all clinically significant patient.
- Pralidoxime is given as 1 gm IV in normal saline.
- Toxogonine: one ampoule (250 mg) IV to be repeated within 1-2 hours.

Carbamate insecticides

Similar to organophosphorus but ChE inhibition is reversible.

- **Clinical picture** :

Same as manifestations of organophosphorus poisoning.

- **Treatment**

Same lines of treatment as for OP poisoning but oximes are not indicated.

L17 - **Methyl Alcohol (Methanol)**

Methyl Alcohol (Methanol)

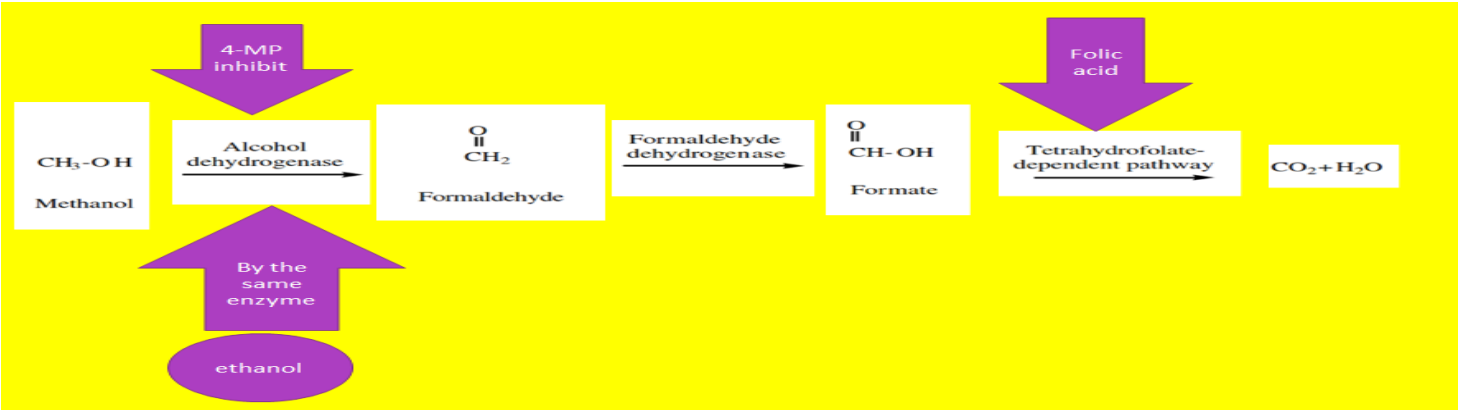
- ❑ It is clear colorless liquid at room temperature
- ❑ with burning taste.
- ❑ It has other names wood alcohol, wood spirits.
- ❑ Has no therapeutic indications.
- ❑ It is used as antifreeze, fuel, paint\ varnish remover, dyes, inks, and automotive cleaning solutions.
- ❑ Also, it is used as adulterant to ethanol.
- ❑ Poisoning outbreaks may occurs in ethanol shortage
- ❑

Kinetics

•***Absorption***: Methanol is absorbed via the skin, GI, and respiratory routes

•**Excretion:**

- Liver: 80-85% of the ingested dose.
- Kidneys: 12-15% of the ingested dose.
- Lungs: 3-5% of the ingested dose.



Action:

The exact mechanism of action is unclear, but it has been found that it produces:

1. Metabolic acidosis: due to formic acid and lactic acid formation.
2. CNS depression: including the respiratory center.
3. Ocular toxicity: formic acid inhibits the cytochrome oxidase in the optic nerve→ disturbed flow of axoplsm.
4. Direct myocardial depression: it is a terminal event (a grave sign).

Fatal dose

60-100ccs (more toxic than ethanol). The minimal dose reported to cause blindness is 10ml of pure methanol.

Fatal period

It is expected to be delayed 3-7 days(long half life).

Mode of poisoning

It occurs mostly accidentally by alcoholics. It also may be used intentionally as it is cheap and easily available.

Clinical presentation

1) History

Usually in epidemic outbreaks.

There is latent period from 2-3 days with the presence of vomiting, ***snow storm vision (blurred***), and abdominal pain during this period.

2) On examination:

Metabolic acidosis: it is the first cause of death in such cases.

CNS manifestations: initial inebriation - especially if ethanol coingested.

1. **Ocular manifestations:**

- Diminished visual acuity.
- Irreversible blindness (25 % of cases).
- Nystagmus.
- Optic disc examination:

- Early: hyperemia & peripheral edema.
- Late: pallor.
- Decreased pupillary response to light.

2. **Cardiovascular manifestations:**

- Maintained normal blood pressure.
- Terminally: hypotension and bradycardia (a grave sign).
- Miscellaneous disorders.

3.Respiratory manifestations:

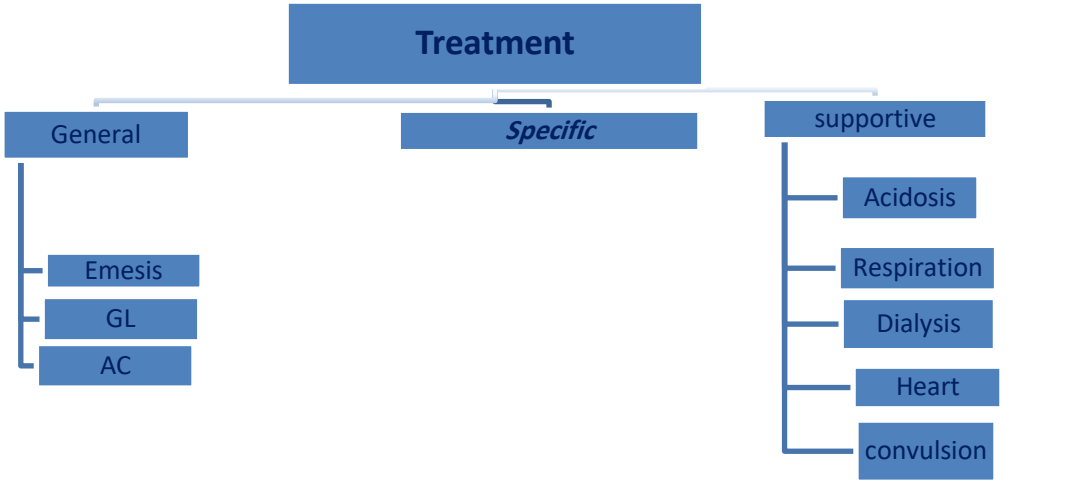
- Dyspnea:
- Early: due to unmetabolized methanol.
- Then: Tachypnia to compensate acidosis.
- Late: Sudden respiratory failure.

4.GIT disorders: - (early manifestations): nausea, vomiting and severe abdominal pain.

Laboratory evaluation:

1- Arterial blood gases: acidosis.
2- Serum electrolytes: severe anion gap.
3- Urine analysis and blood ethanol level (serial).
4- Serum urine ketones.
5- Fundus examination.

Treatment :



1-General measures:

- **Emesis: not preferred as;**

1. The patient is usually comatosed.
2. Altered mental status.
3. Rapid deterioration of consciousness is expected at any moment.

- **Gastric lavage:**

Better as it overcomes the contraindications of emesis by ensuring airway protection prior to lavage**.**

- **Activated charcoal and cathartics:**

Only indicated if co-ingestion if suspected.

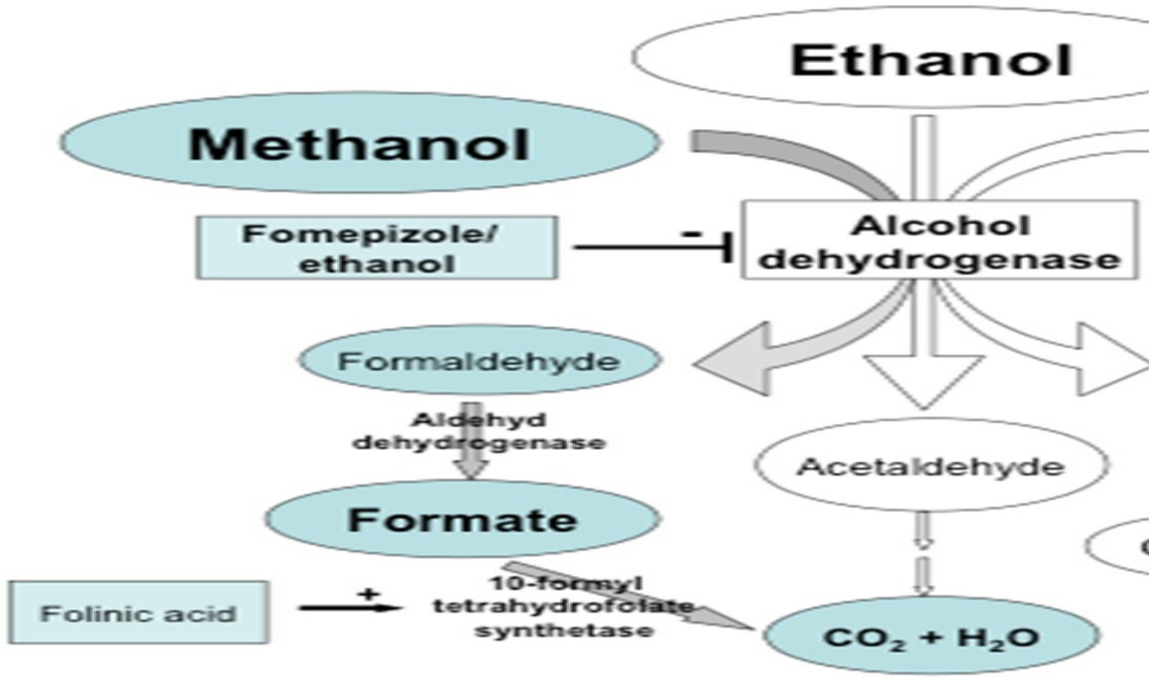
2- Specific measures (antidotes):

Ethanol and methyl pyrazole

	ethanol	3- Methyl-Pyrazole: (4-MP= fomepizole)
Aim	decrease the conversion of methanol into the more toxic format	
Mechanism:	strong competitive inhibitor of methanol at the dehydrogenase enzyme	alcohol dehydrogenase inhibitor
Advantages	Cheap, available	No CNS depressant, easier to use,
disadvantages	CNS depressant, difficult dose adjustment	Expensive, not avialable

Cofactor therapy

(Folic acid and folinic acid :(Leucoverin): Because that the tetrahydrofolate is the rate limiting in conversion of formic acid to CO2 and water, all patient receive ADH inhibitors should receive 50mg of folinic acid every 4 hours until ADH inhibitor therapy is discontinued.



L18- Acetaminophen (paracetamol)

Therapeutic uses

- **Analgesic antipyretic.**

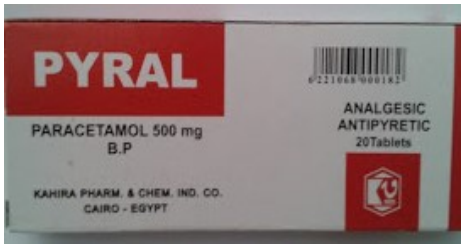
Therapeutic dose: 10 – 20mg/kg or up to 2.6gm/24 hours.

❑ Minimum toxic doses of acetaminophen for a single ingestion, posing significant risk of severe hepatotoxicity, are as follows:

✓ Adults: 7.5-10 g

✓ Children: 150 mg/kg

❑ Common paracetamol preparations



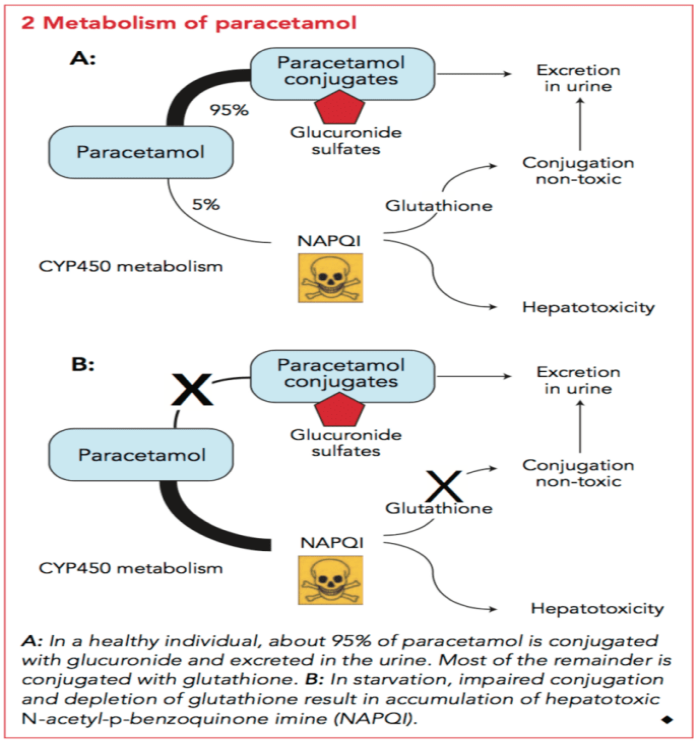
Acetaminophen

❑ Mechanism of action: it inhibits the prostaglandin synthesis mainly

❑ Circumstances of poisoning : it may be accidental or suicidal (10 gs)

❑ Toxokinetics and pathophysiology:

End resulted with : Centrilobular hepatic necrosis



A: In a healthy individual, about 95% of paracetamol is conjugated with glucuronide and excreted in the urine. Most of the remainder is conjugated with glutathione. B: In starvation, impaired conjugation and depletion of glutathione result in accumulation of hepatotoxic N-acetyl-p-benzoquinone imine (NAPQI).

Clinical picture

Stage 1

- Within first 0.5 -24 hr
- Clinically:
  Anorexia ,Nausea ,Vomiting ,Malaise,
  Pallor ,Diaphoresis
- Lab findings :
  Normal except acetaminophen level

Stage 2

- Within 24-48 hr
- Clinically:
  -Resolution of earlier symptoms
  -Right upper quadrant abdominal pain and tenderness
- Lab findings :
  -↑Bilirubin , Prothrombin time ,Hepatic enzymes
  - Oliguria

Stage 3

- Within 72-96 hr
- Clinically& Lab findings:
  - Peak liver function abnormalities
  - Fulminant hepatic failure
  - Multisystem organ failure
  - Potential death

Stage 4

- Within 4 days – 2 weeks
- Clinically& Lab findings:
  - Resolution of liver abnormalities
  - Clinical recovery precedes histologic recovery

LABORATORY INVESTIGATIONS:

Assessment of severity of acetaminophen overdose is achieved using RumackMattew nomogram

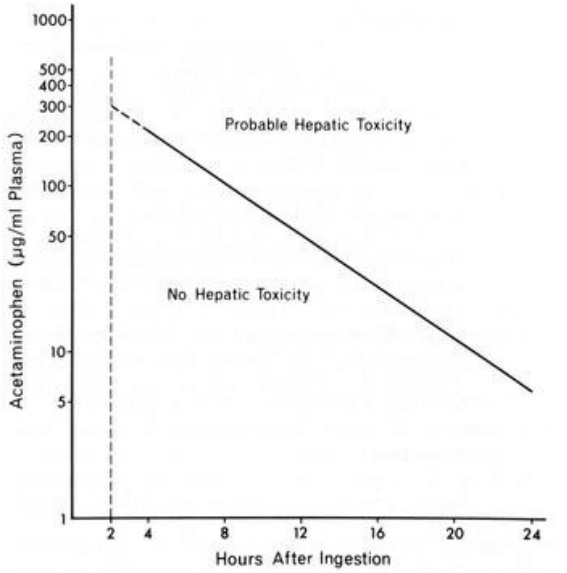


FIG. 1. Semilogarithmic plot of plasma acetaminophen levels vs. time.

Rumack BH, Matthew H, Acetaminophen Poisoning and Toxicity. Pediatrics 1975 (55)871-876

1. The measured serum acetaminophen level at 4 hours or longer following an acute ingestion predicts the possibility of hepatic injury and it determines the need to treat a patient using its specific antidote.

2-Aspartate and Alanine transaminase plasma levels.

3-Coagulation profile

4-Glucose level

5-Bilirubin level

6-Renal function tests

7-Acid- base status and electrolytes

Treatment

Initial treatment :

- Basic life support (ABCs)
- Decontamination by emesis, gastric lavage and **activated charcoal** (within 1-2 hr of ingestion)
- The **antidote** for **acetaminophen** poisoning is ***N*- acetylcysteine** (**NAC**) (which works primarily via refilling hepatic glutathione stores).

❑ Most effective when initiated within 8 hr of ingestion

❑ There is no demonstrated benefit to giving NAC before the 4 hr post-ingestion mark.

❑ NAC is available in oral and intravenous forms, and both forms are equally efficacious

1- Oral Nac

N- Acetylcysteine (Mucomyst)
Dosage: 140 mg /kg loading ,followed by 70 mg / Kg every 4 hrs. for 17 doses
Route of administration : Oral
Side effects: Nausea ,vomiting
N.B. Most effective if given within 8 hr of ingestion

2- IV NAC

N- Acetylcysteine (Acetadote)
Dosage: 150 mg /kg over 1 hr ,followed by 50 mg / Kg over 4 hrs. followed by 100 mg /Kg over 16 hrs.
Route of administration : IV
Side effects: Anaphylactoid reactions (most commonly with loading dose)

- Patients who develop hepatic failure in spite of NAC therapy may be candidates for liver transplantation

	Admission laboratory finding	Discharge laboratory finding
Glucose mg/dl	119	100
BUN mg/dl	21	15
Creatinine mg/dl	0,7	0,7
Total bilirrubin mg/dl	0,7	0,8
Direct bilirrubin mg/dl	0,3	0,3
Ast U/L	47	27
Alt U/L	14	10
Ldh U/L	478	515
Alkaline phosphatase U/L	180	144
PT sn	19,4	19,8
Inr	1,6	1,65
Wbc mm^3	5600	7800
pH	7,42	7,40
pO_2	91,2	95
pCO_2	36,7	36
SpO_2 (%)	98	98
HCO_3	23,5	20

Both Alt and AST lab results are important for Hepatic failure diagnosis specially regarding alcohol , the doctor mentioned that we have to memorize the lab results encircled (results of admission)

الصفحة الأخيرة ،

هذه الدوسية هي عمل فردي ، و قد يشوبه الخطأ و يحتاج التصويب ، و لذلك أرفقت ايميلي في بداية الدوسية و ها هو مرة أخرى :

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لأي تصحيح أو رأي قد يفيد و يخد زملائنا و زميلاتنا ، و سيتم ارفاق ملحق الاسئلة و الصور في ملف الكتروني و ذلك لحجمها الكبير و حتى تقتصر هذه الدوسية على المادة المدروسة للامتحان و تتمكنوا من طباعتها .

هذا العمل هو عن روح جدتي و أمي الغالية ، الحاجة أم محمد(عائشة الطراونة) ، و هو سبيل لكل قارىء ، فكل ما اتمناه ختامًا و ان كان بعد سنين من الان هو دعوة لها بالرحمة و المغفرة

الفاتحة لموتانا من المسلمين المسلمات ....

طيف هيثم الصرايرة ، 2-2-2020

((وَآخِرُ دَعْوَاهُمْ أَنِ الْحَمْدُ لِلَّهِ رَبِّ الْعَالَمِينَ))

(يونس-10)

الحمدلله حبًا

الحمدلله رجاءً و طاعة

الحمد لله دائمًا أبدا ..

الحمدلله ، تمت بخير .