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Forensics & Toxicology Final

🔊 Podcast Style Review (Experimental Feature)

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👨‍⚕️ Made by: Ibrahim Al-Khatib

- **NOTE:** Highlighted in **bold** are the important key info!
- Topics are arranged in order of most to least commonly tested
- Check the table of contents below for easier navigation
- Good luck 🍀

1. Wound & Firearm Injuries

Abrasions

- Appear as a **reddish-brown scab 1-2 days** after injury.
- Help assess: Site of injury, **Direction of injury** (indicated by **skin tags**), Age of injury (approximate).
- Do *not* reliably assess the severity of the injury itself.
- Types:
    - **Sliding abrasion (Brush burn/Graze abrasion)**: Force is tangential, low or no bleeding, heals quickly.
    - **Pressure abrasion (Patterned abrasion)**: Instrument pattern may be imprinted.
- Exact aging is generally difficult ('Can't be determined').
- Can be useful for identifying the instrument shape and indicating resistance/struggle (presence in certain locations).

Contusions (Bruises)

- Result from **blood extravasation** under the skin.
- **Undergo color changes** over time due to hemoglobin breakdown (e.g., **Hematoidin pigments cause greenish** discoloration).
- Severity depends on: Force applied, vascularity of tissue, health status (e.g., bleeding disorders), age, skin color.
- The presence of multiple contusions doesn't automatically mean the injury isn't simple.

Lacerations (Tear Wounds)

- Caused by **blunt force trauma** tearing the skin.
- Characteristics:
    - Irregular edges.
    - **Bridging tissue** within the wound.
    - Bruising around the edges.
    - Often less bleeding than incised wounds.
- Commonly occur over bony prominences (e.g., **scalp**).
- **Most common type of open wound** seen in the ER.
- Are *not* typically suicidal.

Incised Wounds (Cuts)

- Caused by sharp-edged objects (**pressure and friction**).
- Characteristics:

    - Cleanly divided edges.
    - No tissue bridging.
    - Often bleed profusely.
    - Length is greater than depth.
- **Fabricated/Self-inflicted wounds** are often:
    - Incisional type.
    - Multiple, parallel, superficial.
    - Located in accessible areas (e.g., wrist, abdomen, chest - **not deep**).
    - Small bruises are *not* characteristic of typical fabricated wounds.
- Suicidal incised wounds (e.g., neck) may show hesitation marks.

Stab Wounds (Punctures)

- Depth is greater than length.
- The length of the wound does *not* necessarily correspond directly to the width of the blade.
- The depth of the wound can be less than, equal to, or greater than the length of the blade (due to tissue compression/body movement).
- Examination includes: Site, number, wound characteristics (length, depth - effect on organs is crucial but may not be assessed externally).

Gunshot Wounds (GSW)

- **Entrance Wounds:**
    - Near distance/Close range: Show signs like **stippling (tattooing/powder burns)** and **smoke soiling (black color)**. Stippling is the most sensitive sign of near distance.
    - Contact shot: May show muzzle imprint, tearing of skin (especially over bone).
    - **Tattooing** (stippling) involves embedding of unburned/partially burned powder particles into the skin (dermis/subcutaneous tissue). **It cannot be wiped off**. If destroyed, pigment may be found in deep dermis or regional lymph nodes.
    - Presence of **only tattooing (no burn/soot)** suggests a shot from a few inches (**Close shot**), not contact or distant.
    - A "wipe ring" or "grease collar" (مسحة رصاصية) around the entrance indicates it's an entry wound.
    - Typically circular or oval, edges may be inverted.
- **Exit Wounds:**
    - Often larger and more irregular than entrance wounds.
    - Typically lack abrasion collars and powder tattooing/soiling.
    - Edges are often everted.
- Factors affecting appearance: Distance, type of weapon/ammunition, angle of impact, tissue type (e.g., tattooing less apparent in loose tissue vs. over flat bone).
- Number of entrance wounds may not equal number of exit wounds.

2. Introduction to Toxicology & Management of Acute Poisoning

General Principles

- **Management Priorities:** Stabilize **Airway, Breathing, Circulation (ABC)** first. Diagnosis of poison is *not* the first step.
- **Dose-Response: Maximal efficacy** is the limit of the dose-response relationship.
- **Tolerance:** Decreased responsiveness after prolonged administration; **produces shorter effect with the same dose**.
- **Idiosyncrasy:** Severe sensitivity/unusual reaction to a toxin/drug (e.g., **idiosyncratic reaction to succinylcholine due to pseudocholine esterase deficiency**).

- **Potentiation:** A non-toxic substance increases the toxicity of another substance.
- Poison exposure routes: Ingestion is common.
- Epidemiology: **Majority of acute poisonings occur at home**; many adult fatalities are suicides; most exposures in young children are accidental, *not* homicidal.

Decontamination & Enhanced Elimination

- **Emetics:**
  - Induce vomiting. **Syrup of Ipecac** is an advised emetic (e.g., for a child ingesting grandmother's medication).
  - **Contraindicated** with corrosives (strong acids/alkalis), hydrocarbons, and in unconscious/convulsing patients.
  - Generally used within the first hour.
- **Activated Charcoal:**
  - Adsorbs many poisons in the GI tract.
  - **Effective for substances undergoing enterohepatic circulation (Serial active charcoal)**.
  - Dose often recommended as 10 times the ingested poison weight.
  - Binding affinity is improved in solution.
  - Less effective for ions, small molecules, metals, alcohols, corrosives. **Low molecular weight substances may have poor binding affinity**. Ionized poisons may show *good* binding.
- **Forced Diuresis:**
  - Enhances renal excretion.
  - Requires adequate hydration and urine output.
  - **Alkaline diuresis (e.g., Na bicarbonate)** enhances excretion of **weak acids** (like aspirin, phenobarbital). Give **Na bicarbonate** for acidic pKa drug.
  - Acid diuresis (e.g., ammonium chloride) enhances excretion of weak bases.
  - **Less effective for drugs with high volume of distribution** or high plasma protein binding.
- **Hemodialysis:**
  - Effective for low molecular weight, water-soluble toxins with low protein binding and low volume of distribution (e.g., salicylates, methanol, ethylene glycol, lithium). **Indicated for weak acid with low Vd and low protein binding if anuria present**.
- **Dispositional Antagonism:** Methods that enhance elimination or prevent absorption (e.g., charcoal, diuresis). **Dimercaprol administration** is a specific antidote (chelator), not dispositional antagonism.

Specific Toxicities/Situations

- **Acid/Alkali Exposure:**
  - Strong acids cause **coagulation necrosis**.
  - Strong alkalis (and hydrofluoric acid) cause **liquefaction necrosis**.
  - **Emesis is contraindicated**.
  - Neutralization with mild alkali/acid is generally **not recommended** (risk of thermal injury). Antral stomach often injured part after ingestion.
- **Hydrocarbon (Petroleum Distillates) Poisoning (e.g., Kerosene):**
  - **Low surface tension means rapid spread** in mouth and trachea, increasing aspiration risk.
  - Aspiration causes chemical pneumonitis. Hypoxia can result from direct lung injury, V/Q mismatch. High volatility itself is *not* the primary cause of hypoxia.
  - **Oil cathartics should be avoided**.
  - Emesis usually contraindicated due to aspiration risk.
- **Volatile Substance Abuse:** Associated with **deadly poisoning, hallucinations, trauma, intellectual impairment**.
- **Toxicological Screening:**

    - Positive results help confirm diagnosis.
    - **Negative results do NOT rule out poisoning** (test may not cover the substance, or level may be below detection).
    - Useful for medicolegal documentation and guiding therapy.
- **Acetyl Salicylic Acid (Aspirin):**
    - Toxicity associated with: Gastric erosion, decreased platelet adhesiveness, Reye's syndrome (contraindicated in children with viral illness). Does *not* cause aspirin sensitivity itself (it's a pre-existing condition). Does *not* decrease prothrombin time (can increase it/affect INR).
    - Excretion enhanced by **alkaline diuresis (Aspirin with bicarbonate)**.
- **Antidotes:**
    - **Naloxone** for Opioids (Heroin).
    - **Flumazenil** for Benzodiazepines.
    - **Ethanol / Fomepizole** for Methanol / Ethylene glycol.
    - **N-acetylcysteine (NAC)** for Paracetamol.
    - **Physostigmine** for Atropine poisoning with CNS manifestations (anticholinergic toxicity).
    - **Protamine** for Heparin.
    - **Vitamin K** for Warfarin.
    - **Atropine & Pralidoxime** for Organophosphates.
    - **Oxygen** for Carbon Monoxide (CO), *not* Carbon Dioxide (CO_2).
    - **Naloxone is NOT for barbiturates**.
    - **Disulfiram is NOT an antidote for methanol** (it's used for alcohol dependence therapy).
- **Drug Combinations:** Methadone-Naloxone is *not* a standard combination; Protamine-Warfarin is incorrect; Vitamin K-Heparin is incorrect; **Disulfiram interaction with ethylene glycol is not its primary mechanism/use**. **Methadone - Naloxone** combination *is* listed as correct in one question context (likely referring to Naloxone as the antidote *for* Methadone overdose).
- **Seizures:** Many drugs can cause seizures. Acetaminophen is *least likely* to cause seizures within the first hour compared to isoniazid, amitriptyline, propoxyphene.
- **IV Drug Abuse:** Associated risks include HBV, HIV (autoimmune deficiency), endocarditis, etc. **Leukemia** is not a direct common consequence.

3. Death and Postmortem Changes, Sudden Death, Burns & Electrocution

Early Postmortem Changes

- **Loss of Skin Elasticity:** An **earliest sign of death**.
- **Cooling of the Body (Algor Mortis):** Body cools to ambient temperature. Rate affected by body size, clothing, environment.
- **Postmortem Lividity (Livor Mortis / Hypostasis):**
    - Purplish-red discoloration due to gravitational settling of blood.
    - Starts 1.5-2 hours postmortem.
    - Becomes **fixed (settles) after about 8 hours**.
    - Occurs in **dependent areas of the body**.
    - Indicates the **position of the body after death**.
    - Can occur in internal organs.
    - Does *not* occur in a live person (except under specific rare conditions, not relevant here).
- **Rigor Mortis:**

    - Stiffening of muscles due to **depletion of ATP**.
    - Appears around **2 hours** postmortem.
    - Typically starts in smaller muscles (**Orbicularis oculi**, jaw, hands) and progresses to larger muscles.
    - Affected by: **Temperature (faster in heat, slower in cold)**, muscle mass, pre-death activity (faster if muscles exhausted). Bleeding severity is *not* a primary factor.
    - Usually passes after 24-48 hours.
    - Can be used to estimate time of death (but is unreliable alone).
    - Similar phenomenon: **Cadaveric spasm** (instantaneous rigidity, often holding an object).
- **Corneal Clouding & Tache Noire:** Clouding of cornea; Tache noire (dark stripes on sclera if eyes open) appears after several hours (e.g., **4 hours**).
- **Intraocular Pressure:** Drops to 0 usually within **1-2 hours (e.g., 120 min)**.
- **Order of Events: Flaccidity → Rigor Mortis → Secondary Flaccidity (due to decomposition)**. (Cell death and putrefaction are decomposition processes).

Late Postmortem Changes (Decomposition)

- **Putrefaction:**
    - Bacterial decomposition.
    - Starts with greenish discoloration in the right iliac fossa (over cecum).
    - **Occurs first in tissues like Brain & epithelial linings (e.g., trachea/larynx)**. The **prostate** is relatively late to putrefy.
    - Progresses faster in **air** > water > soil. Faster in heat, slower in cold.
    - Factors increasing decomposition: Heat, sepsis, obesity. **Heat contracture** increases decomposition.
- **Adipocere:**
    - Formation of a waxy substance from body fat in moist, anaerobic conditions.
    - A type of **mummification/preservation**, *not* indication of specific trauma.
- **Mummification:** Drying and shriveling of the body in dry conditions.

Sudden Death

- Definition: **Death within 24 hours of the onset of the first symptom**.
- Most common cause overall, especially in adults: **Cardiovascular system diseases** (e.g., **Ischemic heart disease** in females).
- Most common cause in young patient *after exercise*: Often related to cardiac issues like **Hypertrophic Obstructive Cardiomyopathy (HOCM)** or ruptured berry aneurysm (though HOCM is more classic post-exertion).
- Causes *not* typically recorded as primary cause of sudden death: **Cardiopulmonary arrest** (this is the mechanism/mode of death, not the underlying cause), Hyaline membrane disease (usually infants). Bronchopneumonia, PE, Acute coronary occlusion *are* potential causes.

Burns & Electrocution

- **Burns:**
    - **Pugilistic attitude** (flexion of limbs) occurs in extensive burns due to heat-induced **coagulation of muscle proteins**. It is *not* rigor mortis and occurs even if death precedes the fire.
    - Signs of vitality (person alive during fire): **Soot in airways**, **elevated carboxyhemoglobin (CO)** in blood, vital reaction (inflammation) around burns. The pugilistic attitude itself is *not* a sign of vitality.
    - Presence of high CO levels indicates the person was breathing during the fire. Absence of high CO doesn't rule out death from burns if death was instantaneous or occurred before significant smoke inhalation.
    - **Heat artifacts** can mimic injuries: Epidural hemorrhage, hemopericardium, blisters, slit wounds (skin splitting). Pugilistic position is also related. True slit wounds are different.

- **Electrocution:**
  - Death can be due to ventricular fibrillation, respiratory arrest, asphyxia.
  - May leave an electrical mark (Joule burn) at entry/exit points.
  - Low voltage, high current (like household AC) is dangerous. **Lightning is high voltage, high current**.
  - **Erythema around the skin wound is NOT typical** of an electrical mark.
  - Prolonged resuscitation may not be needed for electrical shock with *alternating current* if cardiac arrest occurs quickly (compared to hypothermia, etc.).
- **Lightning:**
  - High voltage, high current.
  - Victims often found outside.
  - Causes **irregular, bizarre "fern-like" patterns (Lichtenberg figures)** or linear burns.
  - Statement that it involves "Low voltage high current injuries" is **false**.

4. Alcohol

Ethanol

- **Effects:** CNS depressant. Causes initial euphoria/disinhibition (**not true CNS stimulation**), followed by increasing depression, slurred speech, ataxia, coma, **respiratory depression** (cause of death in overdose). Produces a **false feeling of warmth** (vasodilation).
- **Metabolism:** Primarily via **alcohol dehydrogenase (main pathway)** and MEOS. **Metabolism does *not* increase with increasing doses** (follows zero-order kinetics at higher levels). Chronic alcoholism can induce MEOS but overall metabolism rate may not significantly increase or can decrease with liver damage. Atypical ADH has *higher* metabolic rate.
- **Toxicity:**
  - Acute: CNS depression, respiratory depression, hypoglycemia (especially in **children**), aspiration.
  - Chronic: Liver disease, pancreatitis, cardiomyopathy, neurological damage, **macrocytosis**.
  - Interactions: Increased sedative effect with barbiturates, increased CNS depression with phenothiazines, increased hepatotoxicity with paracetamol, increased GI bleeding with aspirin. **Increased ocular toxicity with methanol** is a methanol issue, not a typical ethanol interaction listed.
  - Dependence: Physical dependence can occur with chronic heavy drinking.
- **Methanol Poisoning:** Causes **blindness** (due to **formaldehyde/formic acid** metabolites), metabolic acidosis.
- **Ethylene Glycol Poisoning:** Causes metabolic acidosis, renal failure. **Calcium oxalate crystals** in urine are characteristic. **Fluorescent urine** (if fluorescein added to antifreeze) is a clue. Treat with **oral or IV ethanol** or fomepizole to inhibit alcohol dehydrogenase, reducing toxic metabolite formation. Monitor for hypocalcemia.
- **Forensic Aspects:**
  - Ethanol levels (blood, breath, urine) can be used as evidence. **Blood alcohol level** is the standard.
  - Level of 50 mg/dl typically causes **slurred speech** and some disequilibrium. Higher levels lead to coma, stupor.
  - Drinking associated with violence is relevant in law.
- **Management:** Supportive care. No specific agent significantly speeds up elimination (**oral fructose, heavy exercise, forced diuresis are ineffective**). Hemodialysis for severe methanol/ethylene glycol poisoning.

5. CN Poisoning, CO Poisoning & Paracetamol Toxicity

Cyanide (CN) Poisoning

- **Mechanism: Impairs cytochrome utilization of oxygen** (inhibits cellular respiration).
- **Antidotes:** Hydroxocobalamin (**B12**), sodium nitrite, sodium thiosulfate, amyl nitrite. **Cobalamin** is an antidote.

Carbon Monoxide (CO) Poisoning

- **Characteristics: Colorless, odorless, tasteless, non-irritant gas**. Lighter than air (or similar density), *not* heavier. It is *not* intrinsically irritating. **Garlic odor is wrong**.
- **Mechanism: Binds Hb with high affinity (>> O2), preventing O2 transport** and delivery. Shifts O2 dissociation curve to the left. Increased Hb affinity to gas is the mechanism, *not* decreased O2 perfusion causing asphyxia directly.
- **Source:** Incomplete combustion (fires, faulty heaters, car exhaust).
- **Signs/Symptoms:** Headache, dizziness, confusion, cherry-red skin/lividity (classic but not always present), collapse, coma, death.
- **Sequelae:** Long-term **neurological issues** (memory loss, parkinsonism, cortical blindness, incontinence).
- **Forensic: Presence of CO in blood** indicates breathing during exposure (e.g., fire victim alive when fire started).
- **Affinity:** CO has high affinity for adult Hb and even higher for fetal Hb (HbF). It does *not* have double the affinity compared to O2 (it's >200 times higher).

Paracetamol (Acetaminophen) Toxicity

- **Mechanism:** Normal doses metabolized safely. Overdose saturates normal pathways; metabolism by CYP450 produces toxic metabolite **NAPQI**. **NAPQI depletes glutathione** stores and causes hepatocellular necrosis. **Tissue damage results from the toxic metabolite**.
- **Toxicity:** Primarily **hepatotoxic**. Can also cause renal failure, pancreatitis, cardiac toxicity (less common). Esophagitis is *not* typical. Thrombocytopenia can occur.
- **Clinical Stages:** Initial phase (few symptoms), latent phase (liver enzymes rise), hepatic injury phase (jaundice, coagulopathy, encephalopathy, hypoglycemia, renal failure), recovery phase. **Initial hepatic stage toxicity appears clinically within 24-72 hours**, not necessarily within 24h.
- **Risk Factors:** Chronic alcoholism (induces CYP450), malnutrition (low glutathione). **Chronic alcoholism without acute intoxication predisposes**.
- **Management:**
  - **N-acetylcysteine (NAC)** is the antidote. It replenishes glutathione stores. **Most effective if given within 8-12 hours** of ingestion. Can be given IV or orally.
  - **Paracetamol blood level** is crucial for management, ideally measured 4 hours post-ingestion or later, plotted on the **Rumack-Matthew nomogram** to assess risk and guide NAC therapy. Nomogram is for **acute single ingestion**, *not* chronic/repeated exposure. Not helpful after 2 days. Best sample timing depends on ingestion time, 4hrs is minimum. Taking sample 48hrs post exposure is too late for nomogram use.
  - Monitor **liver function tests (ALT, AST), PT/INR, renal function, glucose, electrolytes**. Electrocardiogram is less critical unless cardiac toxicity suspected.
- **NAPQI:** Toxicity occurs when **glutathione levels are low**. Primarily produced in **Zone III of the liver**. Produced in overdose situations.
- **Metabolic Acidosis:** Can occur in severe poisoning, but **ethanol metabolism does NOT cause acidosis** (it's neutral or can cause ketoacidosis indirectly; Acetaminophen itself doesn't typically cause significant acidosis unless severe liver failure leads to lactic acidosis). Methanol, ethylene glycol, salicylates *do* cause acidosis.

6. Pesticides

Organophosphates (OP) & Carbamates

- **Mechanism:** Inhibit Acetylcholinesterase (AChE), leading to accumulation of Acetylcholine (ACh). OPs cause **irreversible** inhibition (aging); Carbamates cause **reversible** inhibition.
- **Symptoms (Cholinergic Crisis):**
  - **Muscarinic:** DUMBELS (Diarrhea/Diaphoresis, Urination, Miosis, Bronchorrhea/Bronchospasm, Emesis, Lacrimation, Salivation). **Pinpoint pupils (miosis)**, bradycardia, sweating, vomiting, diarrhea, urinary incontinence. Paralysis is Nicotinic. Urinary *retention* is anticholinergic, opposite of OP effect.
  - **Nicotinic:** Muscle weakness, fasciculations, **paralysis**, tachycardia, hypertension.

- **Management:**
  - **FIRST step: Airway management (Clear airways)**, breathing, circulation.
  - **Atropine:** Blocks muscarinic effects. **Needs much higher doses** than for simple bradycardia. Titrate to drying of secretions, stable heart rate. Does *not* treat muscle weakness (nicotinic).
  - **Pralidoxime (PAM):** Reactivates AChE (especially if given before aging occurs). **Reactivates choline esterase's function**. Used to reverse OP effect on AChE. Used *with* atropine. Both used for OPs, only atropine needed for carbamates (usually).
  - Decontamination (remove clothes, wash skin).
  - Supportive care. Gastric lavage/charcoal if recent ingestion.
- **Diagnosis:** History, clinical signs, low plasma/RBC cholinesterase activity (confirmatory).
- **Other:** Some OPs have a **garlic odor**. Both OPs and Carbamates are treated with **Atropine**. Both can be used as nerve agents. Pralidoxime is primarily for OPs.

Strychnine

- CNS stimulant, blocks glycine receptors.
- Causes **severe muscle spasms/convulsions (opisthotonos)**, precipitated by minimal stimuli.
- Consciousness is typically **preserved** initially (*not* early loss).
- Convulsions last 1-2 minutes, recur every 5-10 minutes.

7. CNS Depressants & CNS Stimulants (Opioids, Cocaine, Amphetamine)

Opioids (Morphine, Heroin)

- **Acute Intoxication:** CNS depression (coma), **respiratory depression (often cause of death)**, **miosis (pinpoint pupils)**, hypotension, pulmonary edema (non-cardiogenic). **Acute hypertension is NOT typical**.
- **Withdrawal:** Opposite effects - anxiety, insomnia, sweating, yawning, lacrimation, rhinorrhea, muscle aches, nausea, vomiting, diarrhea, **mydriasis (dilated pupils)**. **Meiosis is NOT a withdrawal symptom**. Physical dependence occurs.
- **Heroin:** Metabolized to morphine. Excreted in urine. Codeine is also excreted in urine but is a different opioid.
- **Management:**
  - Overdose: **Opioid antagonist (Naloxone)**. Supportive care (ventilation).
  - Withdrawal/Maintenance: Methadone, **Buprenorphine**.
- Patient with respiratory depression, coma, constricted pupil likely has **Opiate** toxicity.

Cocaine

- **Mechanism:** Blocks reuptake of dopamine, norepinephrine, serotonin. Causes intense CNS stimulation, vasoconstriction. **Vasospasm of coronaries** (alpha-adrenergic stimulation) contributes to cardiac ischemia. Increased metabolism, hypertension, tachycardia also contribute. Induces arrhythmia.
- **Acute Intoxication:** Euphoria, agitation, hypertension, tachycardia, hyperthermia, seizures, cardiac ischemia/infarction, arrhythmias, paranoia, **tactile hallucinations** (formication).
- **Tolerance:** Develops rapidly.
- **Crack Cocaine:** The active ingredient is **Cocaine** base (freebase).
- **Antidote: No specific antidote**. Management is supportive (benzodiazepines for agitation/seizures, cooling, control BP/HR). Naloxone, Atropine, N-acetylcysteine are irrelevant.

Amphetamines

- **Mechanism:** Increase release and block reuptake of catecholamines.

- **Acute Intoxication:** Similar to cocaine - euphoria, agitation, hypertension, tachycardia, hyperthermia, psychosis, seizures.
- **Withdrawal:** Depression, fatigue, increased appetite (**weight gain**, not weight loss, is typical of withdrawal/cessation).
- Result from intoxication: Cardiac issues, stroke, hyperthermia. **Urinary retention** is *not* a typical effect (more likely urinary frequency or difficulty due to sympathomimetic effects).

8. Introduction to Forensic Medicine & Medical Reports

Forensic Medicine Scope

- Primarily depends on: **Identification of persons**, determining cause and manner of death, analyzing trauma. Detecting time since death is part of it. Understanding 'why and how people harm other' is the broad context.

Medical Evidence & Reports

- **Evidence in Court:** A **medical report** (e.g., stating a driver was drunk) can be used. Blood alcohol level itself is data that needs interpretation in a report.
- **Physician's Role (ER Trauma/Fight): Document all injuries accurately**. Taking history is important, but documentation is key for potential legal proceedings. Informing police may be necessary depending on jurisdiction/severity. Writing specific details is the most important task when first receiving patient.
- **Homicidal Case:** Physician called to scene/body should **examine the entire body**, not just injured parts, follow police procedures/guidance. Family permission not needed for legally mandated examination.
- **Fraudulent Reports:** Giving a false report (e.g., exaggerating injuries from a fight for time off work) is illegal and unethical. It can lead to false accusations and legal consequences for the other party.
- **Consent:**
  - Needed for examination/treatment.
  - Specific consent needed for procedures like therapeutic abortion. Consent from **pregnant patient** needed (if competent), potentially spouse depending on local law/context, but patient autonomy is key. Consent needed for abortion after rape. Consent needed if patient < 13 years (from guardian). **Consent from pregnant woman in difficult labor** is needed for interventions.
  - Forensic examinations (e.g., court-ordered) may have different consent rules. Obtaining consent from spouse/guardian *before* examining competent adult females for forensic purposes (non-treatment) is generally **not required** or appropriate unless legally mandated.
- **Medical Reports (Content & Purpose):**
  - Should be objective, factual.
  - Forensic reports may estimate **period of incapacity (مدة التعطيل)**, assess injury severity, describe findings.
  - Reports can help determine **causation** (link between act and injury).
  - **Determining intent (النية العمدية)** is a legal conclusion, *not* typically stated directly by the physician in the report, though findings may suggest it.
  - Report should state diagnosis, description of injuries, possibly prognosis. Include date/time of examination.
- **Period of Incapacity (مدة التعطيل):**
  - Estimate of time needed to recover from injury, preventing work/normal activities. Based on nature of injury and treatment, *not solely* patient's occupation.
  - Legally significant (e.g., >10 or >20 days may change classification of assault).
  - A general public prosecution case (دعوى الحق العام) can be initiated even for one day of incapacity.
  - Does *not* automatically drop if the victim drops personal charges (الحق الشخصي).
- **Injury Severity Classification:** Terms like 'minor', 'serious', 'grievous', 'fatal' have specific legal/medical meanings. 'Serious/grievous' (بليغة) often defined by law (e.g., >20 days incapacity, permanent disability, danger to life). A fracture or head injury with contusion/SAH is serious. Simple contusions/abrasions usually minor.
- **Confidentiality (Medical Secrecy):**

    - Duty to maintain patient confidentiality.
    - Exceptions: Patient consent, **court order**, mandatory reporting (certain infectious diseases to health authorities, child abuse, gunshot wounds), public safety threat.
    - Disclosing information to a spouse without patient consent is a breach (unless specific legal exception applies). Reporting to Minister of Health for specific diseases is allowed. Reporting based on prosecutor's decision is allowed.
- **Physician's Duties & Ethics:**
    - Avoid actions detrimental to the profession's honor.
    - Cooperate with judicial authorities when required.
    - Cannot refuse to treat emergency patients.
    - Should not establish professional relations with a patient already under another doctor's care without consent/notification.
    - Must provide patient information if transferring care.
- **Medical Malpractice:** Requires proof of duty, breach of duty, causation, and damages. Stopping treatment is permissible under specific circumstances (e.g., patient non-compliance, after providing reasonable notice and ensuring continuity of care), but **not if it harms the patient's health without proper handover**.

9. Asphyxia & Drowning

Asphyxia (General)

- Interference with oxygen exchange.
- Signs: Cyanosis, petechial hemorrhages (small pinpoint spots) in conjunctiva, skin (face, neck), internal organs. Petechiae are *not* typically caused by **drowning**.
- **Hanging:** Asphyxia due to constriction of the neck by a ligature with body weight involved.
    - Ligature mark typically runs obliquely upward.
    - Fracture of hyoid bone/larynx may occur.
    - May involve cerebral ischemia (carotid occlusion) or vagal inhibition, not just airway occlusion.
    - **Scratch marks** on the neck are **not typically found** (suggests struggle against assailant, i.e., strangulation).
- **Strangulation:** Asphyxia due to constriction of the neck by ligature (ligature strangulation) or hands (manual strangulation/throttling).
    - Ligature mark is usually horizontal.
    - Signs of struggle, neck injuries (bruises, scratches, hyoid fracture) common.
    - **Closure of neck by hand (throttling)** can cause petechial rash.
    - **Mugging** (strangulation from behind with elbow/arm - Bansdola) is a form. Garroting involves a tightening device.
- **Suffocation (Smothering):** Obstruction of external airways (nose/mouth).
    - Can occur accidentally (e.g., **infant overlaid by sleeping mother**, face down in pillow/soft bedding due to intoxication/illness).
    - Can be homicidal.
    - Manual smothering (intentional) is *not* typically suicidal.
- **Choking:** Internal airway obstruction by foreign object.
- **Traumatic Asphyxia:** Compression of the chest preventing breathing.

Drowning

- Asphyxia due to submersion in fluid.
- **Signs of True Drowning (Vital Reaction):**
    - **Persistent, fine, white froth** (oedema fluid mixed with air and mucus) at mouth/nostrils.

    - Watery fluid in stomach/lungs (matching submersion medium).
    - Signs of circulation during submersion (e.g., diatoms in distant organs like bone marrow - requires specialist analysis).
    - Lung changes (emphysema aquosum - overdistension).
- Diagnosis involves finding these signs AND **excluding other causes of death**.
- Forensic examination of body recovered from water: Identify victim, determine cause of death (drowning vs. other cause before entering water), look for injuries (ante-mortem vs. post-mortem), check for poisons/alcohol. Determining exact time of death difficult.

10. Child Abuse & Domestic Violence / Sexual Assault

Child Abuse

- **Signs Suggestive of Non-Accidental Injury (NAI):**
    - **Bruises on a non-walking child are suspicious**.
    - **Bruises of different ages/healing times**.
    - Patterned bruises (e.g., belt marks).
    - Injuries inconsistent with history (**discordance**).
    - Delay in seeking medical help.
    - Specific fracture types (e.g., spiral fractures in infants, posterior rib fractures, metaphyseal corner fractures). **Linear tibial fracture** could be accidental or NAI depending on context.
    - Scald burns with clear demarcation lines (immersion). **Scald marks just above ankle level** could suggest forced immersion.
    - Hair removed in clumps.
    - **Adherent scar** is a sign of *healed* injury, not recent. Oozing serum/bluish areas relate to *recent* bruising. Rib fractures can be recent or old.
- Factors affecting abuse: Related to caregiver stress, substance abuse, mental health; *not* directly related to **parents' race**.
- Suspected case (e.g., child with severe sore throat, exam reveals bruises on thighs of different ages): This pattern is **highly consistent with child abuse**. Severe anxiety in the child also supports suspicion.
- **Forehead wound in a 2-year-old** is *not* automatically a sign of abuse (toddlers fall frequently).
- Who reports? **Medical professionals** (doctors, nurses) often have a legal duty to report suspected abuse.

Infanticide

- Killing of a newborn infant (< 1 year) by its **mother**. Father killing baby is homicide/filicide. Nurse killing newborn is homicide.

Sexual Assault (Rape / Domestic Violence)

- **Medical Examination (Rape):**
    - Physician's role in ER: **Collect samples and evidence** according to protocol, take full history, document findings, provide medical care/prophylaxis. Calling a specialized forensic examiner is ideal if available, but initial ER doc has responsibilities. Admission to hospital may/may not be needed based on injuries/protocol.
- **Evidence Collection:** Swabs (vaginal, oral, anal), clothing, hair samples, blood/urine (toxicology).
- **Findings:**
    - Presence of **active spermatozoa** is strong evidence of recent intercourse.
    - Presence of seminal fluid components (e.g., acid phosphatase).
    - DNA analysis.

- Physical injuries (bruises, lacerations). **Lacerated hymen** can indicate penetration but absence doesn't rule out assault, and hymen can be torn accidentally. Its presence/absence is *least useful* alone compared to sperm/DNA.
- Positive gonorrhea culture indicates STI, possible link but not definitive proof of assault itself.

- **Lack of findings does NOT disprove assault.** Absence of sperm/injury doesn't mean it didn't happen.
- **Consent Issues:** Assault occurs when sexual act is without consent.
- **Legal Definitions:** Vary by jurisdiction (e.g., concerning age of consent, relationship between parties - سفاح means incest). Laws exist against exploitation by persons in authority (religious figures, employers). Prosecution may depend on victim/family complaint in some cases.
- **Male Sexual Assault (Lواط - Sodomy):** Absence of semen in anus or injury doesn't rule it out. Matching DNA/blood type of semen source to suspect is key. Presence of feces on perpetrator's genitals can be suggestive. Presence of semen in suspect's *urethra* is irrelevant to the assault itself.

11. Hallucinogens Toxicity, Sports Doping & Plant Toxicity

Hallucinogens & Cannabis

- **Cannabis (Marijuana):**
  - Active ingredient: **THC**.
  - Has **specific cannabinoid receptors** (CB1, CB2).
  - Causes euphoria, relaxation, altered perception, impaired coordination.
  - Abuse primarily associated with **psychological dependence**, physical dependence is less pronounced than opioids but can occur.
  - Usually abused by **smoking** (higher bioavailability than ingestion).
  - Active ingredients stored in **lipid tissue**.
  - Metabolites detectable in urine for days to weeks (**within seven days** mentioned).
  - Fatalities are rare but possible (e.g., accidents while intoxicated).
  - **Spice (Joker):** Synthetic cannabinoid, *not* made from natural plant, potent, dangerous, deaths reported.
- **Other Drugs Mechanisms:** Ethanol enhances GABA, Opioids act on opioid receptors, Cocaine blocks reuptake. Statement that "Opioid agonists are effective as antidotes" is false (antagonists are antidotes).

Sports Doping

- **Prohibited Substances:** Anabolic steroids, amphetamines, erythropoietin, certain hormones. **Caffeine** is *not* generally prohibited (though high levels might be restricted).
- **Masking Agents: Diuretics (e.g., Furosemide)** can be used to dilute urine or speed excretion.
- **Physician Recommendations for Athletes:** Should *not* advise amphetamines for stress or anabolic steroids for muscle tone. Advising blood transfusion (blood doping) or erythropoietin is prohibited. Advising diuretics for weight loss (e.g., in weight-category sports) is doping. **Avoid erythropoietin** is correct advice.

Plant Toxicity (Anticholinergic Example)

- **Scenario:** Child ingests seeds of wild plant → presents 1 hr later with **high fever, erythema (flushing), dilated pupils, blurred vision, dry skin, hallucinations**.
- **Diagnosis:** Consistent with **anticholinergic poisoning** (e.g., from Datura/Jimsonweed seeds containing atropine, scopolamine).
- **Management:** Supportive care, **cooling measures**, **activated charcoal** (if recent ingestion), **diazepam** for seizures/agitation. **Gastric lavage** may be considered if very recent. **Anticholinergic agents** are the *cause*, so administering them would be wrong (except specific contexts like physostigmine as antidote, but that's a cholinergic agent used for anticholinergic toxicity).

12. Abortion

- **Definition:** Termination of pregnancy before fetal viability.
- **Legality (Based on Jordanian Law Context in File):**
  - Generally **prohibited** unless performed to save the mother's life.
  - Requires specific conditions if performed legally for maternal health:
    - Written consent from the woman (or guardian if incompetent).
    - **Two physicians must certify** in writing that continuation poses a threat to the mother's life or health, and abortion is the only means to save her.
    - Must be performed in a licensed hospital/maternity home.
  - Therapeutic abortion *may* be considered if fetus has condition incompatible with life (e.g., **anencephaly - لا جنين رأس له**), or if mother's health severely threatened by condition acquired during pregnancy (e.g., **German measles/Rubella in first trimester**, exposure to **radiation in first trimester**).
  - **Pregnancy resulting from rape** is *not* listed as a legal ground for abortion in the provided text.
- **Signs of (Illegal/Attempted) Abortion:** Examination may reveal instrumentation injury, infection, retained products of conception. Identifying a **live fetus (الجنين حي)** means abortion hasn't occurred or completed.

13. Miscellaneous (DNA, Food Poisoning, Snake Bite)

DNA Fingerprinting/Genotyping

- **Applications: Identification** of individuals (forensic cases, paternity), linking suspects to crime scenes. Helps in **exclusion and inclusion**.
- **Samples: Blood**, bloodstain, **semen stain**, **material under nails**, hair roots (hair shaft less reliable for nuclear DNA), tissue. **Hair** itself is listed as *not* usable for genotyping in one question (likely meaning shed hair without root vs blood/semen). Hair is the *least* accurate sample compared to blood/semen in another question, but genotyping is based on DNA level.
- **PCR (Polymerase Chain Reaction):** Used for **DNA amplification**. Not directly related to drug industry or patient organization, but used in identifying people. DNA probing utilizes **multiple bands (VNTRs/STRs)**, coding segments, etc.
- **Analysis:** Can determine **sex**, compare profiles. **Cannot determine age of blood spot**.
- **ABO blood grouping** is a different, less discriminating technique.

Identification (الإستعراف)

- Uses various methods: Visual ID, fingerprints, dental records, DNA, skeletal remains.
- **Skeletal Remains: Pelvis** is useful for **sex determination** (not 100% accurate). **Teeth** can help estimate **age** (but not precisely exact). **Stature** can be estimated from long bones.
- **Blood groups (زمر الدم)** are *not* definitive proof of paternity/maternity but can exclude.
- Distinctive medical features (scars, implants - علامات فارقة) noted in medical records are important.
- Identification is a key duty of forensic pathologists.

Food Poisoning

- **Bacterial:**
  - Salmonella: Antibiotics may promote carrier state.
  - Shigella: Can cause dysentery with mucus/blood in stool, fecal leukocytes common.
  - Clostridium botulinum: Causes **botulism**, a neurotoxic illness (cranial nerve palsies, paralysis). Considered very serious.
  - Cholera, Typhoid are serious bacterial infections, sometimes food/waterborne.
- **Viral:** Often cause vomiting/diarrhea; emetics not usually recommended.
- Diagnosis based on symptoms, identifying organism in stool/food.

Arsenic Poisoning

- Sources can include **fungicides**, industrial exposure (battery factories), contaminated **soil/water**.

Snake Bite First Aid

- **Recommended:** Keep victim calm and still, immobilize the bitten limb (lightly), remove constricting items (rings), seek medical help immediately.
- **NOT Recommended: Application of tight constricting band/tourniquet**, cutting/incising the wound, sucking out venom. Making small parallel incisions is *incorrect*.