



Review File

This is a review file containing only key important points, it is for **revision** and should **not** be used alone as REFERENCE.

GOOD LUCK!

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Surgical Infections

- **Hidradenitis** is a skin infection of the axillae or groin consisting of multiple abscesses of the apocrine sweat glands.
- Cellulitis is gradual while diffuse necrotizing is **sudden onset & quick** with crepitant on examination.
- Necrotizing infection (or gangrene) requires adequate, complete **debridement** to avoid infection.
- **Fournier gangrene is a special form of necrotizing fasciitis in the genital area, we see it in diabetic patients.** High mortality (60-70%).
- Fever after surgery? Look at the 5Ws: **W**ind (atelectasis), **W**ater (UTI), **W**alking (DVT), **W**onder drug, **W**ound (surgical site infection).
- Factors that increase surgical site infection: operation factors (shaving, etc....) and patient factors.
- Thyroid surgery, hernia repair, and breast biopsy are **clean** surgeries.
- Cholecystectomy and planned bowel resection are **clean-contaminated** surgeries.
- Unprepared bowel resection is a **contaminated** surgery.
- Abscess and perforation are **dirty / infected** surgeries.

Sterilization and operating setup

- **Asepsis**: Absence of microorganisms that cause diseases.
- **Cross Contamination** : Transmission of microorganisms from patient to patient and from inanimate objects to patients.
- **Best technique for you to use when rinsing your hands and forearms after a surgical scrub**: Rinsing should start with the hand positioned such that the water runs off the elbow rather than down to the hands.
- **Duration for Hand Cleansing**: All surgical scrubs are **3-5 minutes** in length.
- **Disinfection** is defined as the intermediate measures between physical cleaning and sterilization.
- **High-level disinfection**: can be expected to destroy all microorganisms, with the exception of large numbers of bacterial spores.
- **Sterilization** is the destruction of **all forms of microbial life**.
- **Gowns are only sterile from**: waist to shoulder.

Shock

- Shock = global tissue hypoperfusion + metabolic **lactic acidosis**.
- Types:
 - Hypovolemic: ↑ HR ↓ BP ↓ CO (most common cause: **hemorrhage**)
 - Cardiogenic: ↑ HR ↓ BP ↓ CO (causes: MI, HF, etc..)
 - Vasogenic: ↑ HR ↓ BP ↑ / ↓ CO (can be septic or anaphylactic)
 - Neurogenic: ↓ **HR** ↓ BP ↓ CO (characterized by **bradycardia** + **vasodilation**)
- Classes of hypovolemic shock:
 - Class 1 → <750 ml blood loss + pulse < 100 bpm + BP normal
 - Class 2 → 750 - 1500 ml blood loss + pulse 100 - 120 bpm + BP normal
 - Class 3 → 1500 - 2000 ml blood loss + pulse 120 - 140 bpm + BP decreased
 - Class 4 → >2000 ml blood loss + pulse > 140 bpm + BP decreased



- Best marker for tissue perfusion is **urine output**.
- Neurogenic shock = High cervical injury > **Loss of sympathetic tone** > The **hallmark** is presence of bradycardia with hypotension together. Along with **decreased** cardiac output and systemic vascular resistance
- Management of shock = restore perfusion (A, B, C's) + reverse underlying cause.
- Surgery is a planned injury after which the body goes through two phases: Ebb phase (similar to starvation) and flow phase.
- In fasting/starvation → all the glucose goes to the brain while the rest of the body uses ketones.

Transfusion Medicine and Therapy

Anticoagulants in blood:

Blood collection bags contain an anticoagulant-preservative of:

- Citrate.
- Phosphate: provides 2,3-DPG which helps in oxygen delivery.
- Dextrose.
- Adenine.

They ensure a shelf life of **35** days and hematocrit of 70 to 80% for packed red blood cells.

Additive solutions (**Adsol, Nutricel, Optisol**):

1. Provide additional nutrients > extending maximum storage to **42** days.
2. Reduce viscosity.

Storage of blood:

- Impairs RBCs function.
- Should be stored at a temperature from 1 to 6C.
- Makes the RBCs more spherical and rigid overtime, increasing resistance to capillary flow.
- Cell leakage of potassium > hyperkalemia.

Blood typing:

Blood specimen from the patient is sent for the following tests:

1. ABO grouping: A, B, AB, O.
2. Rh typing: +ve or -ve.
3. Antibody screen for unexpected (non-ABO/Rh) antibodies.


Any Rh -ve mother should only be given Rh -ve blood, if she got Rh +ve blood and got pregnant the child will have **erythroblastosis fetalis**. So she has to take Anti-D injections before getting pregnant.

- **Forward typing**: Determines the ABO and Rh phenotype.
- **Reverse typing = Crossmatch = Coombs test**: Confirms the absence of reactions between the patient's blood and the donor's serum and vice versa.

* Make sure you check for Hepatitis A, B and C, malaria and HIV.

Why do we transfuse blood?

1. To increase O₂ carrying capacity.
2. Restoration of red cell mass.
3. Correction of bleeding caused by platelet dysfunction.
4. Correction of bleeding caused by factor deficiencies.
5. Correction of anemia.



Oxygen delivery: $CaO_2 = (Hgb \times 1.39) \times O_2 \text{ saturation} + (PO_2 \times 0.003)$

*Hgb is the main determinant of oxygen content in the blood.

*Don't give blood too fast to any conditions that restrict the heart's ability to accommodate an increase in blood volume.

Indications for blood transfusion:

1. Normal patients: if Hb is 7 g/dL or less.
2. Cardiac patients: if Hb is 10 g/dL or less.

Blood components:

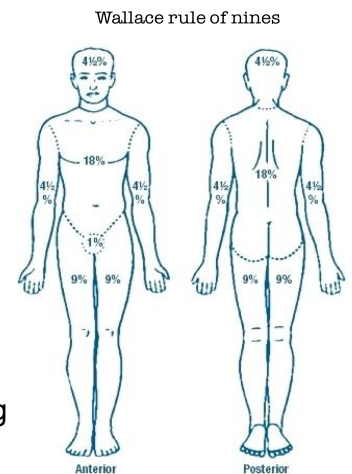
1. Packed red blood cells:
 - a. Given to improve oxygen delivery at the microvascular level.
 - b. In an average adult, 1 U of PRBCs increase the Hgb by about 1 g/dL or the hematocrit by about 3%.**
 - c. Most transfusion are given within a period of 60-90 min.
 - d. Unused blood for **more than 30 min.** should be discarded.
 - e. Should be infused alone or with **normal saline.**
 - f. Never mixed with:** ringer's lactate, calcium containing solutions, dextrose, medications, hypertonic solutions.
2. Fresh frozen plasma:
 - a. Must be ABO compatible.
 - b. Given within a period of 2-6 hours of thawing.
 - c. Contains all clotting factors.
3. Platelets:
 - a. Must be Rh compatible.
 - b. Traditional dose in adults is 4-6 U, in children it's 1 U/kg.
4. Cryoprecipitate:
 - a. A source of fibrinogen, factor VIII (deficiency of this factor causes hemophilia A), and von willebrand factor (vWF) > for dysfunctional (type II) or absent (type III) von willebrand disease.**
 - b. Ideal for supplying fibrinogen in volume sensitive patients.
 - c. Each unit contains approximately 80 units of factor VIII.

Adverse reactions of blood transfusion: Immune mediated reaction: acute hemolytic transfusion reaction (AHTR):

- When the recipient has preformed antibodies that lyse donor erythrocytes.
- The ABO isoagglutinins are responsible for the majority of these reactions.
- Presentation: **hypotension, tachypnea, tachycardia, fever, chills, hemoglobinemia and hemoglobinuria, chest and/or flank pain, discomfort at the site of infusion.**
- **Transfusion must be stopped immediately, intravenous access maintained and the reaction reported to the blood bank.**
- Patient should receive diuretics (furosemide or mannitol).
- Prothrombin time (PT) and activated partial thromboplastin time (aPTT), fibrinogen and platelet count should be monitored in these patients as they are in risk of developing **disseminated intravascular coagulation** due to release of tissue factor.

Burn Injury + Wound Healing

- Phases of wound healing:
 - Hemostasis: 5 - 10 minutes (vasoconstriction then vasodilation)
 - Inflammatory phase: main cells are macrophages
 - Proliferative phase: main cells are fibroblasts → **wound contraction**
 - Remodelling phase: collagen type I replaces collagen type III → reestablish normal **4:1 ratio (I:III)**.
- Collagen synthesis is inhibited by vitamin C deficiency as it plays a role in hydroxylation.
- Types of surgical scars:
 - Keloids → female, familial, black people, goes beyond border of scar, comes in specific sites (sternum, shoulder, face)
 - Hypertrophic scar → not familial or related to race or gender, more in children, doesn't go beyond borders, subsides with time and is found on flexor surfaces.
- To calculate **total body surface area** of burns use **wallace rule of nines**.
- Types of burns: Scalds/hot liquids (most common type in children), Flame/thermal (most common in adults), Electrical, Chemical (mainly causes **hypocalcemia**), Frictional, Flash, Contact.
- Note that zone of **stasis** is most important because for resuscitation.
- Burn classification:
 - Superficial burn (1st degree) → heals by itself
 - Superficial partial thickness (2nd degree)
 - Deep partial thickness (2nd degree) → needs debridement.
 - Full thickness (3rd & 4th degrees) → needs debridement and skin grafting
- Management → A, B, C's + remove/stop the causative agent.
- Fluid resuscitation → **parkland** formula for lactated ringer solution = **2-4ml x TBSA x body weight(kg)** (Half given in the first 8 hours after injury and half over the next 16 hours).
- Adequate fluid resuscitation is monitored by **urine output**.
- If you suspect inhalation injury do a bronchoscopy to determine extent of burn.



IV Fluid and Acid - Base Disorder

- Total body water:
 - Males: 60% of body weight.
 - Females: 50% of body weight (because they have more adipose tissue).
- Factors affecting total body fluid:
 - Age.
 - Gender.
 - Lean body mass (muscles): increase TBW.
 - Weight.
- The most abundant electrolytes:
 - Extracellular: Na and Cl.
 - Intracellular: K and PO₄.
- Distribution of fluid between intra and extravascular spaces depends on:
 - Pressures: oncotic (such as albumin, pulls fluid in), and hydrostatic pressure (forces fluid out).
 - Endothelial permeability.
 - Hormones: Aldosterone, ADH (Na and water retention), and ANP (Na and water excretion).

- Fluids loss in surgical patients:

Table 1.8 Sources of fluid loss in surgical patients

	Typical losses per 24 hrs	Factors modifying volume
Insensible losses	700–2000 ml	↑ Losses associated with pyrexia, sweating and use of non-humidified oxygen
Urine	1000–2500 ml	↓ With aldosterone and ADH secretion; ↑ With diuretic therapy
Gut	300–1000 ml	↑ Losses with obstruction, ileus, fistulae and diarrhoea (may increase substantially)
Third-space losses	0–4000 ml	↑ Losses with greater extent of surgery and tissue trauma

- Third space losses: injuries (even normal surgical procedures) induce movement of fluids outside the cells.
- Fluids loss from the GI:

Table 1.9 The approximate daily volumes (ml) and electrolyte concentrations (mmol/l) of various gastrointestinal fluids*

	Volume	Na ⁺	K ⁺	Cl ⁻	HCO ₃ ⁻
Plasma	—	140	5	100	25
Gastric secretions	2500	50	10	80	40
Intestinal fluid (upper)	3000	140	10	100	25
Bile and pancreatic secretions	1500	140	5	80	60
Mature ileostomy	500	50	5	20	25
Diarrhoea (inflammatory)	—	110	40	100	40

- IV fluids administration: They could be hypotonic, isotonic or hypertonic.
 - Colloids: Contain protein particles that exert oncotic pressure.
 - Natural: Albumin.
 - Synthetic: gelatins, hetastarch, dextran.
 - Major disadvantage: causes allergic reactions same as those caused by blood transfusion.
 - Used for fluid resuscitation.
 - Crystalloids: Contain water and electrolytes, types include:
 - Dextrose solutions:
 - 60% will go intracellularly, and 40% will remain extracellularly (80% interstitial and 20% intravascular).
 - Not good for fluid resuscitation.
 - Doesn't contain electrolytes.
 - DO NOT BOLUS THIS SOLUTION AS IT IS HYPOTONIC!
 - NaCl solutions: (0.9% NS, ½ NS, ¼ NS, Hypertonic saline).
 - Ringer's lactate.

Table 1.10 Composition of commonly administered intravenous fluids

	Na ⁺ (mmol/l)	K ⁺ (mmol/l)	Cl ⁻ (mmol/l)	HCO ₃ ⁻ (mmol/l)	Ca ²⁺ (mmol/l)	Mg ²⁺ (mmol/l)	Oncotic pressure (mmH ₂ O)	Typical plasma half-life	pH
5% dextrose	—	—	—	—	—	—	0	—	4.0
0.9% NaCl	154	0	154	0	0	0	0	—	5.0
Ringer's lactate (Hartmann's solution)	131	5	112	29*	1	1	0	—	6.5
Haemaccel (succinylated gelatin)	145	5.1	145	0	6.25	—	370	5 hours	7.4
Gelofusine (polygeline gelatin)	154	0.4	125	0	0.4	0.4	465	4 hours	7.4
Hetastarch	154	0	154	0	0	—	310	17 days	5.5
Human albumin solution 4.5% (HAS)	150	0	120	0	0	—	275	—	7.4

- Fluid maintenance:
 - 4,2,1 formula:
 - First 10 kg > multiplied by 4.
 - Second 10 kg > multiplied by 2.
 - The rest of body weight > multiplied by 1.
 - The results will be summed and calculated in ml/hr (if you want them per day multiply the result by 24)
- Electrolytes requirement:
 - Na: adults: 1-3 mEq/kg/day, pediatrics: 2-3 mEq/kg/day.
 - K: adults: 1 mEq/kg/day, pediatrics: 2-3 mEq/kg/day.
 - Cl: adults: 1-2 mEq/kg/day, pediatrics 2-3 mEq/kg/day.
- Fluid abnormalities:
 - Hypovolemia: very common condition in surgical patients, due to decreased intake or increased GI loss:
 - Signs: decreased skin turgor, dry mucous membranes, tachycardia, oliguria, hypotension, decreased level of consciousness.
 - Treatment: rapid bolus IV of isotonic solution (for fast management).
 - Hypervolemia: due to excessive fluid administration (hypotonic fluid):
 - Signs are difficult to detect clinically, but they include edema, basal chest crackles, elevated JVP, and pitting edema in later stages.
 - Patients at higher risk: cardiac and renal failure.
- Electrolytes abnormalities:
 - Sodium:
 - Hyponatremia:
 - With loss of extracellular volume: due to diarrhea, diuretics, adrenal insufficiency, and salt losing renal disease.
 - With normal extracellular volume: due to SIADH, hypothyroidism and psychogenic polydipsia.
 - With increased extracellular volume: excessive water administration, secondary hyperaldosteronism (cirrhosis, cardiac failure), and renal failure.
 - Treatment:
 - Normal or high fluids: decrease water intake.
 - Low fluids: isotonic fluid administration.
 - Hypernatremia:
 - Hypovolemic hypernatremia (the most common): due to decreased oral intake, nausea and vomiting, diarrhea, increased insensible water loss, severe burns and diuresis.
 - Euvolemic hypernatremia: due to diabetes insipidus.
 - Hypervolemic hypernatremia: due to excessive sodium load, and increased mineralocorticoid activity.
 - Treatment of hypovolemic hypernatremia: isotonic saline.
 - Avoid rapid correction of Na, as it may cause brain damage.
 - Potassium:
 - Hypokalemia (<3 mmol/L): very common in surgical patients:
 - Causes: inadequate intake, GI losses and transcellular shift-influx.
 - Consequences: ECG changes (flattened T-waves, U waves) and muscle weakness.
 - Treatment: oral K, or IV for severe cases (avoid IV bolus).
 - Hyperkalemia (>5 mmol/L): Life threatening:
 - Causes: excessive IV or oral intake and transcellular shift-efflux.

- Consequences: arrhythmias (tented T waves, reduced heart rate, heart block, broadened QRS, asystole), muscle weakness and ileus.
- Treatment: calcium gluconate if ECG changes are present.

Metabolic acidosis	Metabolic alkalosis
<p>Common surgical causes:</p> <p>1.Lactic acidosis</p> <ul style="list-style-type: none"> - Shock (any cause) - Severe hypoxaemia - Severe haemorrhage/anaemia - Liver failure <p>2.Accumulation of other acids</p> <ul style="list-style-type: none"> - Diabetic ketoacidosis - Starvation ketoacidosis - Acute or chronic renal failure - Poisoning (ethylene glycol, methanol, salicylates) <p>3.Increased bicarbonate loss:</p> <ul style="list-style-type: none"> - Diarrhea . - Intestinal fistulae. - Hyperchloraemic acidosis. 	<p>Common surgical causes:</p> <p>1.Loss of sodium, chloride and water:</p> <ul style="list-style-type: none"> - Vomiting. - Loss of gastric secretions. - Diuretic administrations. <p>2.Hypokalemia.</p>
Respiratory acidosis	Respiratory alkalosis
<p>A common post-operative problem characterized by increased PCO₂</p> <p>Common surgical causes:</p> <p>1.Central respiratory depression:</p> <ul style="list-style-type: none"> - Opioid drugs - Head injury or intracranial pathology. <p>2.Pulmonary diseases:</p> <ul style="list-style-type: none"> - Severe asthma - COPD - Severe chest infection 	<p>Common surgical causes:</p> <p>1.Pain 2.Apprehension/hysterical hyperventilation</p> <p>3.Pneumonia 4.CNS disorders (meningitis, encephalopathy)</p> <p>5.Pulmonary embolism 6.Sepsis</p> <p>7.Salicylate poisoning 8.Liver failure</p>

Cardiac Surgical Diseases

- **Coronary angiography** is the gold standard for diagnosing ischemic heart disease.
- The most common artery affected in IHD is left anterior descending (LAD).
- In CABG we use internal mammary (internal thoracic) artery because it has high graft patency, or great saphenous vein.
- Indication for surgery in IHD: failure of medical therapy, 3 vessel disease, left main disease > 50%, left main equivalent > 70%, mechanical complication, associated valve disease.
- Dyspnea may be cardiac, respiratory, or due to other diseases such as anemia, or hyperthyroidism.
- Symptomatic mitral stenosis is treated by **percutaneous balloon valvuloplasty**. When valve is not favorable (presence of LA clot or significant mitral regurg) we do surgery (commissurotomy).
- Mitral regurgitation can be acute or chronic, asymptomatic or symptomatic (fatigue, dyspnea, pulmonary hypertension, right heart failure).
- Indication for surgery in mitral regurgitation: symptomatic pt with severe acute primary MR, or pt with chronic MR with LV dysfunction, new onset AF or pulmonary HTN.

- Symptoms of aortic stenosis: angina (5 year survival), syncope (3 year survival), and CHF (2 year survival)
- Once a patient develops symptoms he is indicated for surgery → aortic valve replacement.
- Prosthetic heart valve:
 - Biologic: lasts about 10 years, **no need for anticoagulation** (usually used for old pts or those who are contraindicated for anticoagulation)
 - Mechanical: **high durability**, lasts > 20 years (so we usually use it for **young pts**), needs **lifelong anticoagulant**.
- Aortic dissection present with uncontrolled hypertension + tearing pain. CXR shows widened mediastinum. There are two types:
 - Type A: in ascending aorta, requires immediate surgery.
 - Type B: in descending aorta, can be managed medically.
- Most common tumors of the heart are secondary. The most common primary tumor is myxoma.
- Limitation of cardiopulmonary bypass machine: **1**. Requires full anticoagulation **2**. Can cause microembolism **3**. Initiates systemic inflammatory response (SIRS)
- In **penetrating** cardiac trauma the most commonly injured chamber is **right ventricle**.
- Patients usually present with signs of cardiac tamponade (**pulsus paroxysms**) or hemorrhage.

Presentation & management of common thoracic diseases

Congenital lung diseases:

1. Agenesis: absence of the lungs.
2. Hypoplasia: incomplete formation of the lung.
3. Cystic adenomatoid malformation: formation of a non-functioning cyst replacing a total lobe.
4. Pulmonary sequestration: A part of the lung loses its connection from the major bronchial tree.
5. Lobar emphysema: the entire lobe is replaced by an emphysematous bullae.
6. Bronchogenic cyst: a benign cyst with malignant position.

Lung infections:

1. Lung abscess: cough and foul smelling sputum production.
 - Indications for surgery: failure of medical treatment, giant abscess, hemorrhage, rupture.
2. Bronchiectasis: bronchial dilation.
 - Causes: congenital, infections, **obstruction**.
 - Clinical features: productive cough, dyspnea, hemoptysis, clubbing.
 - Investigation of choice: CT scan.
 - Indications for surgery: failure of medical treatment, unilateral localized disease, cystic dilation.
3. Tuberculosis:
 - Causes can be intra or extra-pulmonary.
 - Indications for surgery: failure of medical treatment, destroyed lobe or lung, pulmonary hemorrhage, persistent open cavity, persistent bronchopulmonary fistula.
4. Aspergillosis: Saprophytic form:
 - Chronic productive cough with hemoptysis.
 - Investigations: skin test, sputum, biopsy and CXR.
 - Indications for surgery: significant aspergilloma and hemoptysis.
5. Hydatid cyst.

Lung tumors:

Primary:

1. Non-small cell carcinoma:
 - Treatment: surgical in early stages, neoadjuvant therapy, and radio/chemotherapy in advanced stages.
2. Small cell carcinoma:

- Treatment: **non-surgical**, chemotherapy.

Clinical features appear due to compression on surrounding structures (recurrent laryngeal nerve, esophagus, C8 and T1 nerves, sympathetic chain, pleura, SVC) or paraneoplastic syndrome.

Investigations of choice for staging is **CT scan**.

Mediastinum: Mass lesions:

1. Superior anterior mediastinum: 5 Ts.
 - One of them is thymoma: could be benign or malignant, mainly causes mass effect or systemic effect like myasthenia gravis.
 - Treatment: if benign > resection, if malignant > neoadjuvant therapy then resection.
2. Middle mediastinum: cysts.
3. Posterior mediastinum: neurogenic tumors.

Trauma:

1. Road traffic accidents.
2. Fractures of ribs (simple or complicated with hemothorax).
3. Pneumothorax:
 - **Tension pneumothorax.**

Chest wall deformities: pectus excavatum (sternal depression) or pectus carinatum.

Pleura: spontaneous pneumothorax, pleural effusion, empyema, mesothelioma (rare cancer causing thickening of the pleura).

Atherosclerosis

- **Homocysteinemia** is a modifiable risk factor for developing atherosclerosis and acute limb ischemia.
- Acute thrombosis of non critical stenosis→ Severe symptoms due to poorly developed collaterals
- Intermittent Claudication (IC) are **muscular pain** that occurs after a **claudication distance**, it is **repetitive** and **relieved by resting**. (*No pain at rest*)
- Symptoms of IC are **Weakness / decreased mobility, Skin changes, Toe nail changes** and **Muscle wasting**.
- Critical limb ischemia (CLI) is caused by **multiple lesions** affecting different arterial segments in the affected limb. These patients usually have **tissue loss** (ulcers, gangrene), and **rest pain**.
- CLI Examination findings:- **Pallor, particularly on elevation** -‘**sunset foot**’ upon dependency due to reactive **hyperaemia**.
- All patient must have their pulses recorded as normal, weak or absent + record Ankle brachial index.
- we investigate in CLI for **Multiple Stenosis or occlusions**.
- All patients should be strongly urged to comply with Best Medical Therapy (**BMT**): **Cessation from smoking**, Control of hypertension, Prescription of a statin and antiplatelet agent.
- Endovascular intervention(Balloon angioplasty, with or without stenting) is favorable in short concentric not occluded lesions.
- Endarterectomy is not feasible in the case of long occlusion or multiple areas of disease thus it is more favorable to perform bypass.
- For a bypass operation to be successful in the long term, three conditions must be fulfilled:1- high-flow, high-pressure blood inflow 2-presence of blood out flow 3- conduit must be suitable.
- Diabetic foot (DF) neuropathy affects the :1) **motor** →toes become dorsiflexed→↑ pressure on metatarsal heads→ callus formation and ulceration, 2) **sensory**→ ulcer formation and joint destruction (Charcot’s Foot), and 3) **autonomic nerves**→↓ sweat→ Dry foot → scaling and fissuring.
- DF prevention by control of (Hb A1c <7%).
- DF Management:
 - 1- blood supply to the foot is adequate→ Excise dead tissue, control infection and protect foot from pressure (off-loading).



- 2- If there is ischemia→ revascularize the foot if possible (no extensive tissue damage), if there is extensive tissue damage→ amputation.
- Acute limb ischemia (ALI) Clinical features summaries in the **6Ps: 1- Pain 2- Pallor 3-Pulselessness 4-Paresthesia 5- Paralysis 6-Poikilothermia**
- In Acute complete ischemia there is an intense distal arterial spasm →marble' white which the turn after hours into → light blue or purple mottling, the limb is salvageable at this stage
- If the mottling persist and turns darker (due to blood coagulates in the skin) → revascularization is futile (do not revascularize) bc. It may lead to reperfusion injury
- The first thing to be done in ALI is to administer IV heparin (5000-8000 IU) if there is no contraindication
- In Compartment syndrome (CS): ↑ interstitial tissue pressure (>25mmHg higher then capillary pressure) → muscle necrosis.
- Palpable pedal pulses do not exclude compartment syndrome.
- CS Management through **fasciotomy** to relieve the pressure.
- Reperfusion injury is Caused by activated neutrophils, free radicals, enzymes, etc.released from perfused tissue→(ARDS), Myocardial stunning, Endotoxaemia, Acute Tubular Necrosis ,Multiple organ failure and death.
- Reperfusion injury treatment: Hydrate, Protect the heart with **calcium**, **Correct acidosis**, **produce alkalosis and use inotropic liberally** .
- Amaurosis fugax: Transient incomplete unilateral loss of vision.

Venous Disease

- The great saphenous vein travels in front of the medial malleolus.
- Above the medial malleolus is the **gaiter** area → site of venous ulcers.
- Chronic venous insufficiency is mainly due to failure of valves, and it can be primary or secondary (to obesity, **pregnancy**, DVT, obstruction). So if the scenario tells us that the failure is secondary to a condition, we divert our attention to the underlying cause!
- The test of choice in assessing venous disease is **duplex US**.
- We have to exclude peripheral arterial disease before using compression stockings.
- Treatment of choice is **EVLT** (endovenous laser therapy) but we need functioning deep system!
- Contraindication of EVLT is **deep system failure** (DVT, mechanical failure, etc..).

Vascular investigations

- Hand held doppler for sounds: normally triphasic arterial signal.
- Ankle brachial index: systolic pressure in the ankle (dorsalis pedis artery) divided by systolic pressure in the arm (brachial artery).

Interpretation of ABI (accepted as normal: 0.9 – 1.30)	
> 1.30	Non-compressible: considered as a false reading, specially in patients with diabetes. Because their lower limb vessels are severely calcified so the cuff cannot close the artery to read the pressure. So we don't use ABI in these patients.
1.00 – 1.29	Normal
0.91 – 0.99	Borderline (equivocal)
0.41 – 0.90	Mild to moderate peripheral arterial disease: Chronic limb ischemia only with claudication.
0.00 – 0.40	Severe peripheral arterial disease: Chronic limb ischemia with rest pain, gangrene and tissue loss.

- Has limited sensitivity, operator dependant but not toxic and not used therapeutically.

Modality	Sensitive	Operator dependent	Toxic	Therapeutic
Handheld doppler	✓	✓✓✓	×	×
Duplex ultrasound	✓✓✓	✓✓✓	×	×
CT Angiogram	✓✓✓✓✓	×	✓✓✓	×
MR Angiogram	✓✓✓✓	×	✓✓✓	×
Angiography	✓✓✓✓✓	×	✓✓✓	✓✓✓ The only therapeutic investigation

Emergency in urology

Hematuria:

- Gross: **1 ml of blood in 1 liter** of urine.
- Microscopic: **3 or more** RBCs/High power, in 2 out of 3 properly collected samples.
- Timing of hematuria:
 - **At the beginning of voiding** : (mostly due to the **anterior urethra**).
 - **At the end** : (Mostly due to the bladder neck, trigone and **posterior urethra**).
- Drugs:
 - Anticoagulants :(**Warfarin**).
 - **Rifampicin**: can cause red or orange discoloration of the urine.

Renal colic:

- Relieved by **movement**.
- Diagnosis: Helical CTU (Helical **CT without contrast**) The gold standard.

Acute urinary retention:

- **Painful inability to void**, with relief of pain following drainage of the bladder by catheterization.

Chronic urinary retention:

- Obstruction develops slowly, the bladder is distended (stretched) very gradually over weeks/months, **Pain is not a feature**.

Acute scrotum:

- Torsion of the spermatic cord (Most serious).
 - Common among teenagers (12-18) years.
 - this is an **emergency case (requires immediate scrotal exploration)**.
- Epididymo-orchitis:
 - **Cremasteric reflex** should be **present**.

Priapism:

- **more than 4 hours** that is NOT related or accompanied by sexual desire.
- **Ischemic** (veno-occlusive, low flow): **Painful**



- Due to hematological disease e.g. **Sickle cell, malignancy, drugs.**
- **Blood gases:** dark blood, PH <7.25 (acidosis).
- **Nonischemic (arterial): Painless**
 - Due to perineal **trauma** which creates an arteriovenous fistula.
 - **Blood gases:** bright red blood similar to arterial blood, PH : 7.4 (**normal**).
 - Penile pudendal arteriography (**VERY IMPORTANT** for patients with nonischemic type and sometimes you can manage them with it).

Renal trauma:

- Imaging:
 - **IVU :** (intraoperative), Done to see if **other (non-injured) kidney** is functioning and/or exists because the injured kidney might have to be removed.
 - **CT scan With contrast:** imaging study of choice.

Ureteral injuries:

- Internal trauma (iatrogenic): **Hysterectomy, Caesarean section.**

Bladder injuries:

- Intraperitoneal perforation: urine to escape into the peritoneal cavity.
 - **Management:** By open repair.
- **Extra-peritoneal perforation:** The peritoneum is **intact** and urine escapes into the space around the bladder.
 - **Management:** u don't need anything except **foley actor catheter** for 1 week or 10 days.

Urethral injuries:

- **Anterior injury :**
 - **straddle injury in boys** or men, **Inflating a catheter balloon.**
 - Diagnostic tool is **Retrograde Urethrography.**
 - Management:
 - Contusion :Small-gauge urethral **catheter for one week.**
 - Partial Rupture of Anterior Urethra: **No blind insertion of urethral catheterization,** Majority can be managed by **suprapubic urinary diversion (catheter)** for one week.

External genital injuries (males):

- Penile Fracture, eggplant deformity sign (the injury is mainly in the Corpora spongiosum).
- Glans Injury (especially with circumcision).

Adult urinary tract disorders

Urethritis:

- Usually related to unprotected sexual intercourse.
- Gonococcal vs. nongonococcal:
 - The main feature to differentiate between the two is the **INCUBATION PERIOD.**
 - **Neisseria gonorrhoeae : 3-10 days**
 - **Chlamydia trachomatis : 1-5 weeks**

Epididymitis:

- **Young** patients due to sexual transmitted infection: **N.gonorrhea, C.trochomatis**
- **Elderly** due to: **E.coli.**
- Gradual onset (along 2 weeks), With urinary symptoms like burning sensation – hematuria.
- Elevation of the scrotum **relief** the pain.

Torsion:

- Usually **in teenagers**, Sudden onset of testicular pain and swelling , There may be a history of minor trauma,

- Red & swollen hemiscrotum (usually too Tender to palpate).
- Loss of cremasteric reflex , Elevation of the scrotum **causes more** pain.

Cystitis:

- Diagnosis: Urine culture; (to confirm the diagnosis), the Gold standard.
- Treatment:
 - For a **Healthy woman** with a **simple cystitis**: **3 days** of wide spectrum antibiotic (Ciprofloxacin,levofloxacin).
 - For a **Male gender/ Older patients/ Diabetic/ Pregnancy/ Complicated cystitis**: **7 days** of antibiotic (TMP-SMX or Fluoroquinolones).

Pyelonephritis:

- Clinical features include: Costovertebral angle tenderness (flank pain), Fever.
- Investigations: **Urine C&S** (culture & sensitivity): (You diagnose by gram stain)
 - **Enterobacteriaceae (E. coli) , Enterococcus**
- Treatment:
 - If there is **no sepsis, no vomiting**, you send a culture , and then start the patient on **oral antibiotic** (Trimethoprim-Sulfamethoxazole or Ciprofloxacin) **as an outpatient for 10 days.**
 - If the patient is in **sepsis** : we give him **parenteral antibiotic** (Ampicillin + Gentamicin or 3rd generation cephalosporins) **for about 14-21 days.**

Renal stones:

- Radiopaque stones: **Calcium (oxalate and phosphate) , struvite.**
- Faint Radiopaque : **cystine** (hereditary and common in **children**).
- Radiolucent: **Uric acid and Xanthine.**
- Treatment :
 - Conservative (Always start with conservative).
 - **Stones (<5 mm)** >90% undergo spontaneous passage.
 - Extracorporeal shock wave lithotripsy: proximal ureteric **8 to 10 mm RADIOPAQUE** stone, **but not for stones larger than 1.5 cm.**
 - Ureterscopy laser. (for Distal ureteric stone or **RADIOLUCENT** stones).
 - **Percutaneous nephrolithotripsy (PNL)**: larger stones more than 2 cm or **staghorn stones**).

Common Urogenital Tumors

- Most renal tumors are malignant → renal cell carcinoma (RCC): most common type is **clear cell** carcinoma.
- Renal cell carcinoma arise from **proximal convoluted tubules.**
- Increased incidence in von Hippel-Lindau syndrome (so if dx we screen entire family).
- RCC can metastasise by blood to the lung resulting in **cannon ball** (well circumscribed and multiple) pulmonary metastases.
- **Lung** is the most common site of metastasis and seen in pts with history of RCC and choriocarcinoma.
- Presentation: triad (pain, hematuria, mass) + **paraneoplastic syndrome**:
 - Pyrexia (unknown origin), hypertension, polycythemia, Cushings, **Stauffer** syndrome, hypercalcemia, hypercalciuria, SIADH.
 - Hypercalcemia can be managed medically while all other require nephrectomy.
- Investigation of RCC: US and **CT** (investigation of choice).
- Management: **radical nephrectomy** +/- immunotherapy.
- Prognosis: most important factor in metastasis is **kidney performance.**



- The most common type of bladder cancer is transitional cell carcinoma (TCC).
- Etiology of bladder cancer: cigarette **smoking**, occupational exposure, schistosoma haematobium.
- Presentation of bladder cancer: **painless hematuria**.
- Investigation: **cystoscopy**, IVP (filling defect).
- Treatment of superficial TCC is transurethral resection, while invasive TCC requires radical cystectomy. Carcinoma in situ requires aggressive treatment (immunotherapy/radical cystectomy).
- Prostate adenocarcinoma is the most common male urogenital tumor, and arises in the peripheral zone.
- Investigations include **PR exam**, PSA levels, transrectal biopsy (graded by gleason classification).
- Treatment: active surveillance, radical radiotherapy (for local disease), and hormonal therapy → androgen suppression (for metastatic disease).
- Testicular tumors present as a **painless** swelling on side of scrotum.
- Types: seminoma (peak incidence at 35 ys) and others: teratoma (peak incidence at 25 yes), etc..
- Risk factors: **cryptorchidism**, klinefelter syndrome, testicular torsion.
- Seminomas are radiosensitive, while nonseminomas require orchiectomy + surveillance vs. RPLND vs. chemotherapy.

Pediatric Urinary Disorders

Kidney:

- Unilateral renal agenesis is usually an incidental finding on CT, we do **DMSA** to confirm diagnosis.
- Bilateral renal agenesis is fatal (either stillborn or die within 48 hours) due to pulmonary hypoplasia.
- Renal ectopia (simple or crossed) and horseshoe kidney are usually **asymptomatic** unless associated with obstructive uropathy or reflux.

Ureters:

- We diagnose ureteropelvic junction obstruction (UPJO) by: US (isolated **hydronephrosis** and **no** hydroureter) and **dynamic renogram** (nuclear study to **confirm**) which will show decrease function.
- Management of UPJO is dismembered **pyeloplasty**.
- In ureterovesical junction obstruction (UVJO) there is **hydroureteronephrosis** on US indicates, which we treat with ureteral reimplantation.
- **Ectopic ureter** presentation in females (continuous wetting) and in males (recurrent epididymo-orchitis). We do MCUG to diagnose.
- Diagnosis of **ureterocele** is by US and **MCUG/IVP** (to confirm).
- Vesicoureteral reflux can be asymptomatic or presents with **febrile UTIs**, and we diagnose by **MCUG** and treat with prophylactic antibiotic, and endoscopic cystoscopy, or ureteral reimplantation.

Bladder:

- Bladder diverticulum can be primary (congenital and single) or secondary (acquired and multiple).
- Gold standard to diagnose bladder diverticulum is **MCUG**.

Urethra:

- Posterior urethral valve will show **bilateral hydroureteronephrosis** + thick bladder wall = keyhole sign. Confirmation of diagnosis is done by **MCUG**.
- Treatment includes feeding tube, prophylactic antibiotic and endoscopic valve **ablation**.

Other:

- **Hypospadias is absolute contraindication to do circumcision**.
- Bladder exstrophy vs cloacal exstrophy → do rectal exam look for anal opening (not found in cloacal).

Pediatric inguinal and scrotal conditions

- Processus vaginalis: an outpouching of peritoneum that normally disappears at birth, and if it persists it leads to inguinal hernia (if wide) and hydrocele (if thin).
 - Inguinal hernia:
 - In males: Intra-abdominal organs pass through the deep inguinal ring, inguinal canal, superficial inguinal ring, to the scrotum.
 - In females: Intra-abdominal organs pass through the canal of Nuck to the labium.
 - Risk factors include: prematurity, connective tissue disorders, VP shunt, peritoneal dialysis, ascites and undescended testis.
 - Clinical presentation:
 - Asymptomatic.
 - Reducible inguinal bulging (intermittent).
 - Pain is only present when hernia is complicated.
 - Disappears when lying down.
 - Complications of hernia:
 - Incarceration/irreducibility: it indicates bowel obstruction, presents as intermittent abdominal pain and vomiting, a tender and sometimes erythematous mass in the groin.
 - Strangulation (can cut off blood supply to the herniated part of the intestines): severe pain, prolonged incarceration, fever, tachycardia and vomiting. Needs immediate surgery.
 - Management of hernia:
 - If uncomplicated: surgery is the only treatment, it can be done by open inguinal herniotomy, and laparoscopic herniotomy.
 - If incarcerated:
 - Peritonitis or septic shock are an absolute contraindication to attempt reduction! The patient is should be on IV rehydration and analgesics with firm and continuous pressure is applied around the incarceration.
 - Sudden pop of contents back to the abdominal cavity indicates successful reduction, after that, a delay for 24-48h for resolution of edema and inflammation is achieved before surgery.
 - Urgent herniotomy is necessary if reduction fails.
 - Congenital hydrocele: abnormal collection of fluid in the processus vaginalis.
 - Types include:
 - Communicating hydrocele.
 - Non-communicating hydrocele.
 - Hydrocele of the spermatic cord: mimics inguinal hernia.
- الهيرنيا لو ضغطنا عليها بترجع مكانها الطبيعي وبيصير مافيه شي، بس الهايدروسيل مايرجع طيب ممكن يجي ببالكم: الهيرنيا إذا كانت incarcerated ماراح ترجع! كيف نفرق؟ في هذه الحالة بتكون الهيرنيا مؤلمة جداً بس الهايدروسيل لا. وكذلك الهيرنيا ممتده للقروين مب بس في السكروتم!
- Clinical presentation: painless scrotal or groin swelling that increases in size following viral infection.
 - It is not reducible.
 - Management:
 - First 2 years: observation, up to 90% resolve spontaneously.
 - If not resolved, surgery is performed (hydrocelectomy for non-communicating hydrocele, and high ligation of PPV for communicating hydrocele).
 - Undescended testis:



- Cryptorchidism: the testis is arrested along its normal path of descent (abdominal or canalicular testis).
- Retractable testis: due to strong contraction of the cremasteric muscle, the testis is sometimes seen and sometimes not.
- Ectopic testis: the testis is located outside its normal path of descent.
- Clinical presentation of UDT:
 - Empty scrotum.
 - Swelling in the groin.
 - The hemi-scrotum is underdeveloped/hypoplastic.
 - The testis could be palpable in the inguinal canal, or impalpable in atrophy or agenesis.
- Management:
 - Hormonal treatment: LHRH and HCG.
 - Surgical:
 - If testis is palpable: orchidopexy is the treatment of choice, done between 6-12 months of age.
 - If testis is impalpable: radiographic imaging or diagnostic laparoscopy (which is better for diagnosis and for treatment).
 - If testis is found intra-abdominal: laparoscopic assisted orchidopexy.
 - If atrophied (presence of blood vessels): inguinal exploration and excision.
 - If agenesis (presence of vas deferens only): nothing could be done.
 - Surgery is mostly done to optimize fertility.
- **All of the above conditions happen more commonly in the right testis than in the left.**
- Acute scrotum:
 - Torsion of the testis (most common): SURGICAL EMERGENCY within 4-6h, along with fixation of the contralateral testis.
 - Torsion of the appendix testis: self-limiting.
 - Epididymitis / orchitis: antibiotics.
 - Idiopathic scrotal edema: self-limiting.
 - Trauma/sexual abuse: conservative treatment.
 - Vasculitis.
 - Cellulitis.

Surgical abdominal problems in pediatrics

History sources:

- **Mother** is the best source.

Persistent vomiting: (color)

- **Milk**: If its persistent and white and **not gaining weight?** Obstruction is proximal to 2nd part of duodenum e.g. **Pyloric obstruction**.
- **Greenish** most likely there's an obstruction in the **2nd part of duodenum**, ileum and large bowel.
- Projectile vomiting → caused by **proximal obstruction**.
- Small amount of vomit after each feed → regurgitation → normal as long as they are gaining weight.

Bowel movements:

- **meconium in newborns: (first bowel movement)**
 - dark greenish and sticky because of whatever the baby swallowed before birth e.g. amniotic fluid.

- 85% of babies pass meconium in first day.. 95% in first two days. If not passed, RED FLAG is raised!

Color of stool:

- The normal color is : **Yellow**.
- Very pale → **obstructive jaundice**.

Esophageal diseases

Gastroesophageal reflux disease:

- chronic and relapsing condition characterized by symptoms OR mucosal damage produced by abnormal reflux of gastric contents into the esophagus.
- Hiatal hernia: **Type I (Sliding Hiatal Hernia): (Strong association with GERD)**.
- Clinical features of GERD and Hiatal hernia: Heartburn (pyrosis) and regurgitation.
- Diagnostic Tests for GERD :
 - **Ambulatory pH manometry “most diagnostic”**: 24-hour-pH monitor.
 - Barium swallow.
 - CXR : usually normal unless there was complications.
- **Endoscopic GERD Therapy: Nissen fundoplication “most common”** (Gastric fundus wrapped around the lower esophageal sphincter).

Barrett's esophagus :

- columnar epithelium replaces the stratified squamous epithelium that normally lines the distal esophagus (**intestinal metaplasia**). **WITH goblet cells!**
- Most patients present with **symptoms of GERD**.
- Diagnosis of Barrett's esophagus: Endoscopy & pathology.
- Treatment of Barrett's esophagus:
 - **Yearly surveillance endoscopy** is recommended in all patients.
 - **Photodynamic therapy (PDT)** is the most common ablative method used to treat BE.

Achalasia:

- Clinical feature :
 - **1. Progressive dysphagia (main symptom)**: to both solids & liquids at the same time [If dysphagia occurs for solids first and then liquids → carcinoma]
 - **2. Regurgitation** is the second most common symptom.
- Diagnosis:
 - Barium study: classic finding **bird's beak**.
 - **Upper endoscopy** is the NEXT diagnostic test.
 - **Esophageal manometry** has the highest sensitivity (**Most accurate**).
- Treatment:
 - **Pneumatic Dilation: “first-line”**.
- Complications:
 - Esophageal cancer (most commonly **squamous cell carcinoma**).

Esophageal diverticula: Pharyngoesophageal (Zenker's).

- It is a False diverticulum (Mucosa and submucosa ONLY).
- Symptoms: **Especially common in elderly: Halitosis**.
- Diagnosis is made by barium **esophagram**.
- Treatment: **Open surgical repair (gold standard of treatment)**.

Esophageal perforation:

- **CXR (appropriate next step):** may demonstrate **hydropneumothorax or pneumomediastinum**.
- **Contrast esophagram with water soluble contrast** (ex. Gastrografin) , if you suspect a perforation in the abdominal part of the esophagus.
- If you suspect a perforation, the most important next step (Before CXR) is to make sure that the patient stays NPO.
- An important symptom to ask about is: **Odynophagia**.

Stomach + Duodenum

- **Peptic ulcer (PUD) presentation** include: Epigastric **Pain, Vomiting, Bleeding**.
- Duodenal Ulcer vs Gastric Ulcer :
 - Duodenal ulcer :**pain when hungry, cyclic** and is **relieved by food**. associated with ↑weight.Common in young and middle-aged.
 - Gastric Ulcer:**pain during eating**, associated with ↓weight.Common in 40-60 years.
- PUD is diagnosed by **EGD with biopsy**,if there is a contraindication (e.g.perforation) do Gastric analysis,Gastrin serum level AND Contrast meal.
- PUD treatment:
 - Medical Treatment:**H2 antagonist (eg.Zantac)**,PPI (eg.Omeprazole) and Antibiotics (eg.Amoxicillin),
 - Surgical:Vagotomy,Antrectomy + vagotomy ,and Subtotal gastrectomy.
 - Complications of surgery include: **Dumping syndrome** and **Anemia**.
- **Ulcer Complications:**
 - **Perforation presents** as **Sudden, Severe, diffuse** abdominal pain.diagnosed by Erect abdominal **X-ray**→**air** under **diaphragm**. Initial management→ **ABC** ,NPO, IV Fluid, NGT and antibiotics,in Definitive perforation surgical repair (Graham patch) .
- Perforation occurs usually in the **anterior** walls ulcer.
 - **Obstruction**:presents as Dull epigastric pain & projectile **vomiting of large volumes of undigested food matter**,can happen also if the ulcer become scarred.
- **upper gastrointestinal bleeding**
 - common causes are **Peptic ulcer**,Esophageal varices,**Mallory-Weiss syndrome** and Gastritis.
 - presents with:haematemesis,Coffee-ground vomiting,melena and hematochezia.
 - Management:Resuscitation (ABC), Short Hx & PE.
 - investigations: Blood and EGD
 - Therapeutic options:1)Endoscopy 2)Angio 3)Surgery
- **Zollinger-ellison syndrome (Gastrinoma)**
 - Signs & symptoms:→ Peptic ulcer disease (often severe) in 95% with **Epigastric tenderness** , **Not recovering by medication**, **pain becomes worse with eating** and severe diarrhea.
 - Investigations:↑**serum gastrin** > 500 pg/ml, CT, Somatostatin-receptor scintigraphy.
 - Treatment: medical (PPI) and the ideal is **surgery**.
- **Mallory-weiss syndrome**
 - Presentation:it usually follows a bout of **severe retching**, coughing, or forceful vomiting.
 - Treatment: **ABC**, brief history,do ice-water gastric lavage,if bleeding does not stop → EGD: If tear is small→ burn it (cautery),if big →surgical intervention.
- **Stress ulcer** also called **erosive gastritis** is due to shock or sepsis,**Curling's ulcer** is an ulcer due to burns.**Cushing' ulcer** is due to the presence of a CNS tumor or injury.

- **Gastric Polyps** types: 1)Hyperplastic 2)**Adenomatous (pre-malignant)** - Inflammatory
 - we perform EGD to Rule out malignancy.
- In **Gastric leiomyomas** do **EGD** and **CT** ,but never take biopsy.manage with Surgical wide excision.
- **Gastric Diverticula** is Asymptomatic,Weight loss, diarrhea, anemia.Diagnosis: EGD,X-Ray Rx:Surgery
- **Gastric volvulus** “**is an emergency**” presents with **Severe abdominal (epigastric) pain** and Borchardt’s triad(Vomiting followed by retching and then inability to vomit + Epigastric distention + Inability to pass a nasogastric tube),GERD and hiatal hernia. types:
 - organo-axial volvulus (more common):closed from 2 sides ,*no vomiting* and **Associated with HH (hiatal hernia)**.
 - mesenteroaxial volvulus:closed from 1 side,with vomiting (obstruction)
- **Superior mesenteric artery syndrome** appears after rapid weight loss following injury and presents as obstruction(vomiting),diagnosed with **CT** and treated with **bypass surgery**.
- **Bezoar** (foreign body in the stomach) presents with obstruction symptoms,diagnosis → **EGD and X-ray**. treatment→ **surgical removal**. types :1)Trichobezoars: formed from hair ,in psychiatric pt. 2)Phytobezoars: vegetable

Acute Abdomen

- Differential diagnosis of acute abdomen can be surgical or medical (**pancreatitis, inferior MI, lobar pneumonia**).
- Pathophysiology of acute appendicitis → pain starts as **visceral** (vague, dull, periumbilical) then becomes parietal/**somatic** (sharp, localised to right iliac fossa or RLQ).
- Acute **appendicitis** is most common in those aged **8 - 14**. They present with pain and vomiting, on examination there is tenderness, and guarding.
- **Abdominal CT** to diagnose acute appendicitis.
- Acute mesenteric arterial emboli can occur due to underlying cardiac cause (post-MI).
- **Peptic ulcer** can perforate and cause acute abdomen (CXR will show **free air** under the diaphragm).
- Radiation: acute pancreatitis → back , cholecystitis → right shoulder.
- Movement: pts with ureteric colic → move alot to relieve pain , peritonitis → lie very still.
- Young female presents with acute abdomen, differential includes: **pelvic inflammatory disease**.
- Left lower quadrant pain is most likely sigmoid disease i.e, **diverticulitis**.
- First thing in assessment is stabilizing the patient (check the vital signs)!
- If patient presents with abdominal distention → **obstruction** or ascites? Check for shifting dullness!
- Ruptured AAA is category 1 and need **immediate** operation (pts in shock: hypotensive + tachycardic).
- **Primary peritonitis** may occur in patients with chronic renal failure or nephrotic syndrome. They present with generalised abdominal tenderness and rigidity, and have fever and leukocytosis.

Ddx of abdominal masses and hernias

Anatomy:

Layers of the abdominal wall: skin > subcutaneous fat > scarpa’s fascia > rectus abdominis muscle > external oblique muscle > internal oblique muscle > transversus abdominis muscle > transversus fascia > peritoneum.



Boundaries of Hesselbach's triangle:

1. Laterally: inferior epigastric vessels.
2. Medially: lateral border of rectus abdominis.
3. Inferiorly: inguinal ligament.
4. Above: conjoint ligament.

Types of abdominal wall hernias:

- **Groin Hernias (Inguinal Hernias):**

1- Indirect inguinal hernia (60%): Types include:

- A. Bubonocele.
- B. Funicular.
- C. Complete.

2- Direct inguinal hernia (25%).

3- Combined (pantaloon) hernia.

4- Femoral hernias (15%).

- **Anterior Abdominal Wall Hernias:**

1-Umbilical Hernia 2-Para umbilical Hernia 3-Epigastric Hernia 4-Spigelian Hernia

- **Posterior Abdominal Wall Hernias:**

1-Superior Lumbar Hernia

2-Inferior Lumbar Hernia

- **Pelvic Hernias:**

1-Obturator Hernia

2-Sciatic Hernia

3-Gluteal Hernia

Causes of hernia:

1. Increased abdominal pressure.
2. Weakness of abdominal wall.

Composition of a hernia:

1. The sac.
2. The coverings of the sac.
3. The contents of the sac: omentum, intestines, circumference of the intestines (called Richter's hernia), **appendix (called Amyand's hernia)**, bladder, ovary, meckel's diverticulum (called Littre's hernia), fluids.

Classification of hernia:

1. **Reducible.**
2. **Irreducible.**
3. **Obstructed.**
4. **Strangulated/incarcerated.**
5. **Inflamed.**

Groin hernias:

1) **Symptoms:**

- a) Swelling.
- b) History suggesting increased abdominal pressure.
- c) Asymptomatic.

- d) Incidental finding.
- e) **Usually appears when standing up and disappears when lying down** (if not complicated).

2) Signs:

- a) Inguino-scrotal swelling.
- b) Expansile cough.
- c) Cannot get above swelling.
- d) Reducibility.

3) Types:

- a) Direct: acquired, due to weakness in the posterior abdominal wall, passes only through the external ring through Hesselbach's triangle.
- b) Indirect: congenital, due to patent processus vaginalis, **readily visible when the patient is asked to stand or cough**, extends from the internal to the external inguinal canal.

Treatment for groin hernias is either conservative or surgical.

Inflammatory bowel diseases

Crohn's disease:

- A **chronic, transmural** inflammatory disease of the GI tract of **unknown** cause.
- Macroscopic appearance: **discontinuous and segmental**.
- At exploration: Extensive **fat wrapping**. If you suspect acute appendicitis in a patient and take him to the OR, if the diagnostic laparoscopy shows fat wrapping. what is the most likely diagnosis?
Crohn's.
- The **earliest** gross manifestation of Crohn's disease is the development of small mucosal ulcerations called **aphthous ulcers**.
- Microscopic appearance : **Non-caseating Granuloma** with Langerhans' giant cells.

Ulcerative Colitis:

- Diagnostic characteristic of ulcerative colitis is **continuous, uninterrupted inflammation of the colonic mucosa** beginning in the distal rectum and extending proximally to a variable distance.
- Macroscopic appearance:
 - Despite the disease name ulcer there is no ulcer.
 - The typical gross appearance of ulcerative colitis is **hyperemic mucosa**.
- Extraintestinal manifestations:
 - Which of the conditions associated with UC not curable by Colectomy? **Ankylosing spondylitis and Primary sclerosing cholangitis** (may end up with liver transplant).

Colorectal Cancer

- Almost all cancers begin as a benign polyp. It takes 7 - 10 years to transform from benign → cancer.
- The transformation depends on type, size and number of polyps.
- We should screen with colonoscopy from age 50 (new guidelines say 45).
- Risk factors: family history (first degree family member doubles the risk), IBD, smoking, etc..
- Clinical presentation: bleeding (anemia) → mainly in right, obstruction → mainly in left.
Others: change in bowel habit, vague abdominal pain, weight loss.
- Investigations: colonoscopy + **biopsy**. For staging do CT CAP.

- On barium it appears as **apple core** sign (shouldering).
- Treatment: **surgical** therapy! (remove the segment and corresponding lymph nodes).
- TNM Staging:

TNM staging system:						
	(is)	(0)	(1)	(2)	(3)	(4)
T	invasion of mucosa only	—	Invasion of submucosa	Invasion of muscularis propria	Full thickness (Serosa) in case of colon cancer. Perirectal fat and adjacent organs (asT4) in rectal cancer	Invasion into adjacent organs
N	—	No lymph nodes involvement	1-3 lymph nodes	>3 lymph nodes	distant lymph nodes	—
M	—	No distant organ mets	Distant organ (liver, lung)	—	—	—

- Stages:

Based on the TNM classification, we have 4 stages of Colorectal Cancer:		5 Year Survival chance
Stage 0	Tis Tumors	
Stage 1	T1 and T2 tumors (No nodes nor mets)	90%
Stage 2	T3 and T4 tumors (No nodes nor mets) / ^T3N0 tumors	80%^
Stage 3	Any lymph node involvement (+ve node/s with any T) * (depends on number of nodes involved)	27-69%*
Stage 4	Distant metastases (+ve mets with any T)	8%

Anorectal Conditions

- Internal hemorrhoids present with painless bleeding +/- prolapse and are classified in 4 grades: grade 1 (only bleeding) grade 2 (+ prolapse w/ **spontaneous** reduction) grade 3 (+ prolapse w/ **manual** reduction) grade 4 (+ **irreducible** prolapse).
- External hemorrhoids that become thrombosed present with severe **pain**.
- The three hemorrhoid quadrants are: left lateral, right posterior, right anterior.
- Hemorrhoids are most commonly due to constipation, so we target our management to treating the constipation (high fiber diet, increase fluid intake).
- Other options include: rubber band ligation, or hemorrhoidectomy.
- Anal fissures are due to ischemia and more than 90% are in the **posterior midline**.
- Cardinal symptom of fissure is severe **pain during defecation** +/- bleeding (10 - 20%).
- Signs of chronic fissure (>6 months): **1.** Distal skin tag **2.** Proximal papilla **3.** Fibrotic and raised edges **4.** Exposed internal sphincter fibers (appear white).
- Treatment of fissure: treat constipation, vasodilators (CCB, nitrates), botox, internal sphincterotomy.
- Perianal abscess presents with pain and lump, treatment is **incision and drainage** + antibiotics (**only** in specific patients).
- For perianal fistula physical examination is key: location of internal & external opening, and the tract.
- Treatment of choice is **fistulotomy**. High complex fissures are treated with **seton**.

Pancreatic problems

Acute pancreatitis:

- Etiology:
 - **Gallstones (cholelithiasis): (1st most common)**
 - **Alcohol:** (2nd most common)
 - **ERCP** (endoscopic retrograde cholangiopancreatography): (3rd most common)
- Clinical presentation:
 - **Epigastric pain** the pain refer straight to the back, Nausea and vomiting.
 - Signs: **Grey Turner's and Cullen's signs**, Pleural effusion, shock.
 - **Dehydration (Rehydrate immediately by 2 liters)** The most important thing.
- **Ranson's Criteria** "Assessing severity & prognosis" :

Admission Criteria (GA LAW)	Initial 48-hr Criteria (C HOBBS)	Mortality
Glucose >200 mg/dL	Calcium <8 mg/dL Decrease in Hematocrit >10%	<3 criteria—1%
Age >55 yrs	PaO ₂ <60 mm Hg	3–4 criteria—15%
LDH >350	BUN increase >8 mg/dL	5–6 criteria—40%
AST >250	Base deficit >4 mg/dL	>7 criteria—100%
WBC >16,000	Fluid sequestration >6 L	

Pseudocyst:

- CT scan (**diagnostic**).
- **Treatment:** Observe for 6-12 weeks (**resolve spontaneously**)

Drainage indicated if:

- External drainage: in case of Infection.
- internal (Endoscopic) drainage:
 - Symptomatic (related to size).
 - **> 5 cm** (internal drainage).

Chronic pancreatitis:

- Commonest cause is **alcohol**. Presents with Malabsorption (leads to **steatorrhea** and **whitish stool**).
- The initial investigation for suspected chronic pancreatitis is CT.
- Treatment: **Pancreatic enzymes (for the malabsorption)**.

Pancreatic adenocarcinoma:

- ↑ with cigarette smoking (most important).
- **Examination: jaundice:**
 - A- For tumours in the head of the pancreas, painless jaundice, associated with weight loss is the classical presentation. (prognosis is good).
 - B- For tumours of the body and tail, biliary obstruction occurs late, and symptoms are often vague, with anorexia, weight loss. (they do not present with jaundice and the prognosis is poor).
- **Jaundice + fever = cholangitis (Medical emergency), patient need urgent ERCP.** always in the EXAM !!

Biliary Obstruction

- **Cholethiasis** (presence of gallstones in the gallbladder): presents with RUQ pain (colicky and intermittent) and radiates to back and shoulder, associated with nausea and vomiting but 80% can be asymptomatic.

- Risk factors for cholelithiasis: **5F's** (female, fertile, fat, forty, fair)
- What is the best test to detect stone in gallbladder? **ULTRASOUND**.
- What is the most sensitive modality for "BILIARY TREE SYSTEM" stones "not the gallbladder"? **EUS** (endoscopic ultrasound), if not available → **MRCP**
- ERCP is therapeutic (to remove stones) NOT diagnostic.
- What are **contraindications** of ERCP? active pancreatitis, cholangitis, hypotensive pt.
- What are the **complications** of ERCP? bleeding, perforation, pancreatitis, cholangitis.
- Surgical approach:
 - Afebrile → IV fluids + analgesics + elective cholecystectomy
 - Febrile + ↑ WBCs → IV fluids + analgesics + admit patient for cholecystectomy (timing depends on surgical window)
- Complications of cholelithiasis include:
 - Cholecystitis → continuous RUQ pain + fever + murphy's sign
 - Cholangitis → charcot's triad (**RUQ pain + fever + jaundice**) / management **PTC** or ERCP or cholecystectomy
 - Obstructive jaundice → yellow sclera + dark urine + pale stool = increase ALP & GGT

US findings	Cholelithiasis	Cholecystitis	Obstructive Jaundice
Stones	✓	✓	✓
Gallbladder wall thickening + pericholecystic fluid	x	✓	x
Dilation of biliary system	x	x	✓

Portal hypertension

Congenital Anomalies:

1. Liver cyst:
 - a. Histology: lined by biliary epithelium and contains serous fluid, doesn't communicate with the biliary tree.
 - b. Treatment: only for symptomatic patients, surgical deroofing or resection.
2. Cavernous hemangioma: **one of the most common benign tumors of the liver**
 - a. **Found incidentally.**
 - b. Histology: made by cavernous vascular spaces lined by flattened epithelium.
 - c. Affects women more than men.
 - d. May cause angioembolization or bleeding if it ruptures.
 - e. Diagnosis:
 - i. US: hyperechoic lesion.
 - ii. CT and MRI: centripetal filling of contrast during dynamic imaging.
 - f. Treatment for symptomatic patients: surgical resection.

Hepatic infections:

1. Pyogenic liver abscess:
 - a. Sources of infection: biliary system, portal vein (abdominal sepsis), hepatic artery, blunt or penetrating injury, idiopathic.
 - b. Organisms:
 - i. Hepatic artery: gram +ve aerobes: streptococcus milleri, S.aureus, enterococci.
 - ii. Portal vein:



1. Gram -ve aerobes: E.coli, klabsiella pneumonia, pseudomonas aeruginosa, proteus species and enterobacter cloacae.
 2. Gram +ve anaerobes: bacteroides, fusobacterium species.
 - c. Symptoms: fever, RUQ pain, swinging pyrexia, chills and rigors, toxicity.
 - d. Signs: general malaise and anorexia, jaundice, enlarged and tender liver.
 - e. Investigations: leukocytosis, elevated liver enzymes.
 - f. Radiology:
 - i. AXR: air in the liver.
 - ii. CXR: pleural effusion.
 - iii. **US**: hypoechoic lesion with thick wall, biliary dilation.
 - iv. **CT**: central hypodense lesion + peripheral contrast enhancement during the portal phase.
 - g. Treatment: drainage and antibiotics.
2. Amoebic liver disease:
- a. Pathogenesis: Ingested cyst in the large intestines > releases trophozoites > penetrates the mucosa > portal venous system > liver.
 - b. Organism: Entamoeba histolytica.
 - c. Clinical features: RUQ pain, anorexia, nausea, weight loss, night sweats and diarrhea, tender and large liver +/- jaundice.
 - d. Investigations:
 - i. CBC: leukocytosis.
 - ii. Direct and indirect serological tests:
 1. Indirect haem-agglutination (IHA)
 2. ELISA.
 - iii. Stool analysis.
 - e. Radiology:
 - i. US: hypoechoic lesions with ill-defined margins.
 - ii. CT: ill-defined lesions with complex fluid, enhancing wall with a peripheral zone of edema around the abscess.
 - f. Treatment: antibiotics (metronidazole), percutaneous aspiration (if antibiotics don't work for 3 days).
3. Hydatid cyst:
- a. Pathogenesis: Ingested ova hatch in the duodenum > portal system > liver.
 - b. Organism: **Echinococcus granulosus**, E.multilocularis.
 - c. Clinical features: asymptomatic, RUQ pain, anaphylactic shock (if it ruptures), obstructive jaundice.
 - d. Investigations:
 - i. Labs:
 1. CBC: eosinophilia.
 2. Serology tests:
 - a. Immunoelectrophoresis (IEP): **not for follow-up**.
 - b. ELISA: IgE or IgG4 (4 years), IgM (6 months).
 - c. Immunoblotting: first-line test.
 - ii. Radiology:
 1. AXR: calcification.
 2. US, CT and MRI: well-defined, circumscribed cystic lesions with a clear membrane and multiple daughter cysts.
 - e. Treatment:
 - i. Medical: **albendazole** or mebendazole.
 - ii. Surgical: deroofting, pericystectomy (**for large symptomatic cysts**), liver resection.
 - iii. PAIR if none works.

Tumors of the liver:

1. Benign:

- a. Liver cell adenoma: caused by estrogen and anabolic steroids:
 - i. Symptoms: RUQ pain.
 - ii. Complications: angioembolization, malignant transformation.
 - iii. Investigations: US, **CT and MRI**.
 - iv. Treatment:
 - 1. Female: <5 cm (stop OCP), **>5 cm (surgical resection)**.
 - 2. Males: surgical resection
- b. Focal nodular hyperplasia:
 - i. Symptoms: RUQ pain.
 - ii. Investigations: US, **CT and MRI**.
 - iii. Treatment: observation, if symptomatic > excision.

2. Malignant:

a. Primary:

- Hepatocellular carcinoma:
 - Risk factors: cirrhosis, hepatitis B&C, aflatoxin.
 - Clinical features: abdominal pain, weight loss, abdominal distension, fever and spontaneous intraperitoneal haemorrhage.
 - Investigations: LFT, CBC, coagulation profile, in CT and MRI > arterial enhancement.
 - Screening: **US (splenomegaly)**, AFP.
 - Diagnosis:
 - >1 cm + characteristic features.
 - Cytology: if no characteristic features were present.
 - <1 cm: 3-6 months follow-up.
 - Treatment:
 - Transplantation: Milan criteria: single tumour of 5 cm or less in diameter, or with no more than three tumour nodules each one 3 cm or less in size.
 - Liver resection: Non-cirrhotic patients, child A cirrhotic patients.
 - Locoregional therapy: TACE, local ablation.
 - Chemotherapy: Sorafenib.
- Cholangiocarcinoma:
 - Risk factors: parasitic infection, choledochal cysts.
 - Clinical features: **obstructive jaundice**, abdominal pain, **weight loss**, anorexia.
 - Investigations: **increased total bilirubin**, CA 19-9.
 - Radiology: **CT**, MRI, MRCP, ERCP and PTC.
 - Treatment: resection if solitary, metastatic > chemotherapy.

b. Metastatic:

- i. Sources: GI tract (CEA for colon, CA 19-9 for pancreatic), breast, ovaries (CA 125), bronchus, kidney.
- ii. Radiology: CT, MRI, PET CT.
- iii. Treatment: resection, chemotherapy.

Portal hypertension:

- Portal pressure: 3-6 mm Hg, if >10: shunting, if >12: bleeding.
- Clinical features:
 - Symptoms: **Hematemesis** +/- melena, chronic liver disease symptoms, hypotension, tachycardia.
 - Examination: hepatomegaly, **ascites**, jaundice and spider naevi.
- Assessment in acute settings: ABC > Endoscopy.
- Treatment:
 - **Endoscopy**: variceal ligation, sclerotherapy.
 - Pharmacological: octreotide, vasopressin.
 - Balloon tamponade: Sengstaken-blakemore tube.
 - TIPSS: **indication: uncontrolled variceal hemorrhage that doesn't respond to**

treatment.

- Surgical: shunting or devascularization.

Child's grading system for liver cirrhosis:

Table 14.2 Assessment of patients with portal hypertension using a modification of Child's grading system

Points scored			
Criterion	1	2	3
Encephalopathy	None	Minimal	Marked
Ascites	None	Slight	Moderate
Bilirubin ($\mu\text{mol/l}$)	< 35	35–50	> 50
Albumin (g/l)	> 35	28–35	< 28
Prothrombin ratio	< 1.4	1.4–2.0	> 2.0

Grade A = 5–6 points; grade B = 7–8 points; grade C = 10–15 points.