Nutritional Support

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Nutrition plays a vital role in the recovery of patients from surgery. It is estimated that between 30% and 50% of hospitalized patients are malnourished. Poor nutrition has deleterious effects on wound healing and immune function, which increases postoperative morbidity and mortality.

Nutritional requirements: The Calories are provided mainly by carbohydrate and fat

- Fat = 9 kcal/g
- Carbohydrate = 4 kcal/g
- Protein = 4 kcal/ g
- Daily caloric requirements: 30-35kcal/kg which is increased in sepsis, trauma, surgery or ventilation (35-40kcal/kg/day).
- Daily protein requirements in the average healthy adult without excessive losses are approximately 0.8 g/kg body weight

Malnutrition

According to the WHO, malnutrition is "the cellular imbalance between supply of nutrients and energy and the body's demand for them to ensure growth, maintenance, and specific functions.
What are the causes of malnutrition?

- Neglect (e.g., severe alcoholics, extreme of ages)
- Digestive problems
- Inadequate food intake
- Chronic illness
- Dysphagia
- Stress and trauma
- Vomiting

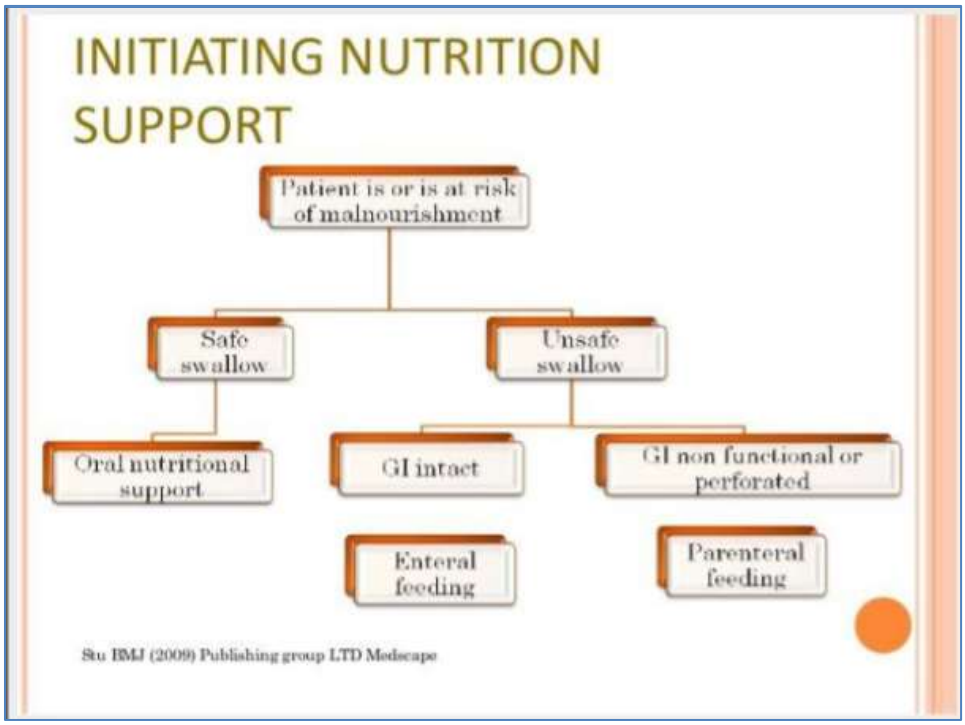
Nutritional assessment

1- Anthropometric measurements such as triceps skinfold thickness and midarm muscle circumference reflect body-fat stores and skeletal muscle mass, respectively.
2- body mass index (weight kg/height m2) < 18.5 indicates nutritional impairment.
3- Laboratory tests: Serum albumin of less than 3.5 g/dL, Serum prealbumin less than 5 mg/dl, Serum transferrin of less than 200 mg/dL.

Nutritional support is the provision of nutrients to patients who cannot meet their nutritional requirements by eating standard diets.

What are the indications for nutritional support?

- Inadequate intake for more than 5 days
- Malnourished patients undergoing surgery
- Major trauma (burn victims, blunt or penetrating injury, etc.)



Routes of nutritional support

1- Enteral nutrition
2- Parenteral nutrition

Enteral nutrition

- Delivery of nutrient into healthy and functioning gastrointestinal tract.
- Most preferred and more physiological
- Advantages:

- Maintain gut mucosal integrity
- Maintain normal gut flora & pH
- Cheap & easily available
- Less complications

. Types of enteral feeding:

1) Nasogastric tube (or nasoduodenal or nasojejunal)
2) Gastrostomy : placing the feeding tube through abdominal wall
   Into stomach (surgically or endoscopic)
3) Jejunostomy : placing the feeding tube through abdominal wall
   Into jejunum (surgically or endoscopic)

- Note: For long-term enteral feeding, enterostomies are the preferred access route than nasogastric tube.
- Nasoduodenal tube feedings are indicated in:
  • Patients at risk for aspiration.
  • Patients who are debilitated, demented, stuporous, or unconscious.
  • Patients with gastroparesis or delayed gastric emptying.

- The available dietary formulations for enteral feedings can be divided into polymeric (blenderized and nutritionally complete commercial formulas), chemically defined formulas (elemental diets)
- Indication: Enteral feedings are indicated for patients who have a functional GI tract but are unable to sustain an adequate oral diet

Indications for enteral tube feeding

Indication for feeding	Examples
Unconscious patient	Head injury, ventilated patient
Swallowing disorder	Post-CVA, multiple sclerosis, motor neurone disease.
Physiological anorexia	Liver disease (particularly with ascites)
Upper GI obstruction	Oesophageal stricture.
Partial intestinal failure	Postoperative ileus (see section 5.0), inflammatory bowel disease, short bowel syndrome.
Increased nutritional requirements	Cystic fibrosis, renal disease.
Psychological problems	Severe depression or anorexia nervosa.

GI, gastrointestinal; CVA, cerebrovascular accident.

Source : Nightingale, J. et al. 2003

- Contraindication: intestinal obstruction, ileus, GI bleeding, severe diarrhea, vomiting, enterocolitis, or a high-output enterocutaneous fistula. It is also contraindicated in patients in shock.
- Complications:
  I. Tube-related: malposition, break, block and leakage of feeding tube.
  II. Gastrointestinal: nausea, vomiting, diarrhea and pulmonary aspiration
  III. Metabolic: constipation, electrolyte imbalance
  IV. Infections

Parenteral nutrition

Parenteral nutrition is a way to feed the patient intravenously. It can be delivered centrally through a central venous catheter, most commonly in the superior vena cava or peripherally (PPN) via a peripheral vein.
While the total Parenteral nutrition (TPN) is the delivery of all the required nutrients parenterally. It is a solution containing proteins, carbohydrates, fat, vitamins, and minerals. Because of the high osmolarity of the solution and the risk of phlebitis, it is usually given centrally rather than peripherally. Consequently, solutions delivered peripherally need to be diluted and may not meet the complete nutritional requirements of the patients.

When are TPN and PPN indicated?
TPN is indicated when patients need long-term nutritional support but are not able to receive enteral feedings (nonworking GI tract, shock, pancreatitis, bone marrow transplant, etc.). PPN is indicated in patients requiring short-term nutritional support (<10 days) to restrict protein breakdown.

- **Indications** of parenteral nutrition: indicated for patients who require nutritional support but cannot meet their needs through oral intake and for whom enteral feeding is contraindicated or not tolerated.
- **Contraindications**: heart failure, blood dyscrasia and altered fat metabolism.
- **Complications** of parenteral nutrition?
  Hyperglycemia, fatty liver, hypercapnia, acute respiratory distress syndrome, GI mucosal atrophy (predisposing the gut for bacterial translocation and septicemia). Catheter-related complications include infections and pneumothorax

Blood products and blood Transfusion

Blood provides transportation of oxygen to meet the body's metabolic demands and removes carbon dioxide in addition to its function: regulation (PH, heat) and protection (enzymes, antibodies …).
Blood grouping involve adding A, B, RhD antibodies to donated blood to determine blood type – it takes less than 5 minute
Cross-matching involve mixing donated blood with intended recipient serum, it is used to assess compatibility, it takes about 20 min.

Blood products:

Banked whole blood : whole blood (consist of RBCs, WBCs and platelets in plasma) is stored at 4 C° and has a storage life of up to 35 days. It may be necessary in certain types of major surgery (as in ACUTE BLOOD LOSS > 15%) and major trauma such as a car accident or gunshot wound requiring emergency surgery**.**

Fresh Whole Blood This term refers to blood given within 24 h of its collection.. one unit of blood increase Hb by about 1g/dl.

Packed Red Cells and Frozen Red Cells Packed cells have approximately 70 percent of the volume of whole blood. Used in elderly and CHF.

Platelet Concentrates: Platelet transfusions should be used for Thrombocytopenia, one unit(50 ml) increase platelets counts by 10^9/L. indications of platelets transfusion:

- Platelet count < 20,000/mm3
- Platelet count <50,000/mm3 **if with microvascular bleeding**.
- Complicated surgeries with >10 units of blood transfused, with signs of microvascular bleeding
- Documented platelet dysfunction (prolonged BT, abnormal platelets function tests)

Fresh Frozen Plasma: One unit of FFP contain all the coagulation factors except platelets. Fresh frozen platelets are used for replacement of deficiencies of factors II, V, VII, IX, and XI when specific component therapy is not available or desirable. Also FFP is indicated in :

- PT or PTT greater than 1.5 times the mean of the reference range (PT>16, PTT>39) in a non-bleeding patient scheduled to undergo surgery or invasive procedure
- Massive transfusion (more than 1 blood volume or 10 units)
- Emergency reversal of warfarin anticoagulation

In an average-size adult, each unit of FFP increases the level of all clotting factors by 2%-3%, and most bleeding can be controlled by transfusion of FFP at a dose of 10 *mL/kg* of body weight.

Cryoprecipitate: one bag of cryoprecipitate contains 150-250 mg fibrinogen, and factors VII and VIII. Examples are Von Willebrand disease or hemophilia unresponsive to desmopressin (DDAVP) and no appropriate factor concentrates available. Also, in Uremic patients.

Methods of blood transfusion

1- Intravenous (I.V.)

A. Auto-transfusion: is a process where a person receives their own blood for a transfusion, instead of banked allogenic (separate-donor) blood. Autotransfusion is intended in cases involving rare blood groups, risk of infectious disease transmission, restricted homologous blood supply There are two main kinds of autotransfusion.
   - ❖ collect blood from the patient 3 weeks before operation and given to him when needed.
   - ❖ collected during and after the surgery using an intraoperative blood salvage device (such as a Cell Saver). This form of autotransfusion is utilized in surgeries where there is expected a large volume blood loss - e.g. aneurysm, total joint replacement, and spinal surgeries.

B. Iso-transfusion: The most common type of transfusion from donor to the patient, we give up to 1L of blood in short time.

2- Intraperitoneal and intramedullary (theoretically)

Technique of transfusion

- **Blood aspirated from the healthy donor with normal Hb%,** (500 cc) taken into plastic bag with liquid anticoagulant (citrate phosphate dextrose). This can be stored for 5 weeks at 4C.
- **Blood grouping and Rh for the patient and the donor** with cross matching can be done by:
  a. Long method: take 1-2 hrs it is best way because can distinguish minor groups incompatibility.
  b. Short method: take 5-15 min, we mix RBC of the donor and serum of recipient, centrifuge and look for coagulation under microscope. It is mainly used in emergency.
  c. Blood group O-ve blindly: this universal donor can be given to recipients of any ABO Rh group without incompatibility reaction. It is used for very extreme emergencies (rare).

Indications of blood transfusion:

1- Replacement of blood: e.g. trauma (pelvic fracture), major surgery with excessive blood loss. Loss of 1 pint (500 cc) has almost no effect, while loss

of 2 pints lead to postural hypotension and should be corrected by crystalloid alone. Loss of 4 pints lead to hypotension and need blood transfusion.

2- Improvement of O2 carrying capacity: especially in severe anemia and acute hemorrhage.

3- Replacement of clotting factors, fibrinogen and platelets.

- Platelets and factors VIII and IX in selected patient like in thrombocytopenia and hemophilia
- Fibrinogen given for dissiminated intravascular coagulation (DIC)

4- Preoperative correction: e.g. anemia, hypoproteinemia.

5- Miscellaneous: extensive burn, sepsis

Complications:

1- Hemolytic reactions: due to

a. Major incompatibility reaction: due to mismatched blood (ABO incompatibility)
b. Minor incompatibility reaction: due to minor group and Rh incompatibility.

Most often of ABO mismatch due to a clerical error.

Clinical features:

1. Fever, rigor, chills, hypotension.
2. Loin pain, hematuria and later anuria due to renal involvement
3. In an unconscious or anesthetized patient: hypotension and Uncontrollable bleeding due to disseminated intravascular coagulation may be the only signs of a hemolytic transfusion reaction

Treatment

1. Stopping the transfusion immediately.
2. Large doses of mannitol to enhance diuresis.
3. i.v. fluid.
4. Urine alkalization by NaHCO3 (help in dissolving heme from the renal tubules).
5. Sometimes dialysis is used when above measures fail.

2- Allergic reaction: it is less dangerous and is due to any antigen in the plasma or WBC.

- Clinical features: fever, itching, urticaria rash, and rarely anaphylactic shock.
- Treatment: I.M. antihistamine, I.V. hydrocortisone and sometimes s.c. adrenaline.

3- Pyrexial reaction: it is due to pyrogens in the transfused blood causing fever and rigor.(the more the blood is left at room temperature, the more liable to pyrogenic reaction as blood is good media for bacteria growth).

4- Bacterial sepsis

5- infections: syphilis, HIV, HBV.

6- Thrombophlebitis

7- Air embolism: rarely occurs because it needs 80 ml of air to cause embolism.
8- Specific complications of massive blood transfusion: these can be seen if more than 5 pints of blood is given within short period.
Causes of post-transfusion bleeding:

a. Hypocalcemia: due to union of serum calcium with the component of the anticoagulant leading to hypocalcemia which affect O2 dissociation curve. So for each 2 pints of blood , 10ml of Ca^{++}gluconate should be given and for each 4-5 pints of old blood, the next one should be fresh blood.
b. Dilutional thrombocytopenia
c. Platelets sensitization in which antibody develops against donor platelets.
d. Hemolytic reaction with DIC.

TREATMENT OF POST-TRANSFUSION BLEEDING:
1- Heparin given to decrease DIC and open the microcirculation
2- Low molecular weight (40,000) dextran.
3- platelets
4- fresh frozen plasma FFP
5- 1/3- 1/4 of the blood should be in fresh form
6- Ca^{++} gluconate 10 ml for each 2 pints of blood (which is important for coagulation).

Case history and clinical examination

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The art of taking accurate case history is probably the most important single step in the diagnosis of a medical or surgical condition.
A case history may be divided into:

I. The patient name, age, occupation and address
II. Chief complaint
III. History of present illness
IV. Medical, social, dental and family history.

- Cc: The nature and duration of the presenting symptoms should be considered briefly in one- or two-word summary. abdominal pain, nausea and vomiting.

- HPI: what was the first thing that he noticed wrong?
what other symptoms have occurred?
what make it better or worse?
what seems to be the main trouble now?
what treatment has he had and does it help?
what does the patient think he is suffering from?
ask about: (appetite, weight, bowl habits, sleep, dypnea, chest pain or swollen ankles).

-Medical Hx: inquire of the patient what diseases, operations or accidents he has sustained and list them in chronological order .Always give the dates and do not write 'three years ago' ….ect.
-Family Hx: Health and medical status of patient relatives should be asked.
-Social history: this part of history enables the physician to build up a picture of patient background like smoking, drinking alcohol and occupation.

Clinical examination:

After accurate case history has been taken, the clinical examination is carried out. This consists of:-
1- General physical examination of the patient using the principles of examination (inspection, palpation, percussion, auscultation).
2- Local examination of the lesion which carefully elicits all its clinical characteristics.

Clinical examination of patient with a pain

Pain anywhere should have the same features elicited. These can be summarized by the acronym SOCRATES.

- Site :where is the pain, is it localized or generalized?
- Onset : Gradual or sudden? Intermittent or generalized?
- Character: Sharp, stabbing, dull, aching, sore?
- Radiation : Does it spread to other areas?(from loin to groin in ureteric pain, to jaw and neck in myocardial pain)
- Associated symptoms: Nausea, vomiting, dysuria, jaundice?
- Timing: Does it occur at any particular time?
- Exacerbating or relieving factors: relief with hot water bottles suggest deep inflammatory or infiltrative pain.
- Surgical history: Does the pain relate to surgical intervention.

- **Other common surgical symptoms:** dyspepsia, dyspnoea, dysphagia, haematemesis, haemoptysis, abdominal distension, jaundice, change in bowel habit

The examination of lump

Before carrying out a local physical examination of any lump or mass, it is essential to ascertain:-

- How long the swelling has been present?
- Whether it is getting larger?
- Whether there is any possible cause for swelling., trauma.

The features of lump that should be considered can be remembered by acronym (4 students and 3 teachers around the campfire):-

- Site: the lump may arise from skin, s.c. , muscle, tendon, BV., nerves or organ. The lump must be described with reference to the body surface landmarks,e.g. angle of mandible.
- Size
- Shape
- Surface: of the mass may be smooth, lobulated or irregular.
- Tenderness: on gentle palpation is valuable physical sign. Inflammatory lumps are tender while neoplasms are painless unless secondarily infected.
- Temperature: the site of acute inflammation is usually warmer than the adjoining areas.
- Transillumination: Whether a torch behind lump will allow light to shine through the lump. The only readily transilluminable swelling of the head and neck is the cystic hygroma .
- Consistency and color: the consistency of lump is defined surgically as Soft as in lipoma , Firm as in fibroma , Cartilage Hard as in pleomorphic adenoma, Bony hard as in

osteoma, Rock hard as in malignant lymph nodes, Rubbery hard as in Hodgkin lymphoma.

The color of lump may be helpful diagnostic sign like reddening may suggest inflammatory etiology.

- Appearance of patient: massive swellings associated with cachexia of the patient are usually indicative of malignant neoplasms.
- Mobility: Move lump in two directions, right-angled to each other. Then repeat exam when muscle contracted:

a) Bone: immobile.
b) Muscle: contraction reduces lump mobility.
c) Subcutaneous: skin can move over lump.
d) Skin: moves with skin

- Pulsation: Assess with 2 fingers on mass, there are three types of pulsation which may occur in lumps:

a) The mass may be pulsatile: aneurysm
b) Transmitted pulsation occur when the mass rests on a large artery,e.g. palatal adenoma of the palate which transmit pulsation of greater palatine artery.
c) A mass lying deep in the tissue may displace artery so that it lies superficially upon the mass.

- Fluctuation: indicate presence of fluid within the lump. It is elicited by placing the tips of two fingers on the lump. When pressure is applied to the mass with one finger, transmitted upward impulse is felt with the other finger-tip.
- Reducibility: Reducible mass reappears only on cough,e.g. hernia.
- Regional lymph nodes
- Edge: of the lump may be clearly defined or diffuse, fading into the surrounding tissues as in inflammatory lumps.

Examination of ulcer

Is a discontinuity or break in a skin or mucous membrane.

Classification:

1. Venous
2. Arterial
3. Diabetic
4. Neuropathic
5. Traumatic
6. Malignant
7. Infective

local examination of an ulcer:

A) *Inspection*: we should note

1) Size & Shape (ulcer may be round, oval, crescentic, irregular in shape)

2) Number

3) Location: many ulcers occur in characteristic sites.

- Varicose ulcer → medial aspect of lower third of the leg
- Rodent ulcer → nose
- Squamous cell carcinoma ulcer ⟶ tongue
- Tuberculous ulcer → neck
- Syphilis ⟶ junction of hard and soft palate
- Trophic ulcer → weight-bearing area (e.g. heel of the feet)
- Bedsore ulcer→ sacrum

4) Floor: is the exposed surface of the ulcer. We should note:-

- ❖ The granulation tissue (this may be red, pale), amount of sloughing (necrotic tissue not yet separated from living tissue), membrane..ect.
- ❖ Discharge: which may be
- ❑ Serous (plasma that's thin, clear and watery),
- ❑ Serosanginous (This leakage is thin and watery, and it's pink in color (it can also be a darker red),
- ❑ Sanginous (fresh blood)
- ❑ Purulent. (gray, green or yellow, and purulent drainage is most commonly thick in consistency)

5) Margin & Edge: ***Margin*** *is the border or transitional zone of skin around an ulcer*. There are three types:

-Healing margin [white (outer) – blue (central) – red (Inner)]

-Inflamed margin (red, irregular margin with inflamed surrounding skin)

-Fibrosed margin (thickened white)

Edge *is the mode of union between the floor and the margin of* ulcer. There are five types: (see figure below)

o Sloping edge → healing ulcer
o Punched edge → trophic ulcer, syphilis
o Undermined edge → tuberculous ulcer
o Everted edge→ malignant ulcer
o Raised (rolled) edge → basal cell carcinoma (rodent ulcer).

6) Surrounding skin: if ulcer is spreading and infected the surrounding skin is shiny, red, edematous due to cellulitis.

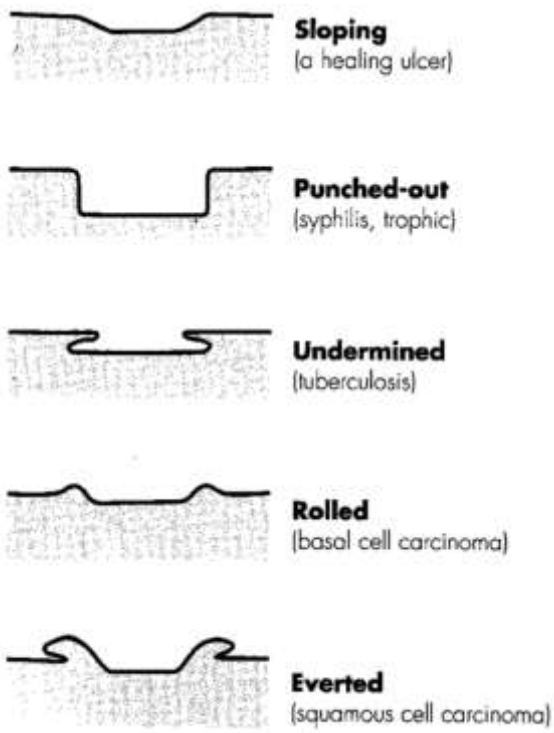

FIG 1.15 The varieties of ulcer edge.

B)Paplation

1) Surrounding skin for temperature and tenderness.
2) Ulcer: edge, base
3) Test the fixity of the ulcer to the structures in its base.

Base (tissue on which the ulcer rests): note
• Consistency (soft, indurated or fixed)
• Underlying structures (muscle, fascia or bone).

C) Focal examination

1. Regional Lymph node,e.g.
• Hard, discrete, non-tender → malignant ulcer
• Soft, tender → infective
• Non-tender, matted → tuberculous ulcer
2. State of arteries, venous circulation, nerves
3. Movement of neighboring joints

D) Systemic examination

• Cardiovascular: for CHF which delays ulcer healing
• Respiratory: for TB .

Fluid and electrolyte management

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Learning objective

- To understand the distribution and composition of body fluids, and how these may change following surgery
- To understand types of intravenous fluid therapy and common electrolyte disorders

The management of a patient' s fluid status is vital to a successful outcome in surgery. This requires preoperative assessment, with resuscitation if required, and postoperative replacement of normal and abnormal losses until the patient can resume a normal diet.

Body fluid compartments (Figure 1)

In the 'average' person, water contributes 60% to the total body weight: 42 L for a 70 kg man. 40% of the body weight is intracellular fluid, while the remaining 20% is extracellular. This extracellular fluid can be subdivided into intravascular (5%) and extravascular, or interstitial (15%). Fluid may cross from compartment to compartment by osmosis, which depends on a solute gradient, and filtration, which is the result of a hydrostatic pressure gradient.

The electrolyte composition of each compartment differs. Intracellular fluid has a low sodium and a high potassium concentration. In contrast, extracellular fluid (intravascular and interstitial) has a high sodium and low potassium concentration. Only 2% of the total body potassium is in the extracellular fluid. There is also a difference in protein concentration within the extracellular compartment, with the interstitial fluid having a very low concentration compared with the high protein concentration of the intravascular compartment.

Knowledge of fluid compartments and their composition becomes very important when considering fluid replacement. In order to fill the intravascular compartment rapidly, a plasma substitute or blood is the fluid of choice. Such fluids, with high colloid osmotic potential, remain within the intravascular space, in contrast to a saline solution, which rapidly distributes over the entire extravascular compartment, which is four times as large as the intravascular compartment. Thus, of the original 1 L of saline, only 250 mL would remain in the intravascular compartment.

Osmolality refers to the number of osmoles of solute particles per kilogram of water. The asymmetric accumulation of effective osmoles in either extracellular fluid (e.g., Na+, glucose, mannitol, and glycine) or intracellular fluid (e.g., K+, amino acids, and organic acids) causes transcompartmental movement of water. Because the cell membrane is freely permeable to water, the osmolalities of the extracellular and intracellular compartments are equal. The effective osmolality of a solution is equivalent to its tonicity.

Plasma osmolality= 2[Na+] + [Glucose]/18 + [BUN]/2.8

- The normal range is 280-290 mOsm/L

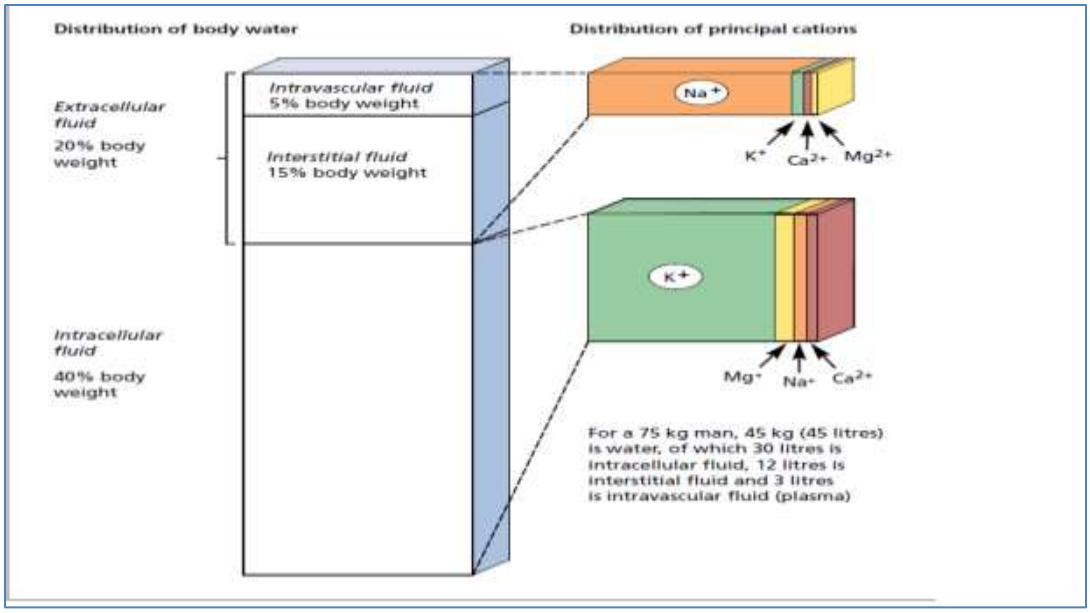

Figure 1: Distribution of fluid and electrolyte in body

Table 2.1 Normal daily fluid losses

Fluid loss	Volume (mL)	Na^+ (mmol)	K^+ (mmol)
Urine	2000	80–130	60
Faeces	300		
Insensible	400		
Total	2700		

Types of intravenous fluids

The fluids used in clinical practice are usefully classified into colloids and crystalloids.

1-Colloids: solutions that contain large molecules that can't pass through gap junctions of blood vessels. When infused, they remain in the intravascular compartment and expand it and they draw fluid from extravascular spaces via their higher oncotic pressure.

Indications:

- Rapid replacement of intravascular fluid (so called plasma expander)
- Correct albumin and protein level

Examples: albumin, plasma, blood and its products, dextran.

2- Crystalloids: solutions contain small molecules that flow easily across cell membranes, allowing for transfer from the bloodstream to the cells and tissues. This will increase fluid volume in both the interstitial and intravascular spaces.

It is divided according to osmolarity into:

- Isotonic : 0.9% NaCl, lactate ringer , 5% dextrose
- Hypotonic: 0.45%NaCl
- Hypertonic: D5 in 0.9% normal saline.

Intravenous infusion	Na^+ (mmol/L)	Cl^- (mmol/L)	K^+ (mmol/L)	HCO_3^- (mmol/L)	Ca^{2+} (mmol/L)
Normal saline (0.9% saline)	150	150	–	–	–
4% dextrose/ 0.18% saline	30	30	–	–	–
Hartmann's (compound sodium lactate)	131	111	5	29	2
Normal plasma values	134–144	95–105	3.4–5.0	22–30	2.2–2.6

INDICATIONS OF FLUID THERAPY

I. Fluid resuscitation

Patients who are in hypovolemic shock require rapid fluid infusions in the form of fluid challenges to maintain intravascular volume.
Rapid infusion of a 1000 mL bolus of normal (isotonic) saline (NS) or lactated Ringer's solution (RL) within 15 minutes.

II. Replacement of ongoing fluid loss

Fluids are also indicated in the post-resuscitation phase when the patient is no longer hypovolemic but still has ongoing abnormal fluid loss that cannot be compensated for by oral intake alone.
Some common conditions associated with an ongoing fluid loss are:

- Burns
- Polyuria (high output renal failure, diabetes insipidus)
- Surgical drainage
- Significant ongoing gastrointestinal loss (vomiting, diarrhea)

III. Maintenance fluid therapy

Maintenance fluids are indicated in patients who cannot or are not allowed to take fluids orally. The most commonly used formula is

Holliday-segar method which is 4-2-1 or 100-50-20.

- 100 ml/kg/24-hours = 4 ml/kg/hr for the 1st 10 kg
- 50 ml/kg/24-hours = 2 ml/kg/hr for the 2nd 10 kg
- 20 ml/kg/24-hours = 1 ml/kg/hr for the remainder of weight

Example: 70-kg patient with severe mandibular fracture and can not take fluids orally. What is the amount of maintenance fluids which should be administrated to patient in 24 hrs?
100 x 10 kg= 1000 ml
50 x 10 kg= 500 ml
The remainder of 70kg is 50 kg, so 50kg x 20=1000 ml
The Total is (2500 ml) which is the amount of maintenance fluid.

Abnormalities of body water

1-Dehydration: is excessive loss of body water.

- Causes:
  I. Insufficient fluid intake
  II. Excess loss of fluid (surgical procedure, diseases)
  III. Haemorrhage
  IV. Diarrhea, bowel obstruction, vomiting
  V. Fistula
  VI. Diuresis by drugs
  VII. Insensible losses (pyrexia)
- Signs and symptoms:
  I. Dry mouth, thirst, oliguria
  II. Decreased skin turgor, pinched face, tachycardia, postural hypotension
- Management:
  I. Identify source of sodium loss if present because loss of water also lead to hyponatremia
  II. Mild- moderate dehydration: use oral rehydration solutions
  III. Severe dehydration: use i.v. isotonic solution such as N/S.

2-Fluid overload and oedema

Excess body water occurs in several diseases

- Causes:
  I. Excess intake of fluid: most common cause, ex. Excess i.v. fluid administration
  II. Decreased loss of water with salt retention which may occur in many diseases such as renal failure, liver failure, cardiac failure.
- Signs and symptoms:
  I. Oedema
  II. Weight gain
  III. Orthopnea
  IV. Increase blood pressure
  V. Distention of jugular vein
- Management
  I. Limit sodium intake
  II. Use of diuretics like frusemide

Fluid and electrolyte management

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COMMON ELECTROLYTE DISORDERS

A. ***Sodium***

Physiology: Sodium balance is maintained primarily by the kidneys. Normal Na+ concentration is ***135 to 145 mmol/L*** (310 to 333 mg/dL). Potential sources of significant Na+ loss include sweat, urine, and gastrointestinal secretions.

1- Hyponatremia

I. ***Causes : may occur in hypovolemia (decreased water content), euvolemia (normovolemia) and hypervolemia (fluid overload).***

Most likely cause of hyponatremia	Type of hyponatremia
Heart failure, renal failure Liver cirrhosis, hypoalbuminemia	Hypervolemic hyponatremia
Hypothyroidism Adrenal insufficiency Drug induced or tumor related SIADH	Euvolemic hyponatremia
Thiazide	Euvolemic or hypovolemic hyponatremia
Severe dietary deficiency	Hypovolemic hyponatremia

II. ***Clinical manifestations***. Symptoms associated with hyponatremia are predominantly neurologic and result from hypoosmolality. Symptoms include lethargy, confusion, nausea, vomiting, seizures, and coma.

III.***Treatment***

1-correction of the underlying disorder.

2-Hypovolemic hyponatremia can be managed with administration of 0.9% NaCl to correct volume deficits and replace ongoing losses.

3-Water intoxication (hypervolemic hyponatremia) responds to fluid restriction (1,000 mL/day).

2-Hypernatremia

i. ***Causes*** : Hypernatremia is uniformly hypertonic and typically the result of water loss in excess of solute.
   1) Hyperaldosteronism
   2) Acute or chronic Renal failure
   3) Corticosteroids
   4) Increase in oral Na intake
   5) Sodium containing IV fluids
   6) Adrenal insufficiency
   7) Skin losses (burns)
   8) GI losses (diarrhea)

ii. ***Clinical manifestations***.
   1) Neuro - Spontaneous muscle twitches. Irregular contractions. Skeletal muscle weakness.
   2) Thirst and altered mental status
   3) CV –. tachycardia and hypotension.
   4) GU – Dec. urine output.
   5) Skin – Dry, flaky skin

iii. Treatment:
- *Severe case - use D5W*
- *Mild – Ensure water intake*

B. Potassium

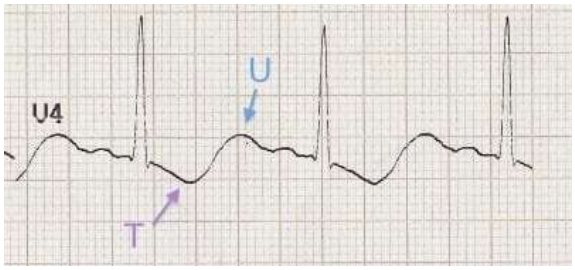
The normal serum concentration is 3.3 to 4.9 mmol/L (12.9 to 19.1 mg/dL). Approximately 50 to 100 mmol K+ is ingested and absorbed daily. Ninety percent of K+ is renally excreted, with the remainder eliminated in stools.

1.Hypokalemia

I. Causes.

- GI losses (e.g., diarrhea, persistent vomiting, and nasogastric suctioning),
- renal losses (e.g., diuretics ex: lasix)
- cutaneous losses (e.g., burns).
- acute intracellular K+ uptake (associated with insulin excess, metabolic alkalosis, myocardial infarction

II.Clinical manifestations. Symptoms occur with severe K+ deficiency [K+ <3 mmol/L)] and are primarily cardiovascular (arrhythmia). Early electrocardiogram (ECG) manifestations include T-wave flattening or inversion, ST-depression and less frequently prolong PR intervals.

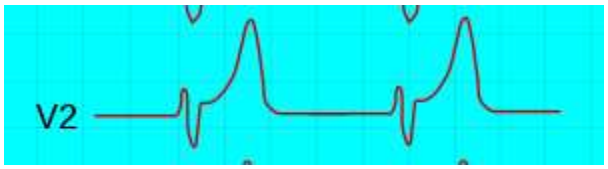


III.Treatment. identify and correct the cause. In mild hypokalemia, oral replacement 40 to 100 mmol KCl orally in single or divided doses is suitable.

2.Hyperkalemia

I.Causes. Abnormal redistribution of K+ from the intracellular to the extracellular compartment may occur as a result of insulin deficiency, β-adrenergic receptor blockade, acute acidemia, rhabdomyolysis, cell lysis, digitalis intoxication, and Addison syndrome.

II.Clinical manifestations. Signs of significant hyperkalemia [K+ >6.5 mmol/L] are, most notably, ECG abnormalities: symmetric peaking of T waves and widening of the QRS complex. If untreated, severe hyperkalemia ultimately may cause a sinusoidal ECG pattern.



III.Treatment

- Emergency: infusion of CaCl, sodium bicarbonate, insulin and glucose
- Non-emergent: restrict K intake+ administration of polystyrene sulfonate or diuretics (Lasix)
- Renal failure: dialysis

C.Calcium

1.Hypocalcemia

I.Causes:

- Dec. oral intake
- Dec. Vitamin D intake
- End stage renal disease
- Diarrhea

- Acute pancreatitis
- Hyperphosphatemia
- Immobility
- Removal or destruction of parathyroid gland

II.Clinical manifestations. Tetany is the major clinical finding and may be demonstrated by Chvostek's sign (facial muscle spasm elicited by tapping over the branches of the facial nerve) and trousseau's sign (carpal spasm by inflating blood pressure cuff and maintaining cuff pressure above systolic). The patient may also complain of perioral numbness and tingling. In addition, hypocalcemia can be associated with QT-interval prolongation and ventricular arrhythmias.

III.Treatment:

- ***Calcium supplements***
- ***Vitamin D supplement***

2.Hypercalcemia

I.Causes :

- Excessive calcium intake
- Excessive vitamin D intake
- Renal failure
- Hyperparathyroidism
- Malignancy
- Hyperthyroidism

II.Clinical manifestations.

- Neuro – Disorientation, lethargy, coma, profound muscle weakness
- Resp. – Ineffective resp. movement
- **CV -** Inc. HR, Inc. BP. , Bounding peripheral pulses. Late Phase – Bradycardia, Cardiac arrest
- **GI –** Dec. motility. Dec. BS. Constipation
- **GU –** Inc. urine output. Formation of renal calculi

III.Treatment:

- Eliminate calcium and vit.D administration
- NaCl 0.9% and loop diuretics may rapidly correct hypercalcemia.
- calcitonin, in conjunction with adequate hydration,
- Pamidronate, in conjunction with adequate hydration,
- Plicamycins

Haemorrhage

Haemorrhage must be recognized and managed aggressively to reduce the severity and duration of shock and avoid death and or multiple organ failure. Haemorrhage is treated by arresting the bleeding – not by fluid resuscitation or blood transfusion.

Attempting to resuscitate patients who have ongoing haemorrhage will lead to physiological exhaustion (coagulopathy, acidosis and hypothermia) and subsequently death.

Classification

A. Revealed and concealed haemorrhage

Haemorrhage may be revealed or concealed. Revealed haemorrhage is obvious external haemorrhage, such as exsanguination from an open arterial wound or from massive haematemesis from a duodenal ulcer.

Concealed haemorrhage is contained within the body cavity and must be suspected, actively investigated and controlled. In trauma, haemorrhage may be concealed within the chest, abdomen, pelvis, retroperitoneum or in the limbs with contained vascular injury or associated with long-bone fractures. Examples of non-traumatic concealed haemorrhage include occult gastrointestinal bleeding or ruptured aortic aneurysm.

B.Primary, reactionary and secondary haemorrhage

Primary haemorrhage is haemorrhage occurring immediately due to an injury (or surgery). Reactionary haemorrhage is delayed haemorrhage (within 24 hours) and is usually due to dislodgement of a clot by resuscitation, normalisation of blood pressure and vasodilatation. Reactionary haemorrhage may also be due to technical failure, such as slippage of a ligature.

Secondary haemorrhage is due to sloughing of the wall of a vessel. It usually occurs 7–14 days after injury and is precipitated by factors such as infection, pressure necrosis (such as from a drain) or malignancy.

C.Surgical and non-surgical haemorrhage

Surgical haemorrhage is due to a direct injury and is amenable to surgical control (or other techniques such as angioembolisation).

Non-surgical haemorrhage is the general ooze from all raw surfaces due to coagulopathy and cannot be stopped by surgical means (except packing). Treatment requires correction of the coagulation abnormalities.

D.Depending on the nature of bleeding vessel:

i) Arterial Hemorrhage: Bright red in color. Blood emitted as a jet with each heartbeat.

ii) Venous Hemorrhage: Dark red in color. Blood flow is steady.

iii) Capillary Hemorrhage: Bright red in color. Generalized ooze of blood instead of blood flow

E. Depending upon percentage of blood loss:

i) Class I: Up to 15%.

ii) Class II: Between 15 – 30%.

iii) Class III: Between 30 – 40%.

iv) Class IV: More than 40%

Degree of haemorrhage

The adult human has approximately 5 litres of blood (70 mL/ kg children and adults, 80 mL/kg neonates). Estimation of the amount of blood that has been lost is difficult, inaccurate and usually underestimates the actual value.

External haemorrhage is obvious, but it may be difficult to estimate the actual volume lost. In the operating room, blood collected in suction apparatus can be measured and swabs soaked in blood weighed.

The haemoglobin level is a poor indicator of the degree of haemorrhage because it represents a concentration and not an absolute amount. In the early stages of rapid haemorrhage, the haemoglobin concentration is unchanged (as whole blood is lost). Later, as fluid shifts from the intracellular and interstitial spaces into the vascular compartment, the haemoglobin and haematocrit levels will fall.

Although conceptually useful, there is variation across ages (the young compensate well, the old very poorly), variation among individuals (e.g. athletes versus the obese) and variation due to confounding factors (e.g. concomitant medications, pain).

Treatment should therefore be based upon the degree of hypovolaemic shock according to vital signs, preload assessment, base deficit and, most importantly, the dynamic response to fluid therapy. Patients who are ‘non-responders’ or ‘transient responders’ are still bleeding and must have the site of haemorrhage identified and controlled.

CLINICAL EVALUATION

Evaluation of patient with coordinated history and physical examination provides valuable clues. History should include following questions:

1. Is there any personal or family history of bleeding tendency?

2. Has the patient undergone surgery or extractions previously?

3. Any history of hematuria, GIT hemorrhage, epistaxis?

4. What medication is the patient taking or has taken recently?

Note for any splenomegaly, hepatomegaly. Hepatic insufficiency should be assessed. Assessment of skin and mucosal surfaces.

LABORATORY TESTS

1. Bleeding Time (BT): • Patients with BT more than 10 minutes have increased risk of bleeding. • Various methods for measuring BT, e.g. Ivy, Duke and template. • BT is prolonged in thrombocytopenia, Von – Willebrand's disease and platelet dysfunction.

2. Platelet count: • Normal count: **150,000** to **450,000** platelets per microliter of blood. • • Patients with count less than 50,000 per cm^3 have easy bruising. • Minor oral surgical procedures can be done if count is above 80,000 -100000 platelets/cm^3.

3. Prothrombin Time (PT): • Normal PT is usually 12 – 14 seconds. • Prolonged in patients on warfarin anticoagulant therapy, vitamin K deficiency or deficiency of factors II, VII, IX, and X, and fibrinogen(I).

4. Partial Thromboplastin Time (PTT): • Normal PTT is less than 45 seconds. • PTT measures the activity of factors I, II, V, VIII, IX, X, XI, and XII.

Management

Identify haemorrhage

External haemorrhage may be obvious, but the diagnosis of concealed haemorrhage may be more difficult. Any shock should be assumed to be hypovolaemic until proven otherwise and, similarly, hypovolaemia should be assumed to be due to haemorrhage until this has been excluded.

Immediate resuscitative manoeuvres

Direct pressure should be placed over the site of external haemorrhage.

Airway and breathing should be assessed and controlled as necessary. Large-bore intravenous access should be instituted and blood drawn for cross-matching. Emergency blood should be requested if the degree of shock and ongoing haemorrhage warrants this.

Identify the site of haemorrhage

Once haemorrhage has been considered, the site of haemorrhage must be rapidly identified. Note this is not to identify the exact location definitively, but rather to define the next step in haemorrhage control (operation, angioembolisation, endoscopic control).

Clues may be in the history (previous episodes, known aneurysm, non-steroidal therapy for gastrointestinal [GI] bleeding) or examination (nature of blood – fresh, melaena; abdominal tenderness, etc.). For shocked trauma patients, the external signs of injury may suggest internal haemorrhage, but haemorrhage into a body cavity (thorax, abdomen) must be excluded with rapid investigations (chest and pelvis x-ray, abdominal ultrasound or diagnostic peritoneal aspiration).

Investigations for blood loss must be appropriate to the patient's physiological condition. Rapid bedside tests are more appropriate for profound shock and exsanguinating haemorrhage than investigations such as computed tomography (CT) which take time. Patients who are not actively bleeding can have a more methodical, definitive work-up.

Haemorrhage control

The bleeding, shocked patient must be moved rapidly to a place of haemorrhage control. This will usually be in the operating room but may be the angiography or endoscopy suite. These patients require surgical and anaesthetic support and full monitoring and equipment must be available.

Haemorrhage control must be achieved rapidly to prevent the patient entering the triad of coagulopathy–acidosis– hypothermia and physiological exhaustion. There should be no unnecessary investigations or procedures prior to haemorrhage.

METHODS OF ACHIEVING HEMOSTASIS

MECHANICAL METHODS

• Pressure: Firm pressure should be applied over the bleeding site using either fingers or gauze for at least 5 minutes

• Hemostat: Application of haemostat (artery forceps) at the bleeding point helps in direct occlusion of the bleeding vessel.

• Sutures and Ligation: Severed blood vessels may be tied with ligatures (Non – resorbable sutures such as silk and polyethylene are used as they evoke less tissue reaction)

CHEMICAL METHODS

- Local Agents: such as Adrenaline, Thrombin, Surgicel, Gelatine Sponge and Bone Wax.
- Systemic Agents: include Whole Blood. • Platelet Rich Plasma. • Fresh Frozen Plasma. • Cryoprecipitate

THERMAL AGENTS

Heat achieves hemostasis by denaturation of proteins

• Electrocautery. routine surgical procedure that converts electricity to heat which causes coagulation of bleeding vessels

• Cryosurgery: Extreme cooling has been used for hemostasis where Tissues, capillaries, small arterioles and venules undergo cryogenic necrosis.

• Lasers: Lasers usually result in bloodless surgery.

Head injuries

Dr.sabah alheeti

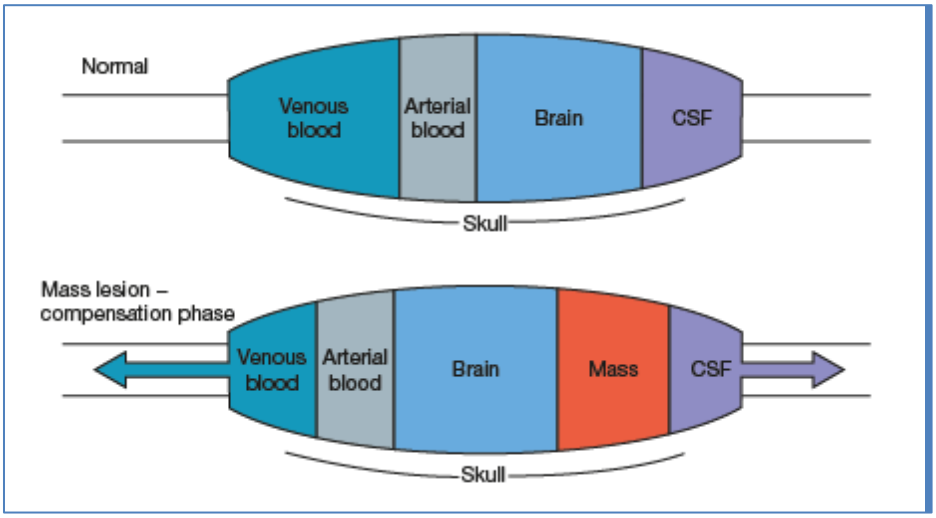
Head injury accounts for 3–4% of emergency department attendances. Head injury is Any injury that results in trauma to the scalp, skull or brain. Head injury and traumatic brain injury are often used interchangeably.

Intracranial pressure and cerebral blood flow

The brain depends on continuous perfusion for oxygen and glucose delivery, and hence survival. Normal cerebral blood flow (CBF) is about 55 mL per minute for every 100 grams of brain tissue. Ischaemia results when this rate drops below 20 mL per minute, and even lower levels will result in infarction unless promptly corrected. Flow depends on cerebral perfusion pressure (CPP), the difference between mean arterial pressure (MAP) and intracranial pressure (ICP).

CPP (75–105 mmHg) **= MAP** (90–110 mmHg) **– ICP** (5–15 mmHg)

Alexander Monro observed in 1783 that the cranium is a 'rigid box' containing a 'nearly incompressible brain'. Any expansion in the contents, especially haematoma and brain swelling, may be initially accommodated by exclusion of fluid components, venous blood and cerebrospinal fluid (CSF). Further expansion is associated with an exponential rise in ICP.
The Monro-Kellie doctrine or hypothesis states that the sum of volumes of brain, cerebrospinal fluid (CSF) and intracerebral blood is constant. An increase in one should cause a reciprocal decrease in either one or both of the remaining two to maintain equilibrium and sustain a normal ICP.



CLASSIFICATION OF HEAD INJURY

1. **According to GCS:**

TABLE 24.1 Head injury classification using the Glasgow Coma Scale (GCS) score.	
Minor head injury	GCS 15 with no loss of consciousness (LOC)
Mild head injury	GCS 14 or 15 with LOC
Moderate head injury	GCS 9–13
Severe head injury	GCS 3–8

2. **According to mechanism of production, head injury can be classified as:**
   - Impact injuries: It results from an object striking the head or the head striking an object. It includes: Scalp injuries, Skull fracture, brain.
   - Acceleration and deceleration injuries: It results essentially as a result of differential movement between skull and cranial content. It includes: Diffuse axonal injury Subdural hematoma
   - Coup injury and Countre-coup injury:
     Coup injury: It occurs at the site of the impact to the head and is produced by compression of brain due to inward movement of the bone.
     Countre-coup: Injury occurs directly opposite to the point of impact and are most common in frontal and temporal lobe.

Consequences of head injury

1. **Injury to the scalp:** There can be scalp contusion, abrasion and/or lacerations

   - Profuse bleeding due to rich vascularity of scalp.
   - Pott's puffy tumor, first described by Sir Percivall Pott in 1760, is a rare clinical entity characterized by subperiosteal abscess associated with osteomyelitis of the frontal bone.

2. **Skull Fracture**: which may be

   - Simple linear fracture: It is the break in the bone that transverses the full thickness of the skull from the outer to inner table. They are usually no bone displacement.
   - Depressed Skull Fracture : are comminuted fractures in which broken bones displace inward. Compound depressed skull fractures occur when there is a laceration over the fracture, putting the internal cranial cavity in contact with the outside environment, increasing the risk of contamination and infection. In complex depressed fractures, the

dura mater is torn. Depressed skull fractures may require surgery to lift the bones off the brain if they are pressing on it by making burr holes on the adjacent normal skull.

- Basilar fractures: linear fractures that occur in the floor of the cranial vault (skull base), which require more force to cause than other areas of the neurocranium. Thus they are rare, occurring as the only fracture in only 4% of severe head injury patients.
  Basilar fractures have characteristic signs: **blood in the sinuses**; cerebrospinal fluid **rhinorrhea** (CSF leaking from the nose) or from the ears (**cerebrospinal fluid otorrhea**); periorbital ecchymosis often called **'raccoon eyes'** and retroauricular ecchymosis known as "Battle's sign" (bruising over the mastoid process)

3. Brain injury: which may be
   - Primary brain injury: Injury caused at the time of impact . it is Irreversible
   - Secondary brain injury: Subsequent or progressive brain damage occurs hours or days after primary brain injury.

Primary brain injury	*Secondary brain injury*
Concussion	Intracranial haematoma
Cortical laceration/contusion	Cerebral oedema
Diffuse axonal injury	Ischaemia
Bone fragmentation	Infection

Concussion

It is the condition of temporary dysfunction of brain without any structural damage following head injury.

It is manifested as: Transient loss of consciousness, Transient loss of memory, Autonomic dysfunction like bradycardia, hypotension and sweating.

Contusion

It is more severe degree of brain injury manifested by areas of hemorrhage in the brain parenchyma but without surface laceration. Neurological deficit persists more than 24 hour and associated with cerebral edema and defects in the blood brain barrier.

Diffuse axonal injury

DAI is a form of traumatic brain injury which results from mechanical shearing at grey-white interface due to severe acceleration and deceleration force. No obvious structural damage. Severity may range from mild damage with confusion to coma and even death.

Intracranial Hemorrhage

Intracranial hemorrhage encompasses four broad types of hemorrhage:

- epidural hemorrhage
- subdural hemorrhage
- subarachnoid hemorrhage
- intraparenchymal hemorrhage

Extradural haematoma
Collection of blood between the cranial bones and duramater
Can follow relatively minor trauma with brief loss of consciousness is typical.
Results from damage to middle meningeal artery
Followed by a lucid interval and then sudden deterioration
lens-shaped or biconvex lesion on computed tomography
Require immediate transfer to a neurosurgical unit for decision on evacuation.

Note: **lucid interval** is a temporary improvement in a patient's condition after a traumatic brain injury, after which the condition deteriorates

Subdural haematoma
Collection of blood between brain and dura mater
Acute: <3 days, Sub-acute: 4-21 days, Chronic: >21 days

- Results from torn bridging vein or injury to the cortical artery
- Haematoma extensive and diffuse
- No lucid interval
- Loss of consciousness occurs immediately after trauma and is progressive
- Features of raised ICP and focal neurological defecits
- CT Scan: Concavo-convex lesion
- T/t: surgical decompression by craniotomy + Antibiotics

Approach to Head Trauma

1.Detailed history should be sought in all cases of head trauma

2.Initial assessment of head injuries must follow advanced trauma and life support. (ALTS).

3. Neurological assessment: BY GCS, pupil size and reaction, checking neurological deficits such as paralysis, loss of sensation.

Treatment of raised ICP

- IV Mannitol
- IV furosemide
- Reverse Trendelenburg if no counter indications like hypovolaemia, spine injury
- If significant agitation and if hypoxia, hypovolaemia or pain is excluded as the cause of agitation: give IV Midazolam
- Analgesics for the pain management
- Phenytoin or phenobarbitone for post traumatic seizure

TUMOURS

A tumor is an independent and uncontrolled growth of new cells that serves no useful function.

• A tumor can be benign or malignant.

In between benign and malignant tumors, an intermediate group of tumors is also known. The tumors in this group are locally invasive, but usually don't spread by lymphatic or vascular route, e.g. pleomorphic adenoma of salivary glands, basal cell carcinoma

Benign tumor	*Malignant tumor*
Slow growing	Rapidly growing
Well-capsulated	No definite capsule
Does not invade adjoining structures	Invades adjoining structures
No distant spread	Distant spread through lymphatics and blood stream
Good prognosis	Poor prognosis

Differences between benign and malignant tumor

Benign Tumors:

A- Adenoma

It arises from secretory glands, e.g. thyroid, parathyroid, breast. If an adenoma contains large amount of fibrous tissue, it is called *fibroadenoma* (commonly seen in breast). If an adenoma has multiple cystic spaces, it is called as *cystadenoma* (seen in parotid, thyroid, pancreas, ovaries). If an adenoma arises from secretory glands of mucous membrane, it is likely to be pedunculated (rectal polyp).

B- Fibroma

It is a benign tumor arising from fibrous connective tissue. A pure fibroma is rare and is mostly combined with other mesodermal tissues, e.g. Nerve sheath – Neurofibroma Glandular tissue – Fibroadenoma Fat – Fibrolipoma Muscles – Fibromyoma A fibroma can be soft or hard depending upon proportion of fibrous tissue with other cellular tissue.

C- Papilloma

It is a benign tumor arising from epithelial surface (skin or mucous membrane). It consists of a central core of connective tissue containing lymphatics and blood vessels that is covered with epithelium. The surface may be rough or made of finger like projections. Depending upon its location, the surface epithelium can be:

• Squamous cell (skin, tongue, lip, cheek)
• Columnar cell (small and large intestine)
• Transitional cell (urinary bladder)

A papilloma of skin is of two types:

1- Squamous Cell Papilloma

2- Basal Cell Papilloma

Treatment:

Papillomas usually need surgical excision due to cosmetic reasons.

D- Lipoma

It is the most common benign tumor arising from fat cells of adult type.
It can occur anywhere in the body where fat is present, hence named universal tumor.
The most common sites are nape of neck, abdominal wall and thighs

Diffuse lipoma at back of thigh

Encapsulated lipoma at nape of the neck

Treatment:
Lipoma is treated by surgical excision. Aim of surgery is to take care of cosmetic disfigurement and to prevent complications.

E- Neuroma
Benign tumor of nerve is called neuroma. Based on site of origin,

Malignant Tumors

A benign tumor may undergo malignant transformation.
• Histopathological features, that help in differentiating benign and malignant tumors

Origin	*Type of malignancy*
Epithelial	Squamous cell carcinoma, Basal cell carcinoma
Endothelial	Adenocarcinoma
Mesoderm	Sarcoma
Germ cells	Seminoma, Teratoma
Melanocytes	Malignant melanoma

Classification of malignant tumors based on cell of origin

Histopathological features of tumors

- **Benign**

• Hypertrophy: Increase in cell size
• Hyperplasia: Increase in cell number

- **Malignant**

• Metaplasia: Change in cell character, e.g. columnar epithelium changes to squamous epithelium
• Dysplasia: Change in intracellular characters, e.g. size and shape of cell as well as nucleus
• Carcinoma in situ: Intracellular characters resemble cancer but without invasion into extracellular matrix
• Anaplasia: Normally tumor cells resemble with the tissue of their origin. If there is complete loss of differentiation of cells, it is anaplasia and indicates aggressive cancer

Staging of Malignant Tumors
Aims of staging are:
• To assess the prognosis of disease, e.g. early stage carcinoma has better prognosis than late stage carcinoma.
• To plan the treatment, e.g. early carcinoma can have curative treatment while advanced carcinoma can only have palliative treatment.
• For comparison of results of treatment in various centers world over.

- ❖ **Cancers are also classified individually according to their stage.**

There are several types of staging methods. The most commonly used method uses classification in terms of tumor size (T), the degree of regional spread or node involvement (N), and distant metastasis (M). This is called the **TNM** staging.

Stage 0 indicates cancer being in situ or limited to surface cells while
Stage I indicates cancer being limited to the tissue of origin.
Stage II indicates limited local spread,
Stage III indicates extensive local and regional spread while
Stage IV is advanced cancer with distant spread and metastasis.

- ✓ **Spread of Malignant Tumors**

It can occur in following ways:
a. *Direct spread:* Malignant tumor can invade adjoining structures.

b. *Lymphatic spread:* It can occur by:
i. *Invasion:* Adjoining lymphatics are invaded by the malignant cells and these cells spread to draining lymph nodes.

ii. *Embolization:* Malignant cells invading lymphatic vessels can embolize with lymphatic circulation to distant lymph nodes.
c. *Hematogenous spread:* Malignant cells can invade the draining veins and embolize to distant organs, e.g. liver, lungs, brain, bone marrow.

d. *Implantation:* Malignant cells may get deposited on adjoining surface that is in close contact, e.g. carcinoma of lower lip involving upper up

Tumor Grading

It is based on degree of pleomorphism seen on histopathological examination of tumor. The tumor can be:

- Well-differentiated
- Moderately differentiated
- Poorly differentiated

Grade 1 – well differentiated cells with slight abnormality
Grade 2 – cells are moderately differentiated and slightly more abnormal
Grade 3 – cells are poorly differentiated and very abnormal
Grade 4 – cells are immature and primitive and undifferentiated

- **Types of Malignant Tumors**

1- Sarcoma
2- Basal Cell Carcinoma (CA) (Rodent ulcer)
3- Squamous Cell Carcinoma (Epithelioma, Epidermoid Carcinoma)
4- Malignant Melanoma
5- Glandular Carcinoma
6- Lymphoma
7- Leukemia- Acute myelocytic leukemia (AML), Chronic myelocytic leukemia (CML), Acute Lymphatic, lymphocytic, or lymphoblastic leukemia (ALL), Chronic Lymphatic, lymphocytic, or lymphoblastic leukemia (CLL)

- **There are seven warning signals of CA**

1- Change in bowel or bladder habit
2- A sore that doesn't heal
3- Unusual bleeding or discharge
4- Thickening or lump
5- Indigestion or difficult swallowing
6- Noisy cough or hoarseness
7- Obvious change in wart or mole

- **Etiology of tumor**

I- Intrinsic factors:

Age
Sex
Race
Genetics
Chronic precancerous conditions
Diet

II-Extrinsic factors

Physical factors (radiation, UV radiation, heat & sun, ulcer….etc) Chemical factors (tobacco, alcohol, vit. Deficiency, arsenic, asbestos……etc)

III- Biological factors
Oncogenic DNA viruses (EBV, Burkett lymphoma, nasopharyngeal CA ...etc) Oncogenic RNA viruses (Bittner virus for Ca breast & HLT for T cell lymphoma…etc) IV- Hormonal factors: eg renal CA is dependent on estrogen & thyroid hormone is dependent on TSH & TRH and prostate CA is dependent on androgen.

V- Others e.g. genes, mutation….etc

Spread of malignant tumors
Direct spread by local extension
Lymphatic spread by permeation & embolism
Blood spread
Seeding
Diagnosis of CA
History
O/E
Lab. Findings
Biopsy
CT & MRI
New modalities ,e.g. gamma probe ,gene therapy and apoptosis …..etc
Prognosis of tumors
Site of primary tumor
Stage of the disease
Histological features (degree of differentiation)
Host immune factors
Age of the patient
Adequacy of treatment.

- **Tumor markers**

These are products of metabolic activity of the tumors which are either tissue derived or tissue waste product. They may be secreted into blood, urine or other body fluids or expressed at cell surface in quantities larger than those in normal tissue. Their concentration in the body fluids are measured by radioimmunoassay or detected on cell surface in paraffin section smear or fresh biopsy tissue.
They include the following types:

1- Appropriate hormone or substance produced by cell in excessive Amount e.g. PTH in parathyroid adenoma or catecholamines in pheochromocytoma or calcitonin in medullary CA. Of thyroid.

2- Inappropriate substance or hormone not produced normally in the normal tissue e.g. ADH & ACTH in Ca. Breast ,HCG in teratoma & chorio Ca , alpha fetoptn in hepatoma. .testicular teratoma & CEA in GIT tumor.

Suggestive Reading
Norman S William, Roman O Connell, Andrew W McCaskie. Bailey & Love short practice of surgery, 27th edition. Taylor and Francis, 2018

GOITER

Enlargement and nodules of the thyroid gland

The generalized enlargement of thyroid gland is goiter. The term goiter is derived from latin word " guttur" that means "the throat". WHO goiter grading system is as follows:

Grade 0 - No palpable/visible goiter
Grade 1 - Palpable goiter/visible on neck extension
Grade 2 - Goiter visible in normal neck position
Grade 3 - Very large goiter

Morphologically, it can be:

- Diffuse enlargement
- Multinodular goiter (MNG)
- Solitary thyroid nodule (STN)

Functionally, it can be:

- Euthyroid
- Hyperthyroid
- Hypothyroid

Simple goiter
- Diffuse hyperplastic
- Colloid
- Multinodular

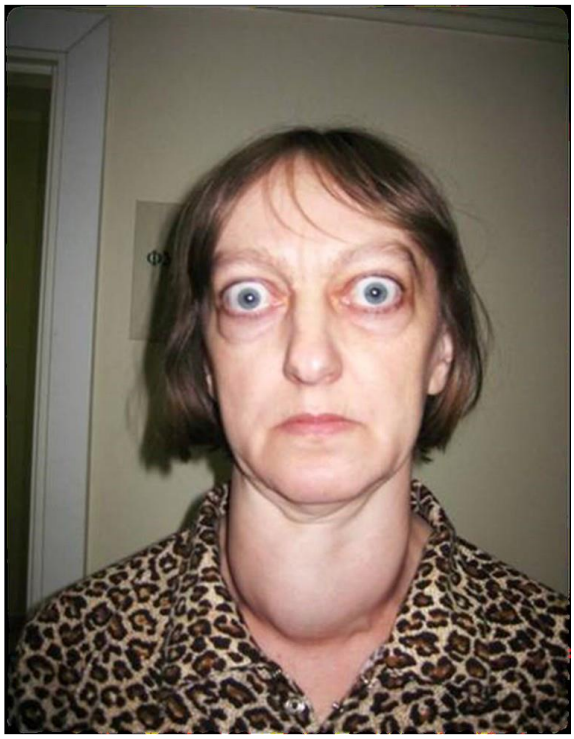
Toxic goiter
- Diffuse (Graves' disease)
- Multinodular (Plummer's disease)
- Toxic adenoma

Neoplastic
- Benign
- Malignant

Inflammatory
- Autoimmune (Hashimoto's thyroiditis)
- Granulomatous (de Quervain's thyroiditis)
- Fibrosing (Riedel's thyroiditis)
- Infective (bacterial, viral)

Classification of goiter

A colloid goitre



Diffuse toxic goitre

Location of the thyroid gland

The thyroid gland, which is located in the anterior portion of the neck just below and bilateral to the thyroid cartilage, develops from the thyroglossal duct and portions of the ultimobranchial body

Oral complications and manifestations

Thyrotoxicosis

Osteoporosis involving the alveolar bone may occur, and dental caries and periodontal disease appear rapidly in these patients. The teeth and jaws develop rapidly, and premature loss of deciduous teeth with early eruption of permanent teeth is common

Hypothyroidism

Infants with cretinism may present with thick lips, enlarged tongue, delayed eruption of teeth, and resulting malocclusion.

Medical Considerations

Thyrotoxicosis

The dentist should be aware of the clinical manifestations of thyrotoxicosis, so that undiagnosed or poorly treated disease can be detected and the patient referred for medical evaluation and treatment By doing this, dentists may be able to help reduce the morbidity and mortality rates associated with thyrotoxicosis

In primary adrenal insufficiency, diffuse or focal brown macular pigmentation of the oral mucous membranes is a common finding. Pigmentation of sun-exposed skin often follows the appearance of oral pigmentation. Patients with secondary adrenal insufficiency may be prone to delayed healing and may have increased susceptibility to infection.

Stages in Goiter Formation

1. Whenever there is rise in TSH, there is increased stimulation of thyroid gland leading to diffuse thyroid hyperplasia. All the thyroid lobules are active.
2. At a later stage, many lobules become inactive and full of colloid (stage of colloid goiter).
3. Later on due to fluctuation in TSH levels, areas of active and inactive lobules develop in thyroid gland.
4. Active lobules may undergo hemorrhage (due to increased vascularity) that follows necrosis and fibrosis leading to formation of nodules. These nodules are inactive while internodular area has active lobules

- ✓ **Diffuse Hyperplastic Goiter**

It is usually seen at times of increased physiological demands (e.g. puberty, pregnancy, lactation) that cause increased TSH stimulation. The thyroid gland is diffusely enlarged in shape of a butterfly and is soft in consistency. If TSH stimulation ceases, the goiter may regress. If TSH stimulation persists, diffuse hyperplastic goiter changes to colloid goiter where all acini are distended with colloid.

In endemic areas, incidence of goiter can be significantly reduced by supplementing iodized salt in the diet. In early stages, 0.1-0.2 mg of daily thyroxin may cause regression of the hyperplastic goiter in a few months time.

Multinodular Goiter (MNG)

It is the end stage of hyperplastic goiter and is irreversible. It is more common in females and usually presents in 4-5th decade of life

Symptoms and Signs

• Asymptomatic neck mass

• Dyspnea and dysphagia may occur in a large MNG due to compression of trachea and esophagus respectively.

Complications • Firm nodular thyroid that moves on deglutition.

• A rapidly appearing painful nodule is usually due to hemorrhage.

• Area of hardness and irregularity may occur which could be due to calcification or malignant change.

• 4-10% of MNG may undergo malignant change and it is usually follicular carcinoma.

• Features suggestive of malignant change in MNG are:

 Rapid painless enlargement

 New solitary nodule

 Fixation and hardness of goiter

 Hoarseness of voice

 Appearance of neck nodes

• 10-20% cases of MNG may have secondary thyrotoxicosis.

Rapid painless enlargement in
multinodular goiter

❖ **Investigations**

• Routine investigations (Hb, BT, CT, Urine)

• Blood urea, blood sugar

• ECG, chest X-ray

• X-ray soft tissue neck: AP and lateral view are done to look for tracheal deviation and tracheal compression(scabbard trachea*) respectively. The patient with thyroid disease is of concern to the dentist from several aspects.

- The dentist may detect early signs and symptoms of thyroid disease and may refer the patient for medical evaluation and treatment. In some cases, this may be lifesaving, whereas in others, quality of life can be improved and complications of certain thyroid disorders avoided

✓ **Treatment**

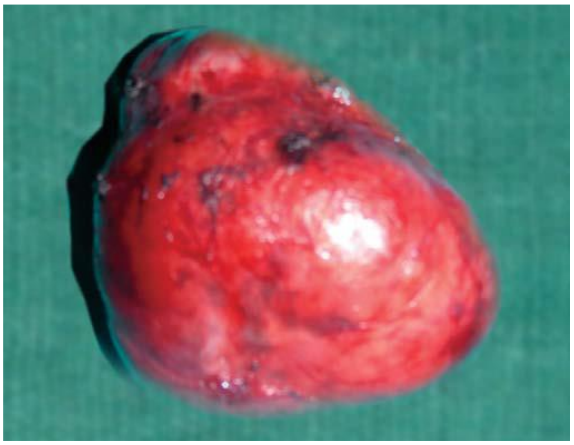
Surgery is the mainstay of treatment.

Indications for surgery are:

• Cosmetic reasons

• Pressure symptoms

• Risk of malignant change



Multinodular goiter involving left lobe only

Left lobectomy specimen

Left lobectomy cut section

- **Types of Surgery**

1. Subtotal thyroidectomy: Remove most of the bulk of the gland leaving a normal size thyroid (size of thumb) in tracheo-esophageal groove on both sides taking care not to injure recurrent laryngeal nerve and parathyroid glands

2. Total thyroidectomy: There are chances of recurrence after subtotal thyroidectomy since etiological factors persist. In such cases reoperation is very difficult and Hazardous

3. Lobectomy: If only one lobe of thyroid gland is involved and the other lobe is not palpable, treatment is removal of involved lobe only

Hyperthyroidism:

Clinical types:

1– Diffuse toxic goiter “Grave’s disease “ .

2– Toxic nodular goiter.

3- Toxic nodule.

4– Hyperthyrodism due to rare causes

Clinical features:

A - The symptoms are:

1 – Tiredness

2 – Emotional lability

3– Heat intolerance

4 – Weight loss

5 – Excessive appetite

6 – Palpitation

B – Signs are:

1 – Tachycardia

2 – Hot, moist palm

3 – Exophthalmos

4 – Lid lag retraction

5 – Agitation

6 – Thyroid goiter and bruit.

Thyroid function test:

1 – High T3, high T4 , low TSH .

2– Thyroid scan to diagnosis an autonomous toxic nodular goiter .

Principles of treatment of the thyrotoxicosis:

1 – Anti thyroid drugs : those in common use are carbinazole and propylthiouracil , B-Adrenergic blocker like propanolol and nadolol , Iodide used which reduce vascularity of thyroid .

Advantage : No surgery and no use of radioactive materials .

Disadvantage : Treatment is prolonged and the failure rate at least 50 % .

2– Surgery : Advantages : goiter is removed , the cure is rapid .

Disadvantage: Recurrence of thyrotoxicosis occurs in approximately 5%.

3–Radioiodine: which destroys thyroid cells and reduces the mass of function thyroid tissue to below a critical level.

Advantage : No surgery and no prolonged therapy.

Disadvantage: Isotope facilities must be available.

Indication for operation in thyroid swellings :

1 – Neoplasia " FNAC positive , clinical suspicion " .

2 – Toxic adenoma.

3 – pressure symptoms.

4 – Cosmesis.

5 – Patient's wishes

Post operation complications:

1 – Haemorrhage causing Tension Haematoma , usually due to slipping of a ligature , Haemorrhage from thyroid remnant .

2– Respiratory obstruction due to collapse or kinking of the trachea or due to laryngeal oedema .

3– Recurrent laryngeal nerve paralysis .

4– Thyroid insufficiency.

5 – Parathyroid insufficiency.

6– Thyrotoxic crisis " storm " .

7 – Wound infection .

8– Hypertrophic or keloid scar.

9- Stitch granuloma.

Neoplasma of the thyroid:

1– Benign : follicular adenoma .

2– Malignant :

A- Primary :

1– Follicular epithelium –differentiated .” Follicular , Papillary “.

2– Follicular epithelium – undifferentiated . “ Anaplastic” .

3–Parafollicular cells , “ Medullary “ .

4 – Lymphoid cells . “ Lymphoma “ .

B – Secondary :

1 – Metastatic .

2 – Local infiltration “ invasive

Malignant Tumors

Malignant tumors of thyroid are uncommon and account for only 1% of all malignancies. However, these are the most common malignant endocrine tumors

Etiology

1. Irradiation: Radiotherapy to neck (e.g. for lymphoma) has been implicated in papillary carcinoma.
2. Endemic goiter: Long standing MNG may change to follicular carcinoma.
3. Hashimoto’s thyroiditis: It may lead to malignant lymphoma.

Pathology

Types of malignant tumors are:

1. Differentiated thyroid carcinoma

 Papillary carcinoma

 Follicular carcinoma

2. Undifferentiated (anaplastic) carcinoma
3. Medullary carcinoma
4. Lymphoma

Clinical Features

• Thyroid cancer usually presents as a lump in the neck which clinically may be a solitary nodule or multinodular goiter.

• About 10% of thyroid nodules are malignant.

• Dominant nodule in MNG has same cancer risk as solitary nodule

A thyroid nodule should be viewed with suspicion if it has following features:

- Family history of thyroid cancer.
- History of neck irradiation in past.
- Age <15 years or > 65 years, especially male patient.
- Recent origin.
- Rapid increase in size.
- Hoarseness of voice.
- Firm, fixed, irregular nodule in thyroid.
- Along with enlarged cervical lymph nodes

Treatment of Differentiated Thyroid Cancer

The strategy of surgical treatment for differentiated thyroid cancer is decided on the basis of low or high- risk group patient (AMES criteria). In low-risk group patients, hemithyroidectomy (lobectomy + isthmusectomy) is sufficient, while high-risk group patients require total thyroidectomy.

Postoperative Management

• After surgery, thyroxine replacement is given to prevent hypothyroidism and to suppress TSH since differentiated tumors are TSH dependent.
• In differentiated thyroid tumors, radioactive iodine scanning is done after surgery because these tumors take up iodine.
• Isotope scanning is not needed in low-risk patients where hemithyroidectomy is sufficient.

Suggestive Reading

Norman S William, Roman O Connell, Andrew W McCaskie. Bailey & Love short practice of surgery, 27th edition. Taylor and Francis, 2018

General anesthesia and pain management

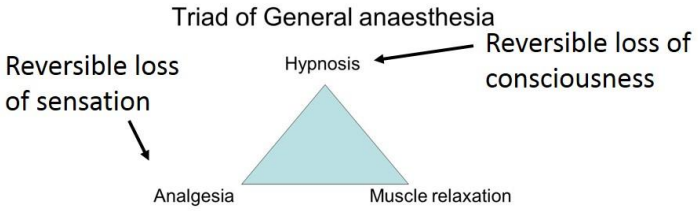
Definition and brief history

General Anaesthetics are drugs which produce reversible loss of sensation and consciousness. If you're having general anesthesia, a physician anesthesiologist will give you medications that make you lose consciousness. After the surgery is complete, he or she will reverse the medication so that you regain consciousness- but you won't be wide awake right away.

Anaesthesia, as we know it today, was first successfully demonstrated by William Morton, a local dentist, at the Massachusetts General Hospital Boston, USA on 16th October 1846 when he administered ether to Gilbert Abbot for operation on a vascular tumour on his neck. Earlier Horace Wells had successfully used nitrous oxide in 1844 for painless extraction of teeth.

General anesthetics, which result in a reversible loss of consciousness, and local anesthetics, which cause a reversible loss of sensation for a limited region of the body without necessarily affecting consciousness.

The cardinal features of general anaesthetics illustrated in triad below, loss of all sensation especially pain, sleep (unconsciousness) and amnesia, abolition of somatic and autonomic reflexes, immobility and muscle relaxation.

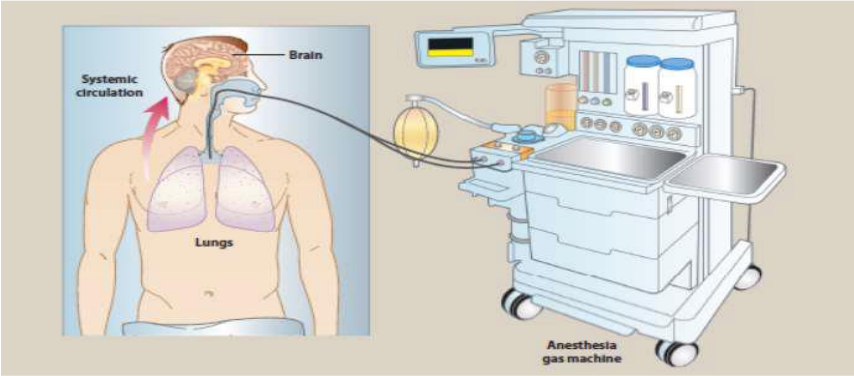


- **There are four main categories of anesthesia used during surgery and other procedures: general anesthesia, regional anesthesia, sedation (sometimes called "monitored anesthesia care"), and local anesthesia**.

- **Key principles of anaesthesia**

Optimum patient care is dependent on a collaborative approach from anaesthetic and surgical teams, together with the other perioperative care providers. The importance of multidisciplinary collaboration has been clearly demonstrated by national audits such as the Confidential Enquiries in Perioperative Deaths (CEPOD) and Enquiries into Maternal Deaths UK. These audits have led to changes in clinical and non-clinical practice to improve morbidity and mortality. The use of a set of safety checklists in the operating theatre in the form of the World Health Organisation's Surgical Safety Checklist has shown a reduction in incidence of perioperative untoward events.

The role of the modern anaesthetist has evolved from just being responsible for the patient in the operating suite into a 'perioperative physician' who optimises the patient for surgery, assessing and minimising risk, cares for them during the operation, and then manages both pain and homeostasis in the postoperative period.



Anaesthetic machine

Anaesthetic machine

Total intravenous anaesthesia pumps in use

General anaesthesia is associated with a risk of respiratory complications, in part due to altered respiratory function caused by general anaesthesia. This is of particular concern in patients with preexisting respiratory disease and reduced respiratory reserve. Regional anaesthetic techniques may reduce or eliminate the need for general anaesthesia. The aims of general anaesthesia are to produce a safe, reversible loss of consciousness, optimise the physiological response to surgery and provide good operating conditions. General anaesthesia has three components: loss of consciousness (hypnosis), analgesia and muscle relaxation.

Intravenous Anaesthetics

Management of airway during anaesthesia

Loss of muscle tone as a result of general anaesthesia means that the patient can no longer keep their airway open. Therefore, the patients need their airway maintained for them. The use of muscle relaxants will mean that they will also be unable to breathe for themselves and so will require artificial ventilation. Head tilt, chin lift and jaw thrust manoeuvres, along with adjuncts such as oropharyngeal airways, are used to facilitate bag-mask ventilation while induction agents exert full effect. Laryngeal mask airway or endotracheal tube are then inserted and the patient is allowed to breathe spontaneously or is ventilated during the procedure. The addition of a cuff to the endotracheal tube facilitates positive pressure ventilation and protects the lungs from aspiration of regurgitated gastric contents.

Supraglottic airways

● Laryngeal mask airway (LMA).

-The laryngeal mask airway (left), i-Gel airway (centre) and reinforced laryngeal mask airway (right)

The Macintosh laryngoscope with a standard blade (left) and McCoy's modification of the Macintosh blade (right)

Endotracheal devices. From left to right: an uncut orotracheal tube; reinforced orotracheal tube; oral version of a Ring, Adair and Elwyn (RAE) preformed tube; nasal version of an RAE preformed tube; tracheostomy tube

✓ **Muscle relaxation and artificial ventilation**

Pharmacological blockade of neuromuscular transmission provides relaxation of muscles allowing easy surgical access, but the patient requires artificial ventilation. Neuromuscular blocking agents are broadly classified into depolarising and non-depolarising groups according to their mode of action. Suxamethonium is the most commonly used depolarizing agent.

Ventilation during anaesthesia

Mechanical ventilation is required when the patient's spontaneous ventilation is inadequate or when the patient is not breathing because of the effects of the anaesthetic, analgesic agents or muscle relaxants. In volume control ventilation, a preset volume is delivered by the machine irrespective of the airway pressure. The pressure generated will be in part dependent on the resistance and compliance of the airway.

- **Monitoring and care during anaesthesia**

A minimum basic monitoring of cardiovascular parameters is required during surgery. This includes:

● Vascular:

● electrocardiogram (ECG)

● blood pressure

● Adequacy of ventilation

● inspired oxygen concentration;

● oxygen saturation by pulse oximetry

● end tidal carbon dioxide concentration

Monitors of temperature, ventilation parameters and delivery of anaesthetic agents are also routinely used, while measurement of urine output and central venous pressure are recommended for major surgery.

- **Local anaesthetic agents**

Local anaesthetic agents such as lignocaine and bupivacaine exert their effect by causing a local, reversible blockade of nerve conduction by reducing nerve membrane sodium permeability. They are nonspecific and act on autonomic, motor and sensory nerves equally. Their duration of action depends on the local anaesthetic agent used, dose, whether adrenaline has been coadministered and the proximity of local anaesthetic to the nerve.

- **Spinal and epidural anaesthesia (types of regional anesthesia)**
  - **Spinal anaesthesia**

Spinal anaesthetic is the introduction of local anaesthetic, usually lidocaine or bupivacaine, into the subarachnoid space to block the spinal nerves before they exit the intervertebral foramina. To protect against damage to the spinal cord, spinal anaesthesia is administered below L2, either at the L3/4 or L4/5 level. At this level, the cauda equina nerves acquire their perineural coverings and myelin sheath as they exit the dura, making them exquisitely sensitive to the effect of local anaesthetic.

  - **Epidural anaesthesia**

Epidural anaesthesia involves the injection of local anaesthetic into the epidural space, which extends along the entire vertebral canal between the ligamentum flavum and dura mater. Local anaesthetic spreads craniocaudally, penetrating the meningeal sheaths containing the nerve roots and causing an anaesthetic block affecting several dermatomes. The level of epidural anaesthetic is therefore dictated by the proposed site of surgery and the dermatomes involved.

  - **Peripheral nerve block**

Peripheral nerve blockade requires a detailed working knowledge of the target nerve's surface anatomy, adjacent structures, as well as the cutaneous area supplied by it. Use of a nerve stimulator and insulated block needle can improve the accuracy of placement of the nerve block catheter.

Peripheral nerve blocks are a type of regional anesthesia. The anesthetic is injected near a specific nerve or bundle of nerves to block sensations of pain from a specific area of the body. Nerve blocks usually last longer than local anesthesia.

- **Postoperative analgesia**

Good postoperative analgesia is essential in ensuring surgical success by minimising psychological and physiological morbidity, enabling early mobilisation and optimising respiratory function. Despite this, approximately 20% of patients will have inadequate analgesia. Successful postoperative analgesia requires preoperative planning, taking into account the nature of the proposed surgery, patient factors and preferences, and their comorbidity. Knowledge of pain physiology, assessment and analgesic drugs, including routes of delivery and pharmacology, is

essential. The pain pathway is illustrated in. Many hospitals have acute pain teams involving doctors and specialist nurses to deliver improved patient analgesia.

- **Paracetamol and NSAIDs**

Paracetamol is effective in the management of postoperative pain and can be administered by the oral, intravenous and rectal routes. Regular use has been shown to reduce opioid requirements by 20–30% and, in combination with NSAIDs, the combination is more effective than NSAIDs alone. Paracetamol should therefore be prescribed to all postoperative patients except in the rare instance of contraindications. NSAIDs are also an important component of multimodal postoperative analgesia. In combination with opioids, NSAIDs increase analgesia and have an opioid-sparing effect, reducing consumption, PONV and sedation. Their use is limited by their side-effect profile, including renal impairment, impaired platelet function with the potential for increased postoperative bleeding, peptic ulceration and bronchospasm in individuals at risk. Asthma is not an absolute contraindication, and previous use without adverse effects permits their use.

- **Post operative relieve of pain : depends on :**

1 – Site of operation during use in premedication , during use in anesthesia , concomitant regional technique , emotional state of the patient will suffer from :

A- Increase stress of the whole procedure and can lead to delay recovery .

B- Inability to cough and breath deeply causing to retention of severe atelectasis and pneumonia .

C- Immobility leads to venous stasis , DVT and pulmonary embolism .

Signs of pain : restlessness , tachycardia , sweating , pallor and hypotension .

- **Methods of relieving pain :**

-Intermittent injection of analgesic drugs:

A- Morphine – dose I.V 3-4 mg in 3 -4 ml slowly.

- **Side effect : nausea and vomiting , respiratory depression.**

B- Pethidine : dose 75 – 100 mg , no respiratory depression .

C- Pentazocine .

D- Continuous I.V infusion : most frequently used for patient with fever post operative pain ,e.g : abdominal operation – common drug used is morphine. .

- **Inhalational analgesia**

– Peripheral Nerve block : by inject local anesthetic drug close to the nerve

e.g : hand surgery , which does'nt block visceral efferent , does'nt produce

hypotension , produce analgesia for prolonged times .

– Epidural : "Extradural " block .

Inject of local anesthesia into extra dural space in the thoracic or lumber spines to give analgesia to the lower half of the body and perineum .

– Oral analgesia : indication :

- Minor surgery under local or general anesthesia .

-The patient able to take drug orally soon after operation .

- ✓ **Drugs :**

1 - Aspirin , paracetol , other NSAID.

2– Pethidine tad 50 -100 mg.

3 – Codeine and dihydrocodeine.

Suggestive Reading

Principles and practice of surgery, Norman S William, Roman O Connell, Andrew W McCaskie. Bailey & Love short practice of surgery, 27th edition. Taylor and Francis, 2018

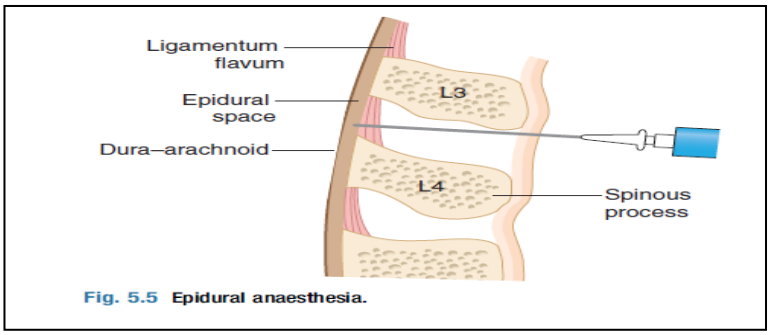
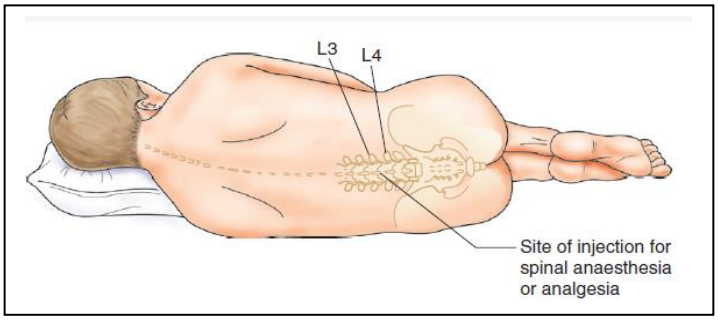
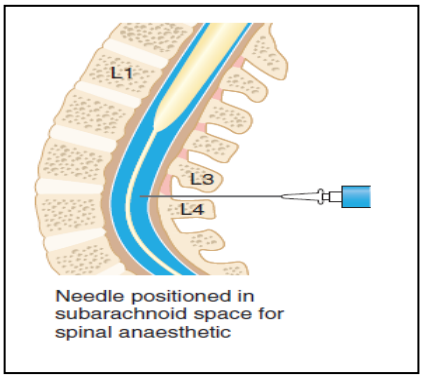
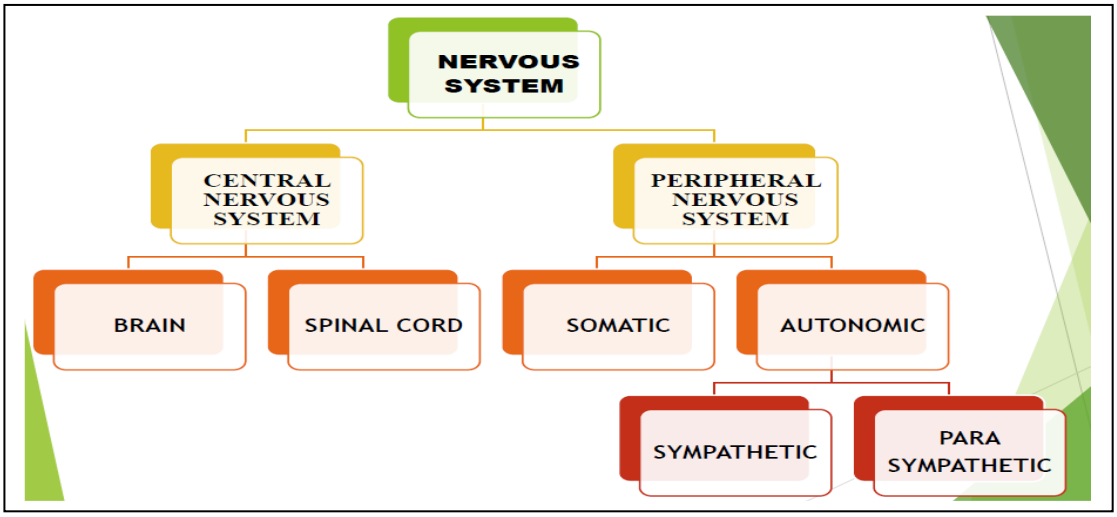


Fig. 5.5 Epidural anaesthesia.







Chest Trauma

Chest injury:

Chest injuries are injuries to the chest wall (the bones, skin, fat and muscles protecting your lungs, including your ribs and sternum) or any of the organs inside the chest. Chest injuries include: bruising or abrasions (cuts and grazes) to the chest area broken bones (for example, a rib fracture)

The vast majority of patients with chest trauma do not require surgery. Approximately 10–15% of thoracic injuries require thoracotomy or sternotomy, and the indications and timing of this are determined by the mechanism, physiology and anatomy of injury. There is an unnecessary 'mystique' and even fear of surgery for thoracic trauma probably because most surgeons who deal with trauma in the UK are more comfortable in the abdomen than the chest. The trauma surgery principles and concepts are, however, the same for any anatomical region and it may be helpful to think of the chest as a 'belly with bones'. This serves as a reminder that, for example, the treatment of bleeding is to stop the bleeding, regardless of body cavity.

Trauma is the leading cause of death, hospitalization, short & long standing disability at any age, any sex, 25% of all traumatic death are due to chest injury , Second leading cause of trauma deaths

after head injury, in war time chest injury are more common than civil & almost always there is a possibility of multiple injury. Chest is a wide surface, so it might affected by external trauma.

- **Chest injuries may result from:**

1- Vehicle accidents RTA

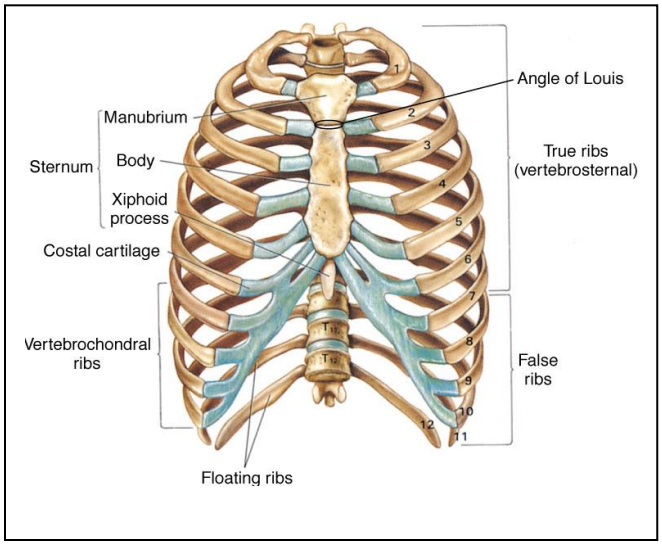
2- Falls from height

3- Gunshot wounds

4- Crush injuries

5- Stab wounds

Different types of chest injuries



Bones and Joints in the Thoracic Region

❖ **Mechanism of injury:**

A- Penetrating trauma
- Gunshot
-Stab wounds

B- Blunt trauma

✓ **Assess the casualty**

- Identify signs and symptoms
  - Airway
  - Breathing
  - Circulation

▪ **Signs & symptoms of chest injury:**

- Shock
- Cyanosis
- Hemoptysis
- Chest wall contusion
- Open wounds
- Distended neck veins

- Tracheal deviation
- Subcutaneous emphysema

❖ **Specific types of chest injuries**

1- Chest wall injuries
2- Lung injury
3- Heart, aorta and diaphragm injuries

1- Chest wall injuries:

- Rib fractures
- Flail chest
- Pneumothorax
- Haemothorax

➢ **Rib fractures:**

Clinical features: The commonest injury to the chest is fracture of the ribs by direct blow, the patient complains of pain in the chest overlying the fracture, this pain is intensified by pressure, the common ribs which are affected are 7th, 8th and 9th ribs.

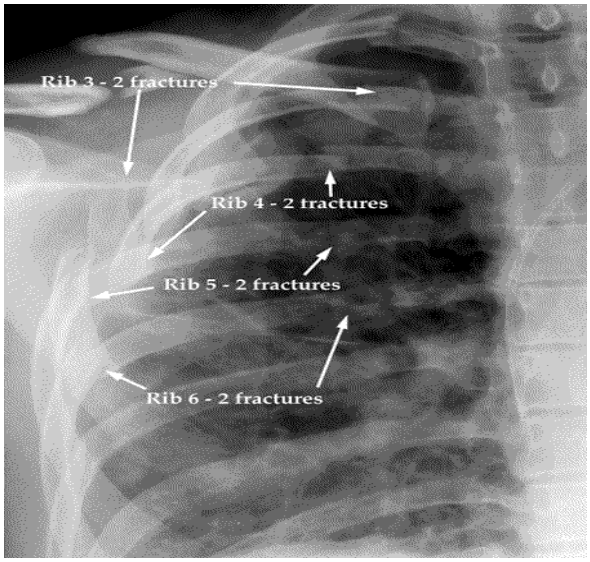
✓ **Special investigation : Chest X – ray**

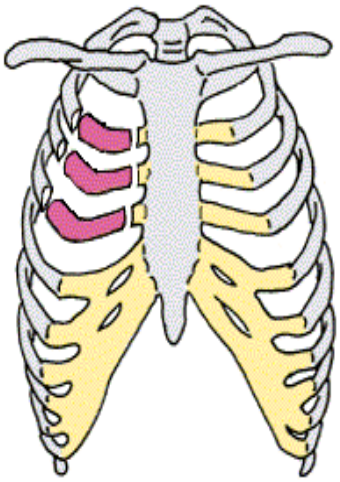
- Most common thoracic injury
- Most commonly 5th to 9th ribs
- Poor protection
- Localised pain, tenderness, crepitus
- CXR to exclude other injuries
- Analgesia..avoid taping
- Upper ribs, clavicle or scapula fracture: suspect vascular injury
- Fractures of 8th to 12th ribs can damage underlying abdominal solid organs:
  - Liver
  - Spleen
  - Kidneys

- **Flail chest:**

In which multiple ribs are fractured at both ends or the whole sternum loosened causing flail chest. In case of inspiration the flail part of the chest wall becomes in drawn, while in expiration the flail part is pushed out, this termed is known paradoxical movement. The patient becomes anoxic due to the failure of adequate expansion of the affected side

- Two or more adjacent ribs are fractured in at least two places or separation of sternum from ribs
- Multiple rib fractures produce a mobile fragment which moves paradoxically with respiration
- Significant force required
- Usually diagnosed clinically
- Analgesia

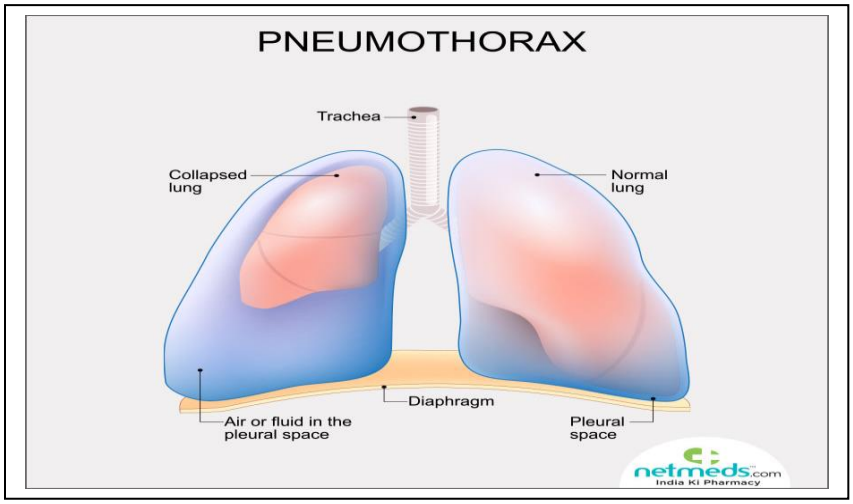




Flail Chest

- **Pneumothorax:**

If the penetration of the lung occurs, air will escape into the pleural cavity and result pneumothorax. If the pleural tear is valvular tension pneumothorax results, since air is sucked into the pleural cavity.

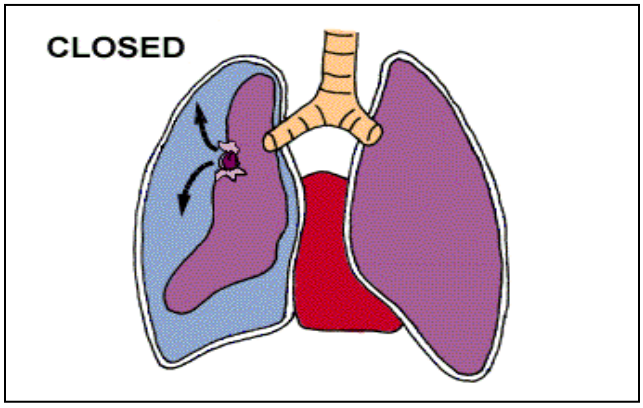


Pneumothorax and normal lung

- ✓ **Pneumothorax (closed):**

Each inspiration, but can't return into bronchi on expiration leading to dyspnea, cardiac dullness absent on the left side, tympanic pressure on affected side ,also occurs in penetrating wound of the chest by knife or gunshot causing sucking chest wound (SCW).

- Air in the pleural cavity
- Blunt or penetrating injury that disrupts the parietal or visceral pleura
- Unilateral signs: ↓movement and breath sounds, resonant to percussion
- Confirmed by CXR (chest X-ray)
- Rx: chest drain



Pneumothorax (closed)

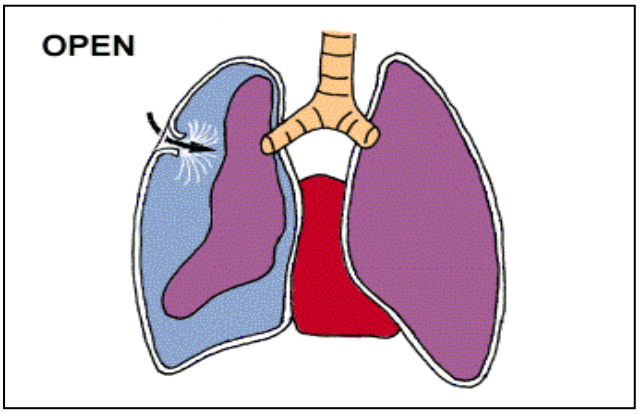
✓ **Tension pneumothorax:**

- Air enters pleural space and cannot escape
- Chest pain, dyspnoea
- Respiratory distress
  - Tracheal deviation (away)
  - Absence of breath sounds
  - Distended neck veins
  - Hypotension

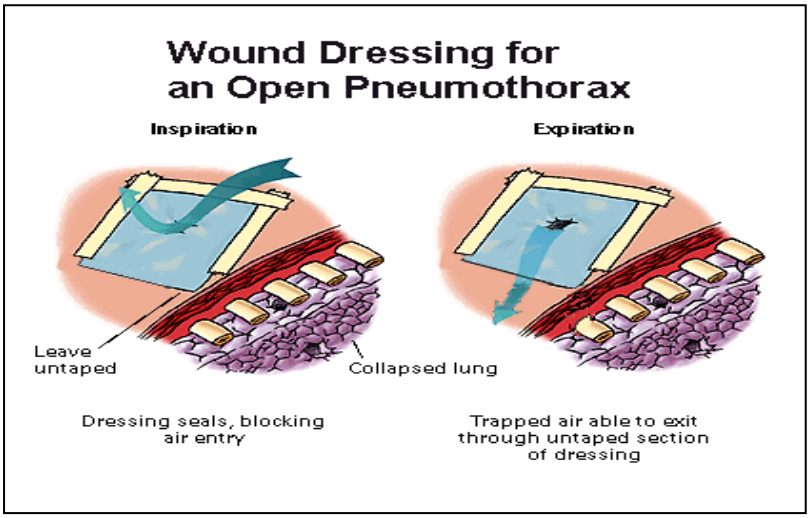
- **Surgical emergency**
- Rx: emergency decompression before CXR
- Either large bore cannula in 2nd ICS (**intercostal space**), MCL (**mid-clavicular line**) or insert chest tube
- CXR to confirm site of insertion

✓ **Open pneumothorax:**

- Defect in chest wall provides a direct communication between the pleural space and the environment
- Lung collapse and paroxysmal shifting of mediastinum with each respiratory effort ± tension pneumothorax
- "Sucking chest wound"
- Rx: closure of wound…chest drain (Rx- medical prescriptions)



Open Pneumothorax



➢ **Haemothorax:**

- Blunt or penetrating trauma
- Requires rapid decompression and fluid resuscitation
- May require surgical intervention
- Clinically: hypovolaemia, absence of breath sounds, dullness to percussion
- CXR may be confused with collapse

✓ **Massive Haemothorax:**

- Loss of 1500 cc blood or 200 cc per hour from the chest tube
- Signs and symptoms
- Hypotension from blood loss or compression of great vessels
- Dullness to percussion
- Decreased breath sounds
- Anxiety or confusion secondary to hypovolemia or hypoxia

2- Lung injury:

- Pulmonary contusion
- Pneumothorax
- Haemothorax
- Parenchymal injury
- Trachea and bronchial injuries
- Pneumomediastinum

3- Heart, Aorta & Diaphragm:

- Blunt cardiac injury
  -Contusion
  -Ventricular, septal or valvular rupture
- Cardiac tamponade
- Ruptured thoracic aorta
- Diaphragmatic rupture

❖ **Iatrogenic trauma**

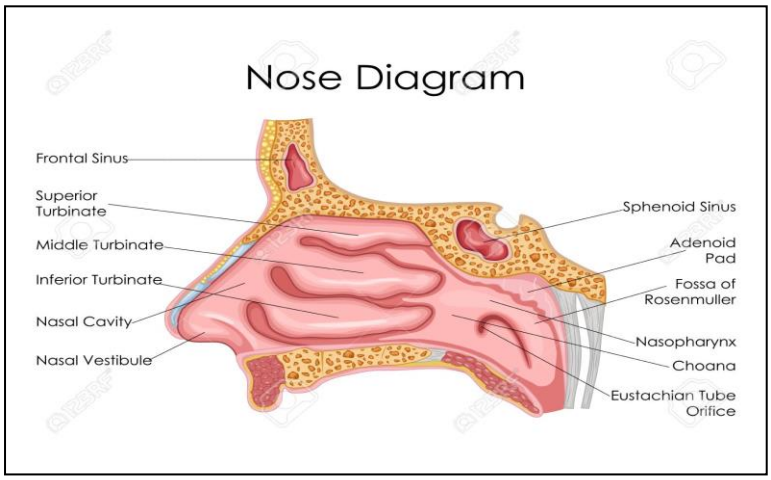
- NG tubes:
  -Coiling
  -Endobronchial placement
  -pneumothorax
- Chest tubes:
  - Subcutaneous
  - Intraparenchymal
  - Intrafissural
- Central lines:
  - Neck
  - Coronary sinus
  - Pneumothorax

Suggestive Reading

Norman S William, Roman O Connell, Andrew W McCaskie. Bailey & Love short practice of surgery, 27th edition. Taylor and Francis, 2018

Diseases of Nose and Paranasal Sinuses

The **nasal cavity** or nasal passage are presented as two channels separated by an bone cartilage called the **nasal septum**. They vommunicate with the outside by means of the nostrils and open rearwardly in the nasopharynx at the middle choanae.



The side wall of the nasal cavity presents an uneven surface: on it, in fact, it consists of 3 bony laminae (sometimes 4) coated with mucosa. An inferior turbinate nasal cavity, a middle turbinate, a swirled higher and sometimes a supreme turbinate is recognised in each one. The underlying space beneath the turbinates are called meatus, where communications occur with the paranasal sinuses.

- **Paranasal sinuses:**

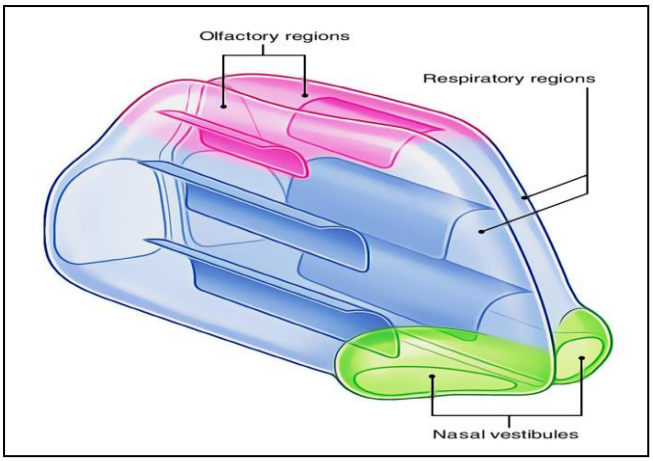
Are pneumatised cavities of the facial mass that develop during the first few years of life and are continuous with the nasal passages. They include:

1- Maxillary sinuses: two large symmetric cavities situated below the orbits.

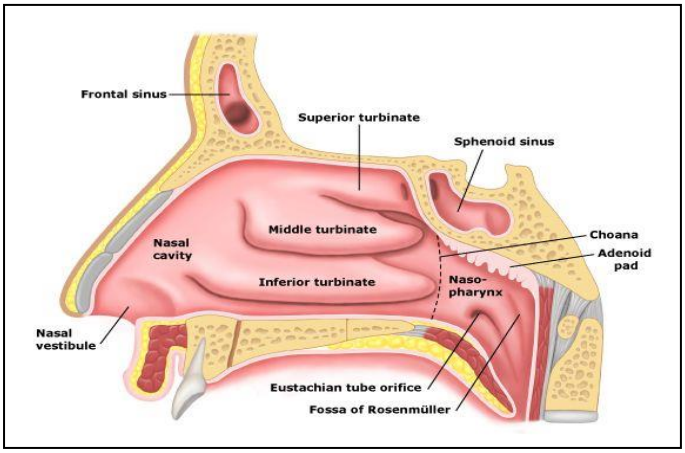
2- Frontal sinuses: irregularly shaped, are included in the thickness of the frontal bone above the root of the nose.

3- Sphenoid sinuses: two cubical cavities located within the body of the sphenoid.

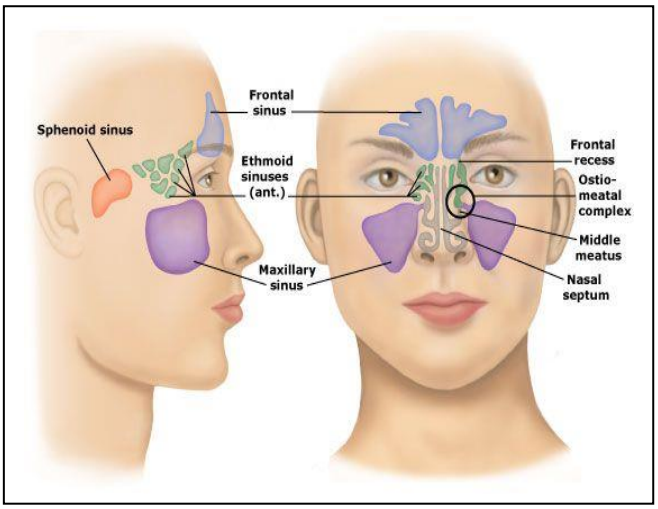
4- Ethmoid cells: the complex system of small cavities which are the two ethmoid labyrinths.



Regions of Nasal Cavities



Related Anatomy and Physiology of the nose



Paranasal Sinus

❖ **The nasal functions are different:**

- Respiratory function: the nose regulates the air flow through very sophisticated central control systems that ensure the right oxygen content according to the different needs of the organism;
- Heating and humidifying of inhaled air happens through an efficient system of vascularised "siphons" (turbinates) that, depending on the air temperature can increase or decrease the volume. Dilating yields more heat and a higher proportion of moisture. Contracting them instead allows more air transit because it makes the wider nasal cavity;
- Olfactory function: permitted by a specific epithelium (neuro-epithelium) located on the ceiling of each nostril;
- Defensive function: guaranteed by a series of systems that provide a barrier against bulky particles, microparticles and pathogenic microorganisms;
- Resonance of the voice function: in particular when pronouncing certain phonemes.

Several assumptions have been made on the function of the sinuses:

- lightening of the skull that otherwise would be too heavy.
- protection of the skull base in case of trauma.
- thermal insulation against the noblest of structures.
- vocal resonance.

➢ **Inflammatory diseases of the nose and sinuses**

❖ **Rhinitis**:

The most common form of acute inflammation of the nasal fossa, represented by acute rhinitis epidemic. This disease is commonly known as cold. It is supported by a viral etiology, particularly rhinovirus and parainfluenza virus. It is characterised by nasal respiratory obstruction associated with abundant nasal secretions. Possible bacterial infections are characterised by muco-purulent secretions. It should be remembered however, that medical therapy depends on anatomical factors (deviation of the nasal septum, hypertrophy of the inferior turbinate, pneumatisation of the middle turbinate) that can facilitate a poor nasal ventilation, with activation during acute and chronic inflammations, these factors are the subject to surgical correction.

A significant portion of nasal inflammation (20%) is represented by allergic rhinitis. These are caused by an immune reaction to specific external factors known as allergens. They are distinguished as seasonal allergens (e.g. pollen) and perennials (e.g. dust mites, animal hair).

Symptoms such as nasal respiratory obstruction, clear nasal discharge, sneezing, nasal itching, reduced sense of smell, eye involvement (allergic oculorhinitis) are reported. Diagnosis is made through a nasal endoscopic exam with flexible instrumentation, and optical fibers by means of specific allergy testing. Medical treatment includes antihistamines, local corticosteroids with low systemic absorption and possible sublingual vaccine therapy.

A form of rhinitis with similar symptoms as the allergic reaction but not related to allergens is the pseudo-allergic or vasomotor rhinitis. In this case the symptoms described above are triggered by thermal, chemical, optical or mechanical stimuli (e.g. exposure to light, heat, cold etc).The aforementioned medical therapy has little effect, very often it is necessary to decongest the inferior turbinate through diathermic or radio frequency surgery.

- **Sinusitis**:

Sinusitis is an inflammation of the sinuses. There are three types of sinusitis: the first is acute sinusitis, a type of inflammation which has rapid onset and can be treated with appropriate medical therapy; the second is the sub-acute sinusitis that lasts for periods up to three months and is also treatable with specific therapies; the third is chronic sinusitis, and occurs due to repeated acute episodes or previous infections that were treated poorly. Sinusitis can be viral, bacterial or fungal.

In the genesis of sinusitis a number of predisposing factors such as: structural alterations of the nose; immune deficiencies; dental infections and more are still considered as initiating aspects. The most common symptoms of sinusitis are: frequent purulent nasal secretions, pain in the facial region localised according to the affected sinuses, reduced or absent olfactory abilities. In addition to a thorough investigation of the symptoms reported by the patient, fibroendoscopic diagnosis is important for the examination, made with flexible fiber optic instruments, and a CT scan of the facial skeleton. Finally, on the basis of the clinical picture (acute, subacute, chronic), the age and the patient's state of health, tolerance to certain types of medications, procedures or therapies, treatment of sinusitis can be formed from medical treatments or surgical therapies

- **Nasal polyp**:

It is a multifactorial disease characterised by edematous reaction of the nasal submucosa with polyp formation. Nasal polyps are thickened mucous sacs due to the recurrence of inflammatory phenomena favoured by allergies, fungal infections, aspirin intolerance, autoimmune diseases (Churg-Strauss syndrome), nasal tumours (symptomatic polyposis),

muco-ciliary abnormalities. The patient suffering from nasal polyps complains of nasal respiratory obstruction, clear nasal secretions, reduction or complete loss of smell, voice alteration (nasal voice).

The diagnosis is made using endoscopic nasal examination with flexible fiber optic instrument that verifies the extent of polyps and the degree of their effect on the nasal passages. The CT scan of the facial skeleton without contrast and allergic tests are useful for more accurate treatment planning.

On the basis of the clinical picture (extent and severity of polyposis), age and state of health of the patient, tolerance of certain drugs, procedures or therapies, treatment of polyps can be based on:

- Medical therapy that includes corticosteroids through local route (more severe nasal sprays) and in some cases, systemically (by mouth or intramuscularly);
- Surgical therapy is the only option in cases of massive polyposis, in cases of failure to respond to medical therapy and patients who, for various reasons, cannot undergo prolonged treatment of cortisone. Surgery called FESS (Functional Endoscopic Sinus Surgery) is through nasal endoscopes and a specific tool (microdebrider) that fragments and aspires polyps and helps in meticulous removal of polypoid growths, restoring the patient's nasal anatomy and physiology. This is usually a non invasive surgery.

There are no external cuts nor are nasal swabs used .The patient is discharged on the next morning of the operation, with a total time of hospitalisation being 24 hours. A convalescent home stay of 8-10 days is recommended to reduce the risk of postoperative bleeding. The operated patient requires outpatient medications, administered twice a week and useful to control scarring in the aspiration of intranasal secretion.

Nasal polyps

- **Diseases and post-traumatic malformation of nose**

Included in this category of pathologies is deviation of the nasal septum, which is a misalignment of the bone cartilage that separates the two nasal cavities. It can be caused by a disharmonious development of the facial skeleton, in which case it is called congenital deviation, or nasal trauma that may also occur during childhood, in this case the deviation is termed as acquired. The deviation of the septum is often accompanied by a compensatory hypertrophy of the turbinates in the opposite nostril due to the convexity of the septum.

The patient shows difficulty in nasal breathing, which will therefore be associated with oral breathing, nocturnal snoring, frequent episodes of rhinitis and, in some cases, sinusitis, favoured by poor ventilation, which in turn determines one continuous state of inflammation of the sinuses and the nasal mucosa.

The therapy is exclusive surgical correction by means of the baffle plate. The surgery is called septoplasty and aims to improve the patient's nasal breathing.

The surgery is performed under general anaesthesia and involves a small incision inside the nose (which is thus invisible), the elevation of the mucosa that covers the nose and remodelling of the same by removal of part of cartilage and bone.

The use of nasal swabs, which make the post-operative care particularly annoying and painful is not required, but only thin silicon wafers are used and inserted between the septum and turbinates, thereby preventing the formation of abnormal postoperative adhesions. The discharge of the patient takes place the morning after the day of intervention, with a total time of 24 hours of hospitalization.

A convalescent home stay of 8-10 days is recommended to reduce the risk of postoperative bleeding. During the course of convalescence we proceed with the removal of the plates.

It is important to note that septoplasty does not in any way alter the aesthetics of the nose, but is intended solely for functional correction. You can, if the patient desires, add a procedure to incorporate aesthetic correction of the nasal pyramid.

- **Fractures of the nasal bones**:

The nasal pyramid is, because of its particular location, frequently involved in trauma affecting the face, which makes the fractures of the nasal bones, a relatively frequent event. They are characterised by nasal bleeding (nosebleeds), swelling of the nose, and in some cases are associated with skin wounds and/or other fractures of the facial skeleton.

The early detection of a fracture of the nasal bones allows rapid treatment by surgical reduction. The reduction of the fracture allows a realignment of the bone stumps. The operation must necessarily be performed within 7-10 days after trauma, since, after this period, it is no longer possible to realign the nasal bones because of abnormal consolidation of the bone segments. In these cases it can result in dimorphism of the nasal pyramid, solvable through rhinoplasty.

- **Tumours of nose and sinuses**

In the facial skeleton there are different histological structures, which can give rise to different types of cancer.

- **Benign tumours**:

Among the benign tumours of the nasal cavity and paranasal sinuses include fibroids, bleeding fibroangioma, osteomas (in the bone with frequent localisation in the frontal sinus) and papillomas. A particular form of papilloma is the so-called inverted papilloma: it is a benign neoformation characterised by a singular tendency to increase in depth with possible erosion of the surrounding bone structures. Its treatment is only surgical through modern nasal endoscopic technology, which allows the complete removal of the tumour in a rather traumatic and non-demolishing manner.

- **Malignancies:**

Malignant tumours of the nasal cavity and paranasal sinuses account for 1% of all malignancies. Particular occupational exposure (mainly woodworking and leather) induce chronic persistent inflammation, which causes progressive paralysis of mucociliary system. This determines an increase in the duration of the contact with the carcinogen, which with time may lead to the malignant transformation of some cells.

Sinonasal tumours involving this area are a part of the physiology of the face along with eyes, meninges and the skull contents. Therefore both surgical and radiotherapy treatment risk becoming excessively offensive and destructive. Early diagnosis is essential.

From the histopathological point of view the following symptoms are recognised:

- squamous cell carcinomas (mostly);
- adenocarcinomas (fairly represented);
- melanomas;
- mucoepidermoid carcinomas (born from ancillary salivary glands);

- adenoid cystic carcinomas or cilindromas;
- neuroestesioblastomas (malignant tumours arising in the olfactory epithelium).

❖ **Diagnosis is based on subjective symptoms, which must be assessed very carefully:**

- nasal respiratory obstruction 60-90%
- nasal bleeding
- frequent purulent nasal discharge usually unilateral (rinopiorrea)
- sense of unpleasant odour (cacosmia)
- pains

This symptom, however, is more easily attributable to common rhinitis or rhinosinusitis, and therefore it is often a late diagnosis of cancer, at the onset of the so-called signs of externalisation or secondary adenopathies.

Endoscopic nasal examination with flexible and rigid instrumentation fiber optic displays is essential for diagnosis and allows direct biopsy of the tumour.

The imaging or radiological evaluation is performed with CT of the facial mass and MRI with contrast medium, which allow one to precisely define the extent of disease and the best treatment plan.

The therapeutic weapons at our disposal make use of surgery and radio and chemotherapy. The surgical therapy uses endoscopic techniques, with the aid of dedicated and laser technology, along with traditional surgical techniques, depending on the choice of the tumour by particular conditions in question. In larger forms, demolition of bony structures of the facial skeleton is required. It is useful (with the exception of rare early forms) for mapping post-operative radiotherapy treatment. The exclusive chemo-radiation treatments are reserved for only extra surgical cases.

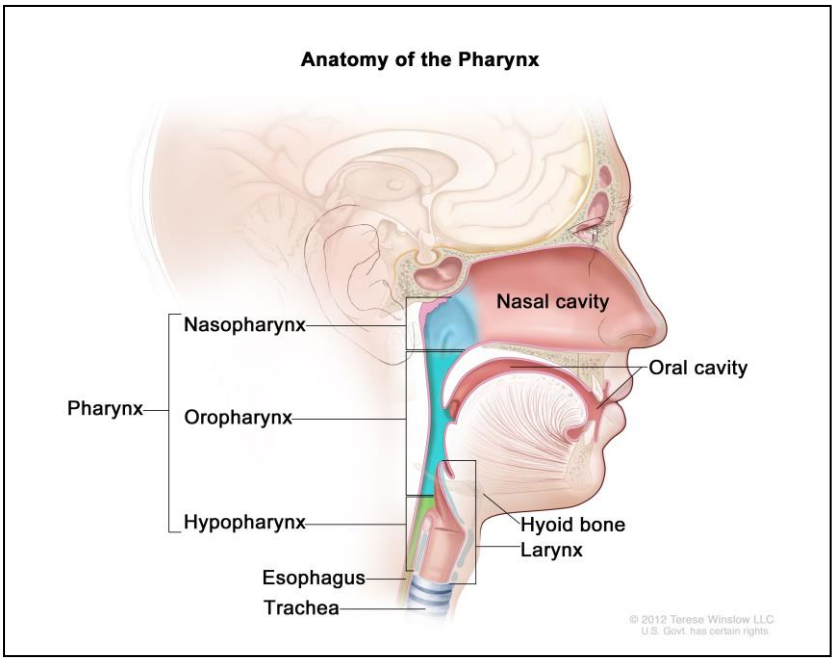
Suggestive Reading

Norman S William, Roman O Connell, Andrew W McCaskie. Bailey & Love short practice of surgery, 27th edition. Taylor and Francis, 2018

Diseases of Pharynx and Larynx

❖ The pharynx:

Is a muscular tube that connects the oral and nasal cavity to the larynx and oesophagus. It begins at the base of the skull, and ends at the inferior border of the cricoid cartilage (C6). The pharynx is comprised of three parts (superior to inferior): Nasopharynx. Oropharynx.

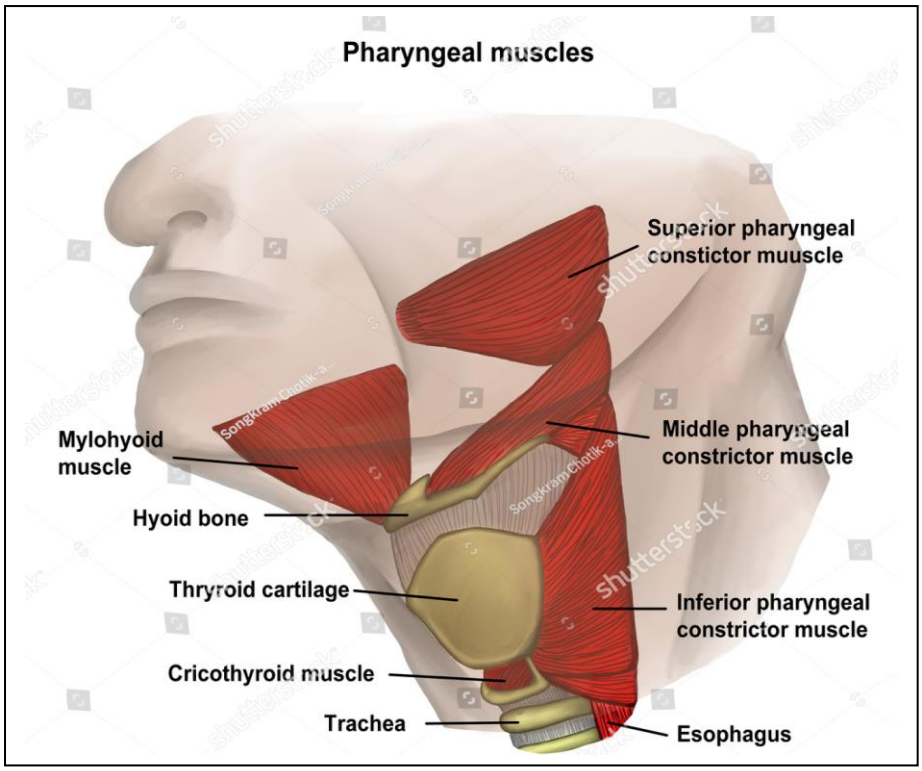


➢ Pharynx function:

The pharynx, commonly called the throat, is a passageway that extends from the base of the skull to the level of the sixth cervical vertebra. It serves both the respiratory and digestive systems by receiving air from the nasal cavity and air, food, and water from the oral cavity. The throat (pharynx) is a muscular tube that runs from the back of your nose down into your neck. It contains three sections: the nasopharynx, oropharynx and laryngopharynx, which is also called the hypopharynx

➢ Muscles of the pharynx:

Two main groups of pharyngeal muscles; longitudinal and circular. The muscles of the pharynx are mostly innervated by the vagus nerve – the only exception being the stylopharyngeus (glossopharyngeal nerve).



Muscles of the pharynx

- **Parts of the Pharynx**

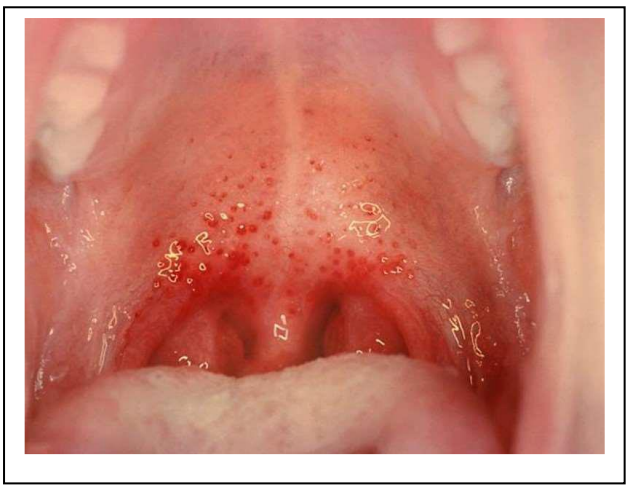
- Nasopharynx
  Between the base of the skull and the soft palate
- Oropharynx
  The middle part of the pharynx,between the soft palate and the superior border of the epiglottis
- Laryngopharynx
  Distal part of the pharynx,between the superior border of the epiglottis and inferior border of the cricoid cartilage (C6)

-Arterial supply is via branches of the external carotid artery Venous drainage is achieved by the pharyngeal venous plexus

- **Diseases of the Pharynx**
  1-Pharyngitis
  2-Tonsillitis
  3-Adenoids Hypertrophy
  4- Tumours of the nasopharynx

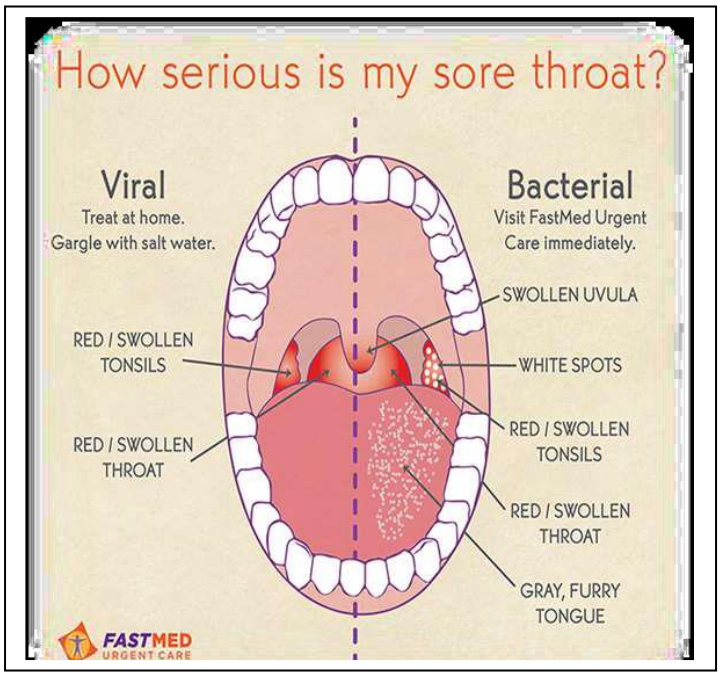
1- Pharyngitis

Inflammation of the pharynx, causing a sore throat



- **Causes**

-viral and bacterial agents cause pharyngitis
-measles
-adenovirus,cause of the common cold
-chickenpox
-croup,a barking cough
-whooping cough



- **Symptoms of pharyngitis:**

 sneezing
 runny nose
 headache
 cough
 fatigue
 body aches
 chills
 fever (a low-grade fever with a cold and higher-grade fever with the flu)

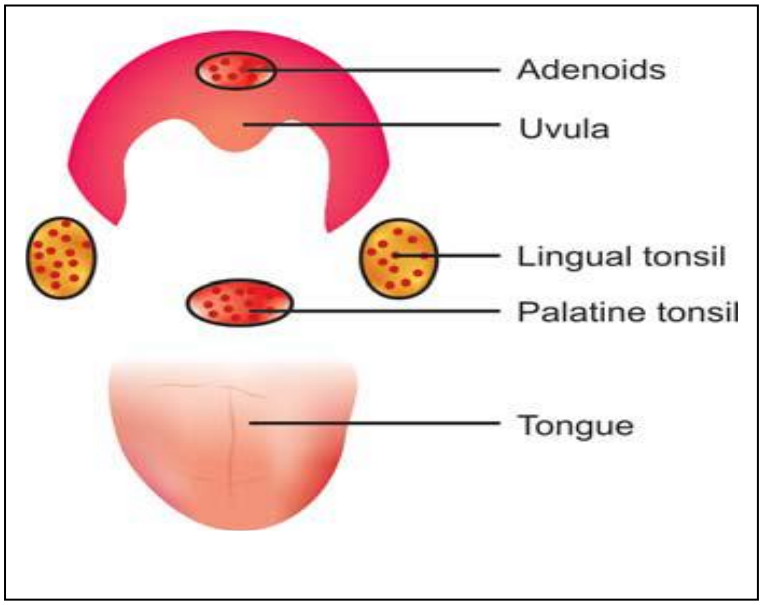
- **How is pharyngitis diagnosed?**

 1- Clinical features
 2-Throat Culture

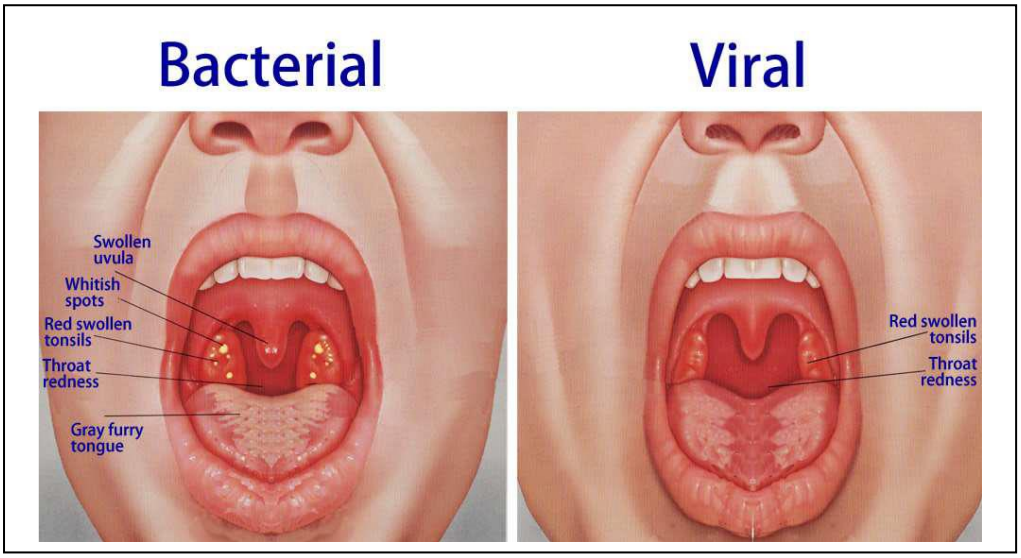
- **Treatment of pharyngitis:**
  1-Home Care
  2-Medical Treatment: According to the Mayo Clinic, penicillin is the most commonly prescribed treatment for sore throat.

2-Tonsillitis

-Tonsillitis is inflammation of the tonsils due to infection
Tonsils are the two lymph nodes located on each side of the back of your throat
Tonsils are your first line of defense against illness and they produce white blood cells to help your body fight infection.
 but are vulnerable to infection from these invaders themselves.



Waldeyer's lymphatic ring



Causes of Tonsillitis

- **Symptoms**

 a very sore throat
 difficulty swallowing or painful swallowing
 a scratchy-sounding voice
 bad breath
 fever
 chills
 Headaches
 a stiff neck
 jaw and neck tenderness (due to swollen lymph nodes)
 tonsils that appear red and swollen
 tonsils that have white or yellow spots

- **Diagnosed**

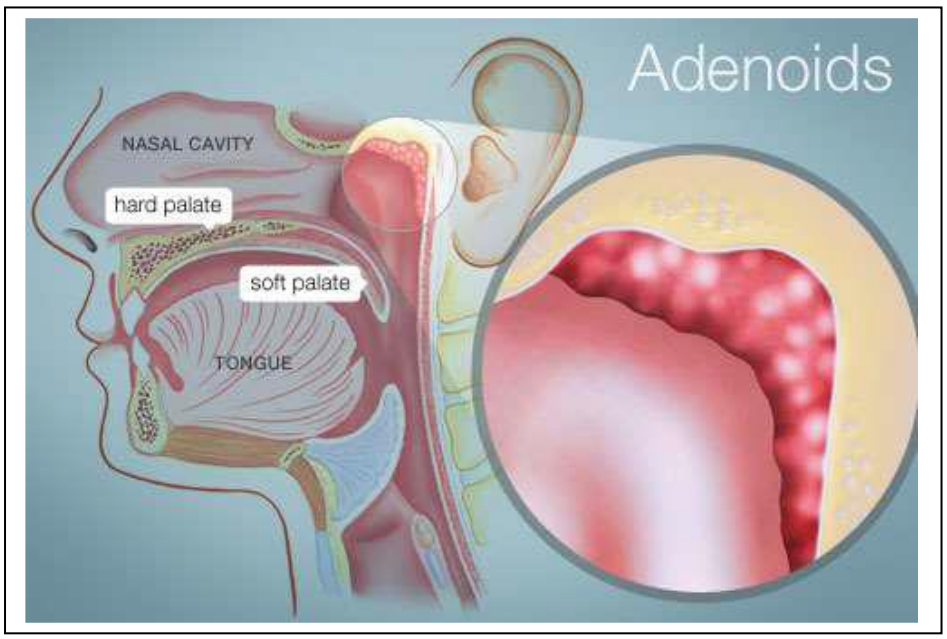
 based on a physical examination of the throat and may include a throat culture

- **Treatments for severe cases**

1-Antibiotic
2-Tonsillectomy

3- Adenoids

Adenoids are small tissues located at the back of the throat.
 They are similar to the tonsils
 Both adenoids and tonsils are part of the immune system, which helps to prevent and fight infection in your body



Adenoid

- **Causes of adenoids**

Bacterial or Viral Infection

-The unusual growth ("hypertrophy") of the adenoid tonsil first described by the Danish physician Wilhelm Meyer (1824- 1895) in Copenhagen in 1868. He described that a long term adenoid hypertrophy will cause an obstruction of the nasal airways.

- **Symptoms**

 blocked, stuffy nose
 ear problems
 problems sleeping
 snoring
 sore throat
 difficulty swallowing
 swollen glands in the neck
 problems breathing through the nose
 glue ear (fluid buildup in the middle ear, which can cause hearing problems)
 cracked lips and dry mouth (from breathing problems)
 sleep apnea (irregular breathing during sleep)

- **Diagnosis**

Clinical feature

Physical examination through Endoscope

- **Treatment**

1- Many people with enlarged adenoids have few or no symptoms and do not need treatment. Adenoids shrink as a child grows older.
2- The health care provider may prescribe antibiotics or nasal steroid sprays if an infection develops.
3- Surgery to remove the adenoids (adenoidectomy) may be done if the symptoms are severe or persistent

- **Obstructive sleep apnoea (OSA)**

This condition is becoming increasingly diagnosed in children and is important because it can cause sleep deprivation and secondary cardiac complications. It has been implicated in some cases of sudden infant death syndrome. The most common symptom is snoring, which is typically irregular, with the child actually ceasing respiration (apnoea) and then restarting with a loud inspiratory snort. The child is often restless and may take up strange sleep positions as he or she tries to improve the pharyngeal airway. Surgical removal of the tonsils and adenoid is curative, but it is important to avoid sedative premedications and opiate analgesics postoperatively because they may further depress the child's respiratory drive.
OSA may also occur in adults, where the obstruction may result from nasal deformity, a hypertrophic soft palate associated with an altered nasopharyngeal isthmus, obesity and general narrowing of the pharyngeal airway, or supraglottic laryngeal pathology.

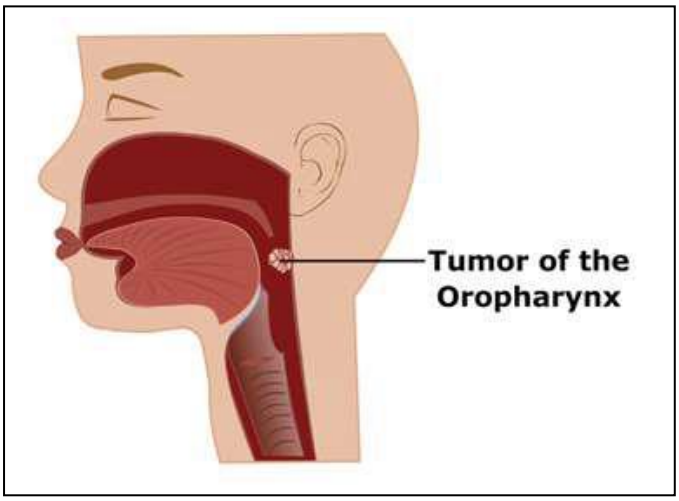
4- Tumours of the nasopharynx

- **Benign**

There are two main types of benign tumour of the nasopharynx: the angiofibroma and the antrochoanal polyp. Both are rare.

- **Malignant**
- **Nasopharyngeal Carcinoma**

Nasopharyngeal carcinoma has a marked geographically variable incidence. In most parts of the world, the tumour is rare with an annual incidence of 1 case per 100 000 population; however, among southern Chinese populations the rate is 30–50 cases per 100 000 population. The aetiology of nasopharyngeal carcinoma is multifactorial. Genetic susceptibility, early infection by the Epstein–Barr virus and consumption of traditional diets, particularly salted fish, are known to
contribute.
Investigation: This is by direct inspection with a flexible or rigid nasendoscope and biopsy under topical or general anaesthesia. Serological investigation for Epstein–Barr virus-associated antigenic markers in combination with the clinical and histological examination is valuable for the early detection of disease.



- **Causes:**

 Throat cancer occurs when cells in your throat develop genetic mutations

- **Types**

1-Nasopharyngeal cancer
2-Oropharyngeal cancer
3-Hypopharyngeal cancer (laryngopharyngeal cancer)
4-Glottic cancer
5-Supraglottic cancer
6-Subglottic cancer

- **Risk Factor**

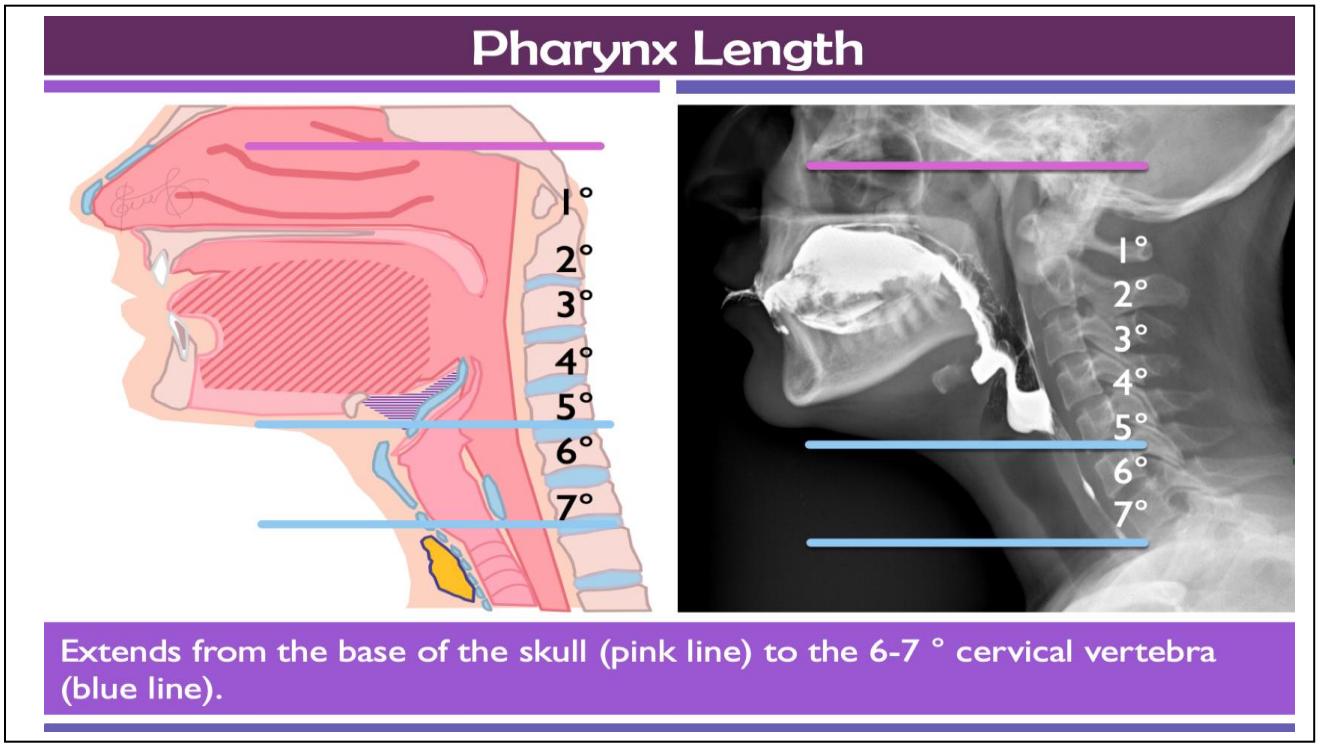
 Tobacco use, including smoking and chewing tobacco
 Excessive alcohol use
 A virus called human papillomavirus (HPV)
 A diet lacking in fruits and vegetables
 Gastroesophageal reflux disease (GERD)

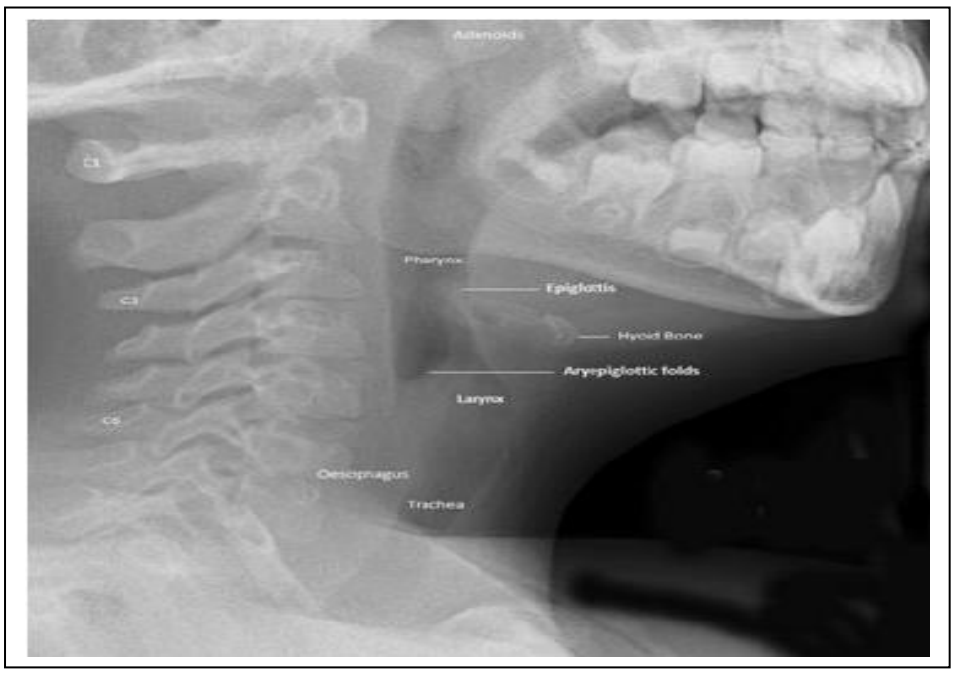
- **Diagnosis**

1-Endoscope
2-Tissue Biopsy
3-Imaging

- **Treatment**

1-Radiotherapy
2-Surgery
3-Chemotherapy
4-Cetuximab (Erbitux)


Pharynx Length
1°
2°
3°
4°
5°
6°
7°
1°
2°
3°
4°
5°
6°
7°
Extends from the base of the skull (pink line) to the 6-7 ° cervical vertebra (blue line).


Adenoids
C1
Pharynx
Epiglottis
C3
Hyoid Bone
Aryepiglottic folds
Larynx
C6
Oesophagus
Trachea

Suggestive Reading

Norman S William, Roman O Connell, Andrew W McCaskie. Bailey & Love short practice of surgery, 27th edition. Taylor and Francis, 2018

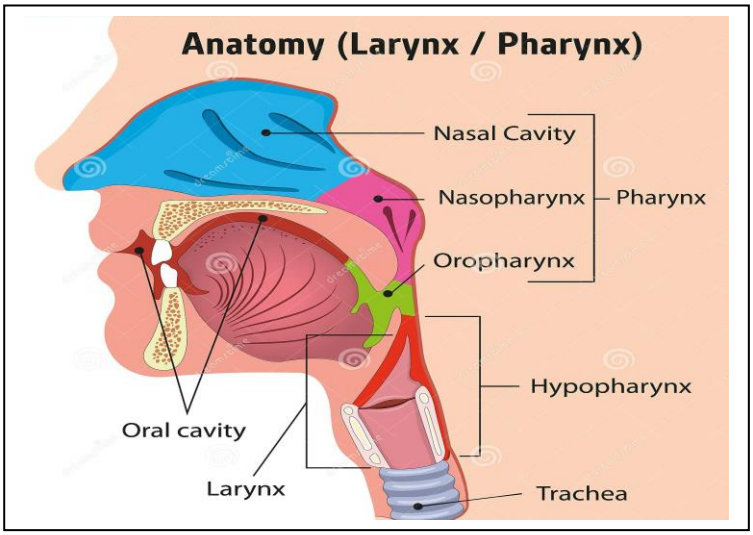
Diseases of Pharynx and larynx

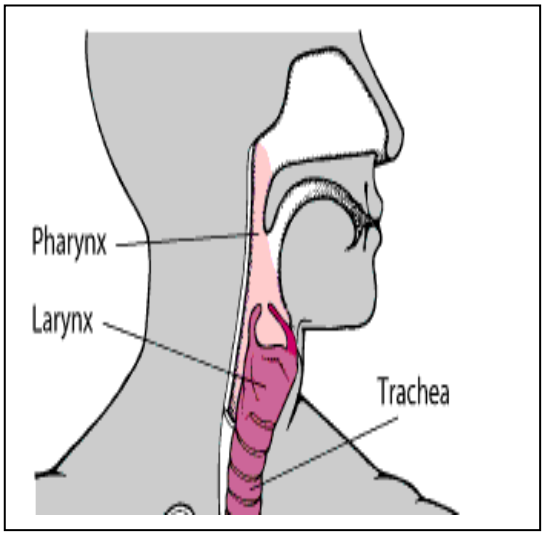
❖ The larynx

The larynx, commonly called **the voice box** or glottis, is the passageway for air between the pharynx above and **the trachea** below. **The larynx** plays an essential role in human speech. During sound production, the vocal cords close together and vibrate as air expelled from the lungs passes between them.

➢ Function of the larynx

The **larynx** serves to protect the lower airways, facilitates respiration, and plays a key **role** in phonation. In humans the protective and respiratory **functions** are compromised in favor of its phonatory **function.** The 3 parts of the larynx**,** the internal space of the **larynx** is wide in the superior and inferior **parts** but narrows in the middle, forming a section named glottis, and dividing all the spaces into **three** sections: supraglottic, glottis, and infraglottic. The vocal cords, the glottis, and the **larynx** ventricles comprise the glottic space.





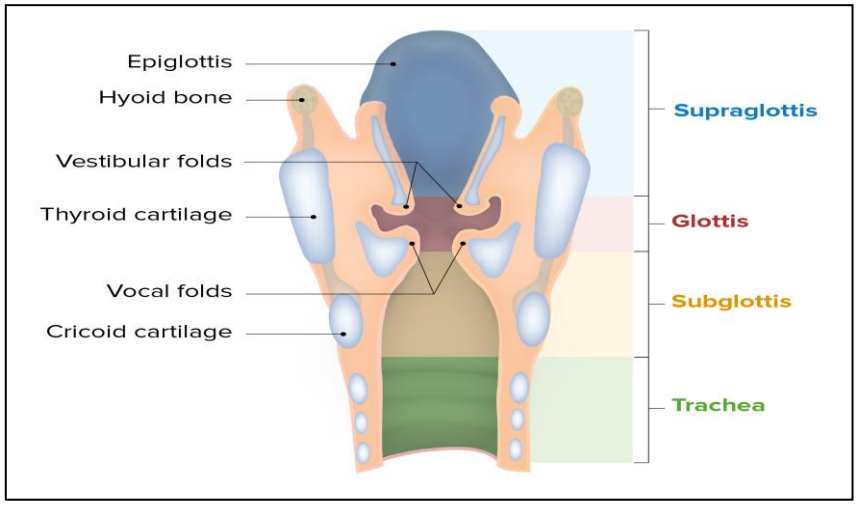
The larynx is a small structure of cartilage that connects the throat to the windpipe. It is found in the front of the neck and houses the vocal cords, producing speech sounds and contributing to respiration.

❖ Surgical Anatomy

The larynx is an integral part of the respiratory system and is the organ of voice production .The larynx consists of a cartilaginous framework bound together by ligaments and covered muscle and mucous membrane. The cartilage of the larynx is either unpaired or paired cartilage. Unpaired cartilages:

1.Thyroid cartilage

2. Cricoid cartilage
Paired cartilages:
1. Arytenoid car.
2. Corniculate car.
3. Cuniform car.



-The larynx is a complex box made of bone and cartilage and lined with mucosa. If extends from tip of epiglottis to the distal rim of cricoid cartilage. It is divided into three anatomical areas:

A. Supraglottic area: It extends from epiglottis to the ventricle including pre-epiglottic space, hyoid bone, arytenoid processes and false vocal cords.

B. Glottic area: It includes true vocal cords and anterior commissures.
C. Subglottic area: It is the area surrounded by cricoid cartilage.

- **Physiology**

The main function of larynx is modulation of air inspired through the nose and expired from the lungs for maintenance of normal speech. It coordinates respiration with the swallowing so that food is prevented from entering the respiratory tree and air from entering the digestive tract.

- **Stridor**

Stridor means noisy breathing. It can be:
A. Inspiratory: It is due to obstruction at or above vocal cords and commonest cause is inhaled foreign body.

B. Expiratory: It is due to lower respiratory tract problems, e.g. asthma, tracheobronchitis.

C. Biphasic: It is due to obstruction or disease of tracheobronchial airway.
In children, often there is history of foreign body ingestion and the child is cyanosed with inspiratory stridor. The foreign body should be immediately dislodged by hooking with finger or by inverting the child and slapping the back. In adults, Heimlich maneuver is done for dislodgement of foreign body. In urgent cases, tracheostomy may be required. In less urgent cases, lateral radiograph of the neck and chest X-ray are done followed by direct laryngoscopy under anesthesia.

❖ Epiglottitis

It is acute edema of aryepiglottic folds and epiglottis.

➢ Causes

• Infection caused by *H. influenzae*, streptococci, diphtheria.
• Ludwig's angina
• Trauma
• Burns and scalds of head and neck region
• Extension of local malignancy
• Radiotherapy

➢ Clinical Features

• Hoarse voice
• Dysphagia
• Dyspnea
Laryngoscopic examination reveals intense inflammation of aryepiglottic folds and epiglottis.

➢ Treatment

• Steam inhalation
• Local spray of dilute adrenaline solution.
• Antihistaminics and steroids.
• Antibiotics (ampicillin or chloramphenicol)
Children with acute epiglottitis may develop acute respiratory obstruction and require intensive care management in form of:
• Endotracheal intubation or tracheostomy
• Oxygenation
• Humidification
• Oximetry

❖ Laryngitis

➢ Acute Laryngitis

Acute laryngitis is often associated with upper respiratory infection. It is usually viral in origin and presents with hoarseness of voice. Treatment is steam inhalation, analgesics and voice rest. It usually gets resolved in 2-3 weeks.

➢ Chronic Laryngitis

If hoarseness of voice lasts for 3-4 weeks, patient should be referred to ENT surgeon particularly in smokers. Its cause can be:

- **Specific**
  - Caused by

• Mycobacteria
• Fungal infection
• Syphilis
Treatment is specific for causative organism.

- **Non-specific**
  - Caused by

• Smoking
• Sepsis of respiratory tract
• Voice abuse
• Gastro-esophageal reflux disease
Treatment is elimination of predisposing factors. In neglected cases, laryngeal mucosa may become dysplastic and premalignant.

- **Vocal Cord Polyp**

It is a soft, grey, pedunculated mass on vocal cord, mostly unilateral. It is usually associated with smoking, voice abuse or acute infection. Treatment is removal by microdissection or laser surgery.

- **Vocal Cord Palsy**

All the muscles of larynx are supplied by recurrent laryngeal nerve except cricothyroid muscle that is innervated by superior laryngeal nerve. Unilateral recurrent laryngeal nerve palsy leads to paramedian position of the affected vocal cord due to unopposed adducting action of cricothyroid muscle. Bilateral recurrent laryngeal nerve palsy leads to paramedian position of both vocal cords causing acute respiratory obstruction.

- **Investigations**

CT scan from skull base to diaphragm reveals most of the pathologies causing undiagnosed vocal cord palsy.

- **Treatment**

In ¼th cases, vocal cord palsy occurs without known pathology and spontaneous recovery occurs with conservative treatment. The vocal cord can be displaced medially and can be corrected by a surgical procedure (Thyroplasty). In bilateral vocal cord palsy, tracheostomy is required immediately

- **Tumors Of The Larynx**

- **Benign Tumors**

These are extremely rare.

A. *Papilloma:* It is the commonest benign tumor. It is probably caused by human papilloma virus. In adults it is usually single and presents as a pedunculated mass attached to vocal cords. The patient presents with hoarseness of voice. The diagnosis is made with

laryngoscopic examination. The treatment is laser ablation or surgical excision since it may rarely become malignant. In children, papillomas are usually multiple with high tendency of recurrence. It is selflimiting condition and disappears spontaneously by adult life. Hence, it should not be subjected to radical excision for fear of damaging vocal cords.

B. Angiofibroma: It is always single and presents as a small, smooth, red colored mass on the vocal cord. The patient presents with hoarseness of voice and hemoptysis. The diagnosis is made on laryngoscopic examination and the treatment is endoscopic removal or cryosurgery.

- **Malignant Tumors**

Squamous cell carcinoma is the commonest tumor of larynx. It is the most common malignancy of the upper aerodigestive tract.

- **Incidence**

It is most commonly seen in elderly male smokers. However, sex incidence is changing due to increased smoking habits among women. The male to female ratio has dramatically decreased from 10 : 1 to 5 : 1 in last two decades.

- *Etiology*

• Exposure to tobacco (smoking) is most important etiological factor.

• Other likely cofactors are:
Metal dust (Nickel)
Wood dust
Asbestos
Hair dyes
• There is some unclear relation between adult onset papilloma and carcinoma larynx.

- **Classification**

There are three varieties of laryngeal carcinoma based on its location:
A. Glottic*:* It is the commonest variety. The tumor arises from true vocal cords involving anterior half. It is mostly papillary in appearance. Due to paucity of lymphatic vessels in the vocal cords, it remains locally malignant for long time. The first symptom is hoarseness of voice that is progressive and may lead to stridor and aphonia. When tumor extends outside the glottis, it becomes aggressive and involves cervical lymph nodes. Due to slow growth, it has most favorable prognosis.

B. Subglottic*:* It is rare variety. The tumor arises below vocal cords. The tumor grows steadily and silently till dyspnea develops. Hoarseness of voice indicates late disease. The growth may involve thyroid gland and deep cervical lymph nodes.

C. Supraglottic*:* It is also called extrinsic laryngeal carcinoma and it involves false vocal cords, laryngeal ventricles and root of epiglottis. Due to abundant lymphatic supply, it presents with advanced stage disease and has worst prognosis. The patient presents with throat pain, hoarseness of voice and dysphagia. Neck nodes are involved in majority of the cases.

❖ Tracheostomy

It is making an opening in anterior wall of the trachea and converting it into a stoma on skin surface.

➢ Indications

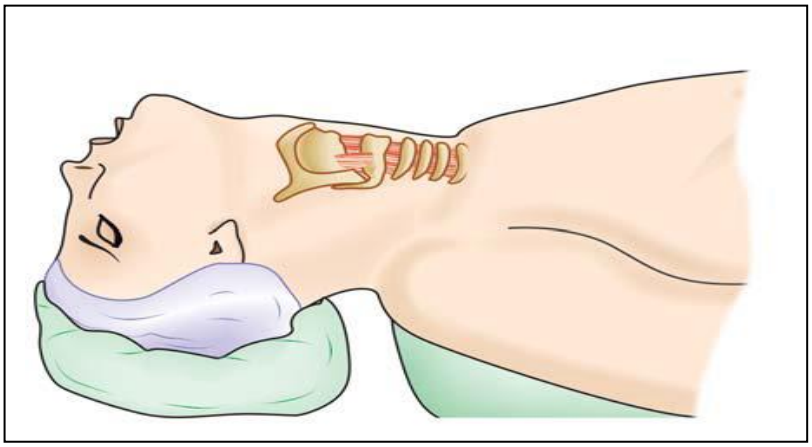
1. Upper airway obstruction
• Foreign body
• Infection (diphtheria, Ludwig's angina)
• Edema of glottis (head and neck burns)
• Bilateral vocal cord palsy
• Trauma (faciomaxillary, larynx, trachea)
• Tumor (carcinoma larynx)
• Congenital lesions (web, atresia)
• Chronic stenosis (Tuberculosis, scalding)

2. Retained secretions
• Severe bronchopneumonia
• Chronic bronchitis
• Chest injury (Flail chest)

3. Respiratory insufficiency
• Head injury
• Bulbar poliomyelitis
• Barbiturate poisoning
• Tetanus

➢ Aims of Tracheostomy

Aim is to assist respiration which it does in the following ways:
i. It relieves upper airway obstruction.
ii. It reduces the anatomical dead space (150 ml).
iii. Toilet of tracheobronchial tree by giving direct access.
iv. Cuffed endotracheal tube protects the airways from aspiration and allows positive pressure ventilation to be maintained for a prolonged period.



Position of the patient for tracheostomy

- **Advantages of tracheostomy over endotracheal intubation are:**

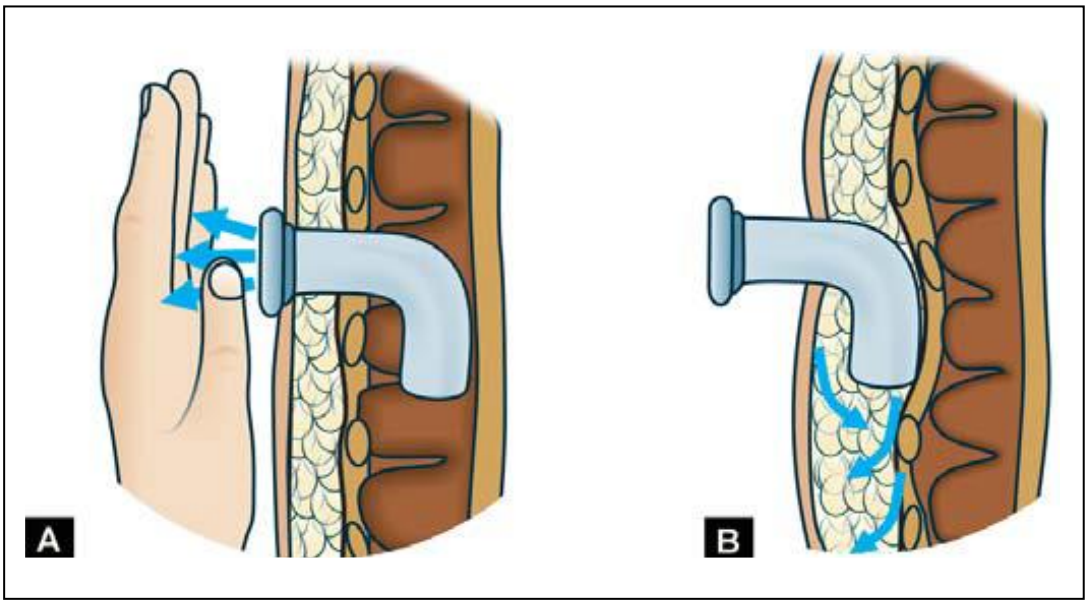
i. Patients are more comfortable and require no sedation.
ii. It can be continued indefinitely.
iii. Suction and clearing of secretions is easier.
iv. Work of breathing is reduced.
v. Alveolar ventilation is increased.
vi. Weaning is easier with tracheostomy.

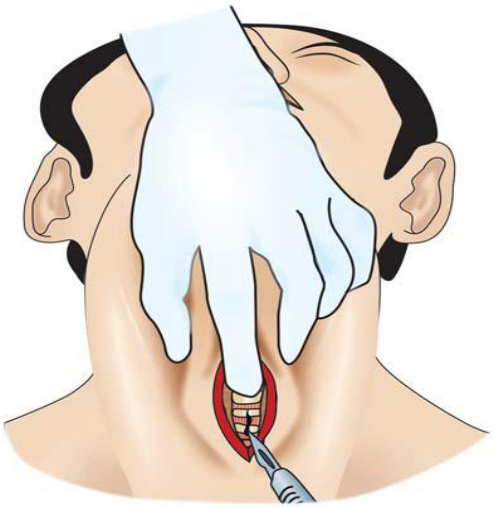
- **Disadvantages of tracheostomy are:**

i. It is an open wound liable to infection.
ii. Loss of heat and moisture leading to desiccation and metaplasia of tracheal epithelium.
iii. Tracheostomy tube acts as a foreign body that stimulates mucus production in the trachea. The mucus gets encrusted and blocks the tube.

- **Types of Tracheostomy**

i. Emergency*:* It is done for acute airway obstruction. If facilities don't exist and experienced doctor is not available, a large intravenous cannula may be inserted into cricothyroid membrane to relieve acute upper airway obstruction.
ii. Elective*:* During certain operations on upper airway.
iii. Permanent: Following laryngectomy.





- **Complications of Tracheostomy**
  - Intraoperative Complications

• Hemorrhage
• Recurrent laryngeal nerve injury
• Tracheal injury
• Esophageal injury

- **Postoperative complications**

• Surgical emphysema
• Pneumothorax
• Pneumomediastinum
• Aspiration pneumonia
• Accidental dislodgement of the tube
• Wound infection
• Tracheal stenosis
• Tracheo-esophageal fistula
• Tracheo-cutaneous fistula
• Tracheo-innominate artery fistula (severe hemorrhage)

Suggestive Reading

Norman S William, Roman O Connell, Andrew W McCaskie. Bailey & Love short practice of surgery, 27th edition. Taylor and Francis, 2018

Nutritional Support

Dr. sabah Alheeti

Nutrition plays a vital role in the recovery of patients from surgery. It is estimated that between 30% and 50% of hospitalized patients are malnourished. Poor nutrition has deleterious effects on wound healing and immune function, which increases postoperative morbidity and mortality.

Nutritional requirements: The Calories are provided mainly by carbohydrate and fat

- Fat = 9 kcal/g
- Carbohydrate = 4 kcal/g
- Protein = 4 kcal/ g
- Daily caloric requirements: 30-35kcal/kg which is increased in sepsis, trauma, surgery or ventilation (35-40kcal/kg/day).
- Daily protein requirements in the average healthy adult without excessive losses are approximately 0.8 g/kg body weight

Malnutrition

According to the WHO, malnutrition is "the cellular imbalance between supply of nutrients and energy and the body's demand for them to ensure growth, maintenance, and specific functions.
What are the causes of malnutrition?

- Neglect (e.g., severe alcoholics, extreme of ages)
- Digestive problems
- Inadequate food intake
- Chronic illness
- Dysphagia
- Stress and trauma
- Vomiting

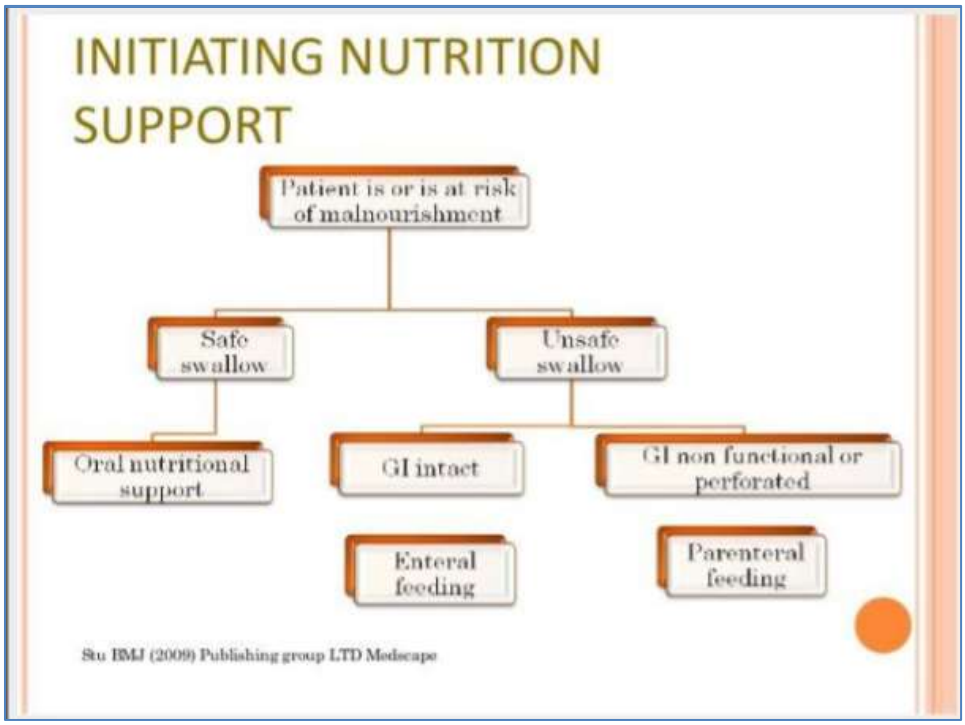
Nutritional assessment

1- Anthropometric measurements such as triceps skinfold thickness and midarm muscle circumference reflect body-fat stores and skeletal muscle mass, respectively.
2- body mass index (weight kg/height m2) < 18.5 indicates nutritional impairment.
3- Laboratory tests: Serum albumin of less than 3.5 g/dL, Serum prealbumin less than 5 mg/dl, Serum transferrin of less than 200 mg/dL.

Nutritional support is the provision of nutrients to patients who cannot meet their nutritional requirements by eating standard diets.

What are the indications for nutritional support?

- Inadequate intake for more than 5 days
- Malnourished patients undergoing surgery
- Major trauma (burn victims, blunt or penetrating injury, etc.)



Routes of nutritional support

1- Enteral nutrition
2- Parenteral nutrition

Enteral nutrition

- Delivery of nutrient into healthy and functioning gastrointestinal tract.
- Most preferred and more physiological
- Advantages:

- Maintain gut mucosal integrity
- Maintain normal gut flora & pH
- Cheap & easily available
- Less complications

. Types of enteral feeding:

1) Nasogastric tube (or nasoduodenal or nasojejunal)
2) Gastrostomy : placing the feeding tube through abdominal wall
   Into stomach (surgically or endoscopic)
3) Jejunostomy : placing the feeding tube through abdominal wall
   Into jejunum (surgically or endoscopic)

- Note: For long-term enteral feeding, enterostomies are the preferred access route than nasogastric tube.
- Nasoduodenal tube feedings are indicated in:
  • Patients at risk for aspiration.
  • Patients who are debilitated, demented, stuporous, or unconscious.
  • Patients with gastroparesis or delayed gastric emptying.

- The available dietary formulations for enteral feedings can be divided into polymeric (blenderized and nutritionally complete commercial formulas), chemically defined formulas (elemental diets)
- Indication: Enteral feedings are indicated for patients who have a functional GI tract but are unable to sustain an adequate oral diet

Indications for enteral tube feeding

Indication for feeding	Examples
Unconscious patient	Head injury, ventilated patient
Swallowing disorder	Post-CVA, multiple sclerosis, motor neurone disease.
Physiological anorexia	Liver disease (particularly with ascites)
Upper GI obstruction	Oesophageal stricture.
Partial intestinal failure	Postoperative ileus (see section 5.0), inflammatory bowel disease, short bowel syndrome.
Increased nutritional requirements	Cystic fibrosis, renal disease.
Psychological problems	Severe depression or anorexia nervosa.

GI, gastrointestinal; CVA, cerebrovascular accident.

Source : Nightingale, J. et al. 2003

- Contraindication: intestinal obstruction, ileus, GI bleeding, severe diarrhea, vomiting, enterocolitis, or a high-output enterocutaneous fistula. It is also contraindicated in patients in shock.
- Complications:
  I. Tube-related: malposition, break, block and leakage of feeding tube.
  II. Gastrointestinal: nausea, vomiting, diarrhea and pulmonary aspiration
  III. Metabolic: constipation, electrolyte imbalance
  IV. Infections

Parenteral nutrition

Parenteral nutrition is a way to feed the patient intravenously. It can be delivered centrally through a central venous catheter, most commonly in the superior vena cava or peripherally (PPN) via a peripheral vein.
While the total Parenteral nutrition (TPN) is the delivery of all the required nutrients parenterally. It is a solution containing proteins, carbohydrates, fat, vitamins, and minerals. Because of the high osmolarity of the solution and the risk of phlebitis, it is usually given centrally rather than peripherally. Consequently, solutions delivered peripherally need to be diluted and may not meet the complete nutritional requirements of the patients.

When are TPN and PPN indicated?
TPN is indicated when patients need long-term nutritional support but are not able to receive enteral feedings (nonworking GI tract, shock, pancreatitis, bone marrow transplant, etc.). PPN is indicated in patients requiring short-term nutritional support (<10 days) to restrict protein breakdown.

- **Indications** of parenteral nutrition: indicated for patients who require nutritional support but cannot meet their needs through oral intake and for whom enteral feeding is contraindicated or not tolerated.
- **Contraindications**: heart failure, blood dyscrasia and altered fat metabolism.
- **Complications** of parenteral nutrition?
  Hyperglycemia, fatty liver, hypercapnia, acute respiratory distress syndrome, GI mucosal atrophy (predisposing the gut for bacterial translocation and septicemia). Catheter-related complications include infections and pneumothorax

Surgical infection

د. صباح الهيتي

Surgical infections : infections that require operative treatment or result from operative treatment.
Infections that require operative treatment include:

- necrotizing soft tissue infections
- body cavity infections such as peritonitis, suppurative pericarditis and empyema.
- confined tissue, organ, or joint infections such as abscess and septic arthritis
- prosthetic device–associated infections e.g. infected plate used in fixation of fracture

infections that result from operative treatments include:

- wound infections,
- postoperative abscesses,
- postoperative body cavity infections such as postoperative peritonitis.
- prosthetic device– related infections,
- hospital-acquired infections such as pneumonia.

Determinants of Infection
The development of surgical infection depends on several factors:
(1) microbial pathogenicity and number,
(2) host defenses,
(3) the local environment: e.g a traumatic wound has greater likelihood if the trauma has resulted in devitalization of tissue or if foreign bodies have been deposited in the wound.
(4) surgical technique: the surgeon can reduce the likelihood of postoperative infections by handling tissues gently; removing devitalized tissues, blood and other substances that promote growth of microbes; and using drains appropriately.

Types of surgical infections

Soft tissue infections include:
1- Cellulitis and lymphangitis: Cellulitis is a non-suppurative, invasive infection of tissues, which is usually related to the point of injury.There is poor localisation in addition to the cardinal signs of spreading inflammation (redness, heatness, swelling, pain and loss of function). Systemic signs (the old-fashioned term is toxaemia) are common, with chills, fever and rigors. These events follow the release of toxins into the circulation.
Lymphangitis is part of a similar process and presents as painful red streaks in affected lymphatics draining the source of infection. Lymphangitis is often accompanied by painful lymph node groups (lymphadenitis) in the related drainage area. Blood cultures are often negative.

Treatment: antibiotics alone but Surgical incision and drainage are indicated if no improvement is seen in 2 to 3 days, or if evidence of purulent collection is identified.

2- Soft tissue abscess:

An abscess is a pocket of tissue containing necrotic tissue, bacterial colonies, and dead white cells.

The area of infection may or may not be fluctuant. The patient is often febrile at this stage.

Treatment: incision and drainage (I&D) and leave the cavity to heal by secondary intention. Antibiotics should be used if the abscess cavity is closed after drainage.

Table 28-3. A Comparison of Cellulitis and Abscess

	CELLULITIS	ABSCESS
Duration	Acute	Chronic
Pain	Severe and generalized	Localized
Size	Large	Small
Localization	Diffuse borders	Well circumscribed
Palpation	Doughy to indurated	Fluctuant
Presence of pus	No	Yes
Degree of seriousness	Greater	Less
Bacteria	Aerobic	Anaerobic

3- Necrotizing Soft tissue infections (gas gangrene, necrotizing fasciitis)

They can be defined as infections of any of the layers within the soft tissue compartment (dermis, subcutaneous tissue, superficial fascia, deep fascia, or muscle) that are associated with necrotizing changes. NSTIs are typically not associated with abscesses, although they can originate from an untreated or inadequately drained abscess. Debridement of the necrotic tissue should be undertaken as soon as possible together with other principles of treatment for any kind of surgical infection: source control, antimicrobial therapy, support.

Antibiotics in surgical infections

A. **Indications :** is used only as adjunct in treating surgical infection; operative treatment is more important. The antibiotics is used either for
   I. *Treatment of infection (Empiric treatment, Definitive treatment).*
   II. *Prophylactic antibiotics*

B. ***Principles of antibiotic treatment***
   I. *Identify most likely causative organism (bacteria, fungus or virus)*

II. *Use appropriate antibiotic agents*
III. *Initially, start antibiotic treatment on presenting identifications and clinical judgment.*
IV. *Assessment of renal and hepatic functions*
V. *Presence of hypersensitivity to drugs.*
VI. *Prior to treatment specimens of blood, urine should be collected.*
VII. *Pus should be drained*
VIII. *Necrotic tissue and foreign bodies should be removed.*
IX. *Once started AB. , should never be changed unless features of no responding by clinical examinations or culture results show different pathogens.*
X. *Route of giving antibiotics*

C. Complications of antibiotic treatment

I. *Development of resistance.*
II. *Hypersensitivity.*
III. *Side and irritation effects.*
IV. *Opportunistic infections (disturbe normal flora).*
V. *Toxic effects*

D. Indications of combined antibiotic treatment

I. *Treatment of mixed infections.*
II. *To delay development of bacterial resistance.*
III. *Initial treatment of serious infections.*
IV. *To obtain potentiation or synergistic actions*

E. Causes of ineffective antibiotic treatment

I. *Wrong route of administration.*
II. *Impaired host defence mechanism.*
III. *Abscess not adequately drained.*
IV. *Presence of foreign body.*
V. *Delay in initiation of treatment.*
VI. *Improper dose given*

F. What are the indications for prophylactic antibiotics?

I. *when bacterial contamination of the wound is high(clean-contaminated, contaminated and dirty wounds)*
II. *for patients having clean operations in which a prosthetic device is placed*

G. Principles of prophylactic antibiotics:

I. *Prophylactic antibiotic therapy should be directed against the bacteria likely to contaminate the wound.*

II. *The antibiotics usually should be given intravenously 30– 60 min before operation . it should not be continued beyond the day of operation.*
III. *The value of antibiotic prophylaxis is low in non-prosthetic clean surgery, while they are effective in reducing the risk of infection in clean-contaminated and contaminated operations.*
IV. *Cephalosporins are the most commonly used antibiotics for prophylaxis because of their broad antibacterial spectrum.*
V. *In long operations or when there is excessive blood loss, or when unexpected contamination occurs, antibiotics may be repeated at 4-hourly intervals during the surgery, because tissue antibiotic levels often fall faster than serum levels.*
VI. *Patients with known valvular disease of the heart (or with any implanted vascular or orthopaedic prosthesis) should have prophylactic antibiotics during dental, urological or open viscus surgery, to prevent bacterial colonisation of the valve or prosthesis during the transient bacteraemia which can occur during such surgery*

Opportunistic infection

An opportunistic infection is an infection caused by pathogens (bacteria, viruses, fungi, or protozoa) that take advantage of an opportunity not normally available, such as a host with a **weakened immune system**, an **altered microbiota** (such as a disrupted gut microbiota), or **breached integumentary barriers** (due to injury or medical procedure like cannula, folley catheter). Many of these pathogens do not cause disease in a healthy host that has a normal immune system.

HOSPITAL-ACQUIRED (NOSOCOMIAL) INFECTIONS

The infection that is acquired in operative theatre and/or wards . The most important and frequent mode of transmission of nosocomial infections is by direct contact. Others routes of transmission are Droplet transmission, airborne, vehicle transmission(food, mediactions..) and vector borne (such as mosquitoes, flies). The most common nosocomial infections are:

I. urinary tract infections are most common, followed by
II. wound infections
III. lower respiratory infections such as ventilator associated pneumonia
IV. bacteremia, and cutaneous infections

Surgical wound infections

The wounds have been classified into 4 categories according to the theoretical number of bacteria that contaminate wounds:

Wound Class	Definition	Examples of Typical Procedures	Wound Infection Rate (%)	Usual Organisms
Clean	Nontraumatic, elective surgery; no entry of GI, biliary, tracheobronchial, respiratory, or GU tracts	Wide local excision of breast mass	2	*Staphylococcus aureus*
Clean-contaminated	Respiratory, genitourinary, GI tract entered but minimal contamination	Gastrectomy, hysterectomy	<10	Related to the viscus entered
Contaminated	Open, fresh, traumatic wounds; uncontrolled spillage from an unprepared hollow viscus; minor break in sterile technique	Ruptured appendix; resection of unprepared bowel	20	Depends on underlying disease
Dirty	Open, traumatic, dirty wounds; traumatic perforated viscus; pus in the operative field	Intestinal fistula resection	28–70	Depends on underlying disease

Prevention of surgical infections

A// Prevention of infections at operative theatre:

- Theatre design and architecture:
    1) Best separated from wards in the single floor and should be situated in cul-de-sac.
    2) Accessory component as scrub or sinks room should be separated.
    3) Sterilization centers should be away from theatre
    4) Walls and floor should be smooth easy to wash.
    5) Positive pressure is essential and air should be filtered before admission.
    6) Ventilation is important
    7) Anesthetic gases must be free of pathogenic organisms.
    8) Temperature 20-25 C, and humidity 50-55%.
    9) Chemical antiseptics used often to clean the operation room

- Surgeon and attendances:
    1) 2 minutes hands washing with liquid contain chlorohexidine or povidone-iodine.
    2) No one with skin infections or sore throat is permitted to enter OR.
    3) Every one should be gowned, masked with cap.
    4) Finger rings should be removed.
    5) Spectators .
    6) Patient preoperative shower with antiseptic soap with shaving operative site and gowning.
    7) Surgical equipments and pack should be sterile.
    8) Prophylactic antibiotics and medication

B// Prevention of infection in surgical wards:

1) Isolated policy to infected cases.
2) Patients who are susceptible to infection should be isolated.
3) General disinfectant of wound.
4) Sterile dressing techniques.
5) Disposable of contaminated articles and materials
6) Urinary drainage and catheterizations should be avoided and should be done in sterile technique.
7) Secretion from patient with URT should be cultured.
8) Treatment of systemic diseases