FRACTURES

A fracture is a break in the continuity of bone; it can be complete or incomplete.

Fractures are the cause of a considerable degree of morbidity and even mortality across all age groups. Patients suffer both in the short term from pain and in the long term from disability and deformity.

Etiology of fractures

Fractures can be caused by a number of different mechanisms and this leads to a variation in the pattern of fractures.

The vast majority of fractures are caused by an excessive force applied to that bone, causing it to break.

A direct force applied to a bone will cause a fracture at the site of impact. Indirect forces cause fractures distant to where the force is applied, such as spiral long-bone fractures

TYPES OF FRACTURES::

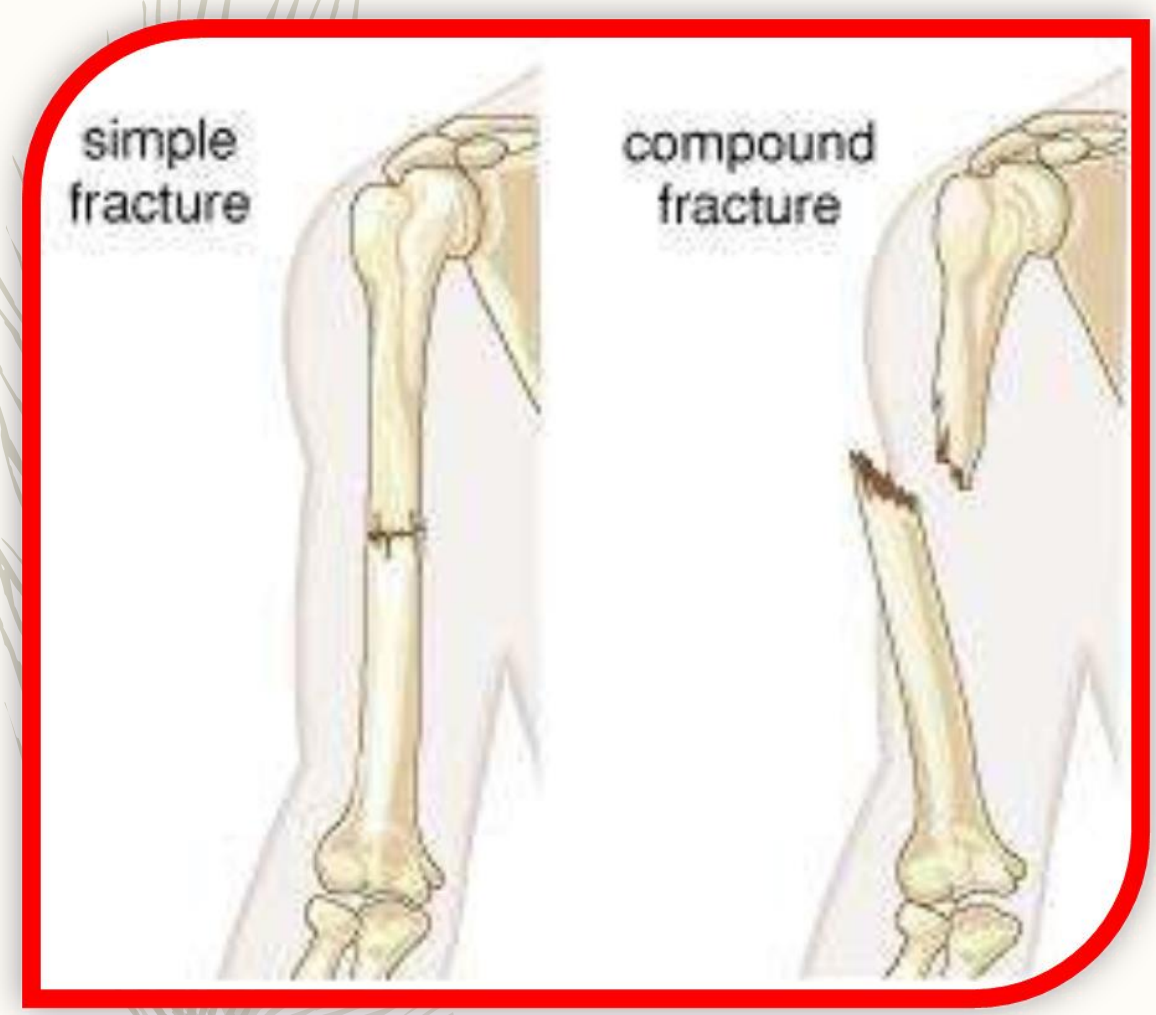
A-Simple Fracture

A fracture is called as simple or closed when there is no communication between site of fracture and exterior of body.

B- Compound Fracture

A fracture is called compound or open when there is a wound on the skin surface leading down to the site of fracture. However, it must be stressed that the presence of a skin wound and fracture of underlying bone without any communication between the two is not a compound fracture.

In compound fracture, there is a risk of contamination of fractured bone by outside organisms while a closed fracture is free from this risk.


simple
fracture
compound
fracture

CLASSIFICATION OF FRACTURES

A- Classification Based on Etiology of Fractures

1- Traumatic fracture: It forms the largest group and the term 'fracture' generally means traumatic fracture. It may be caused by *direct violence*, e.g. fracture mandible due to blow on face or by *indirect violence*, e.g. condylar fracture due to trauma over chin region.

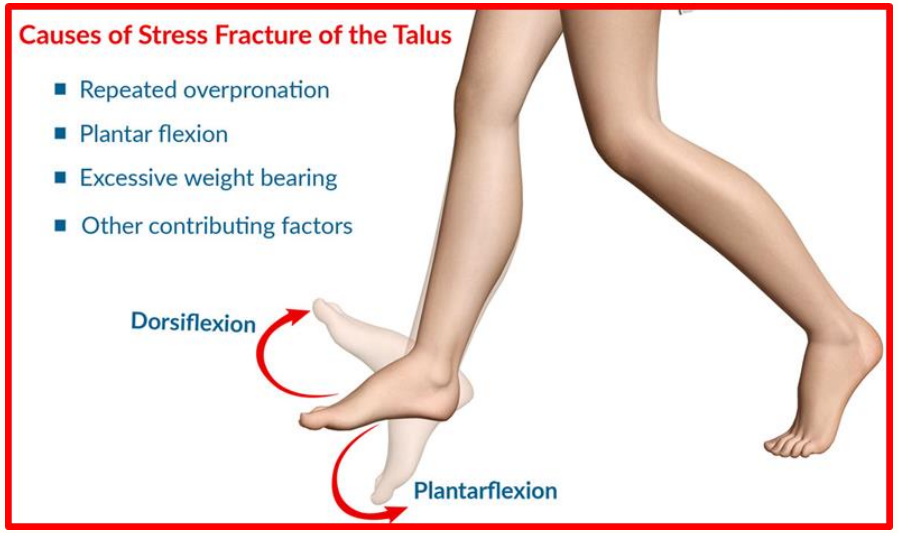
2- Stress fracture (Fatigue fracture): It occurs due to repeated injury occurring at the same site, It occurs in bones with normal strength. The mechanical structure of the bone gets fatigued due to repeated trauma and then bone breaks, e.g. fracture second metatarsal bone due to prolonged marching in soldiers (march fracture).

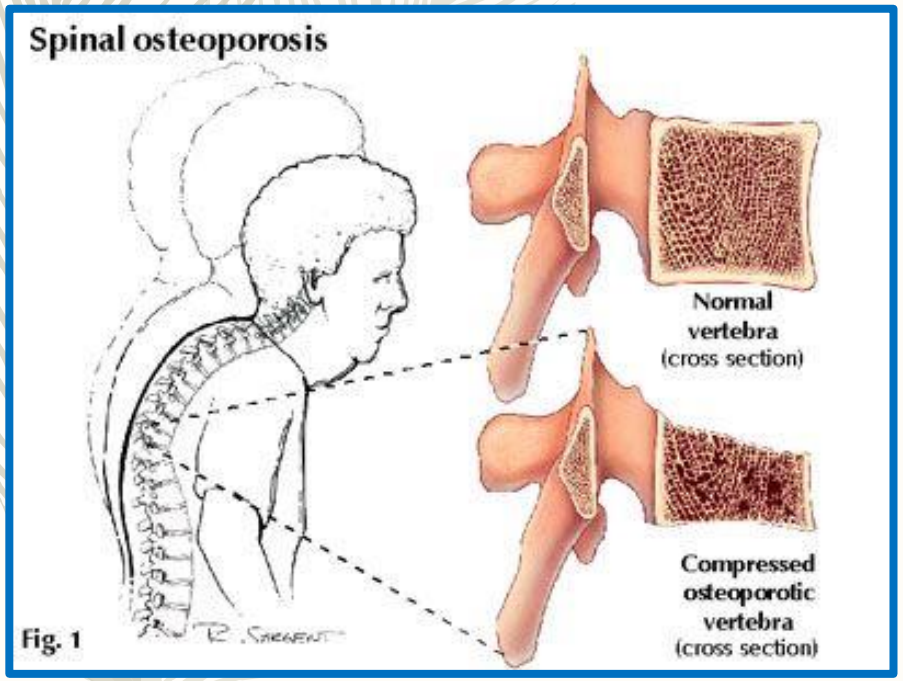
3- Pathological fracture: It occurs in a bone already weakened by disease. The bone gets fractured due to trivial injury or even spontaneously.

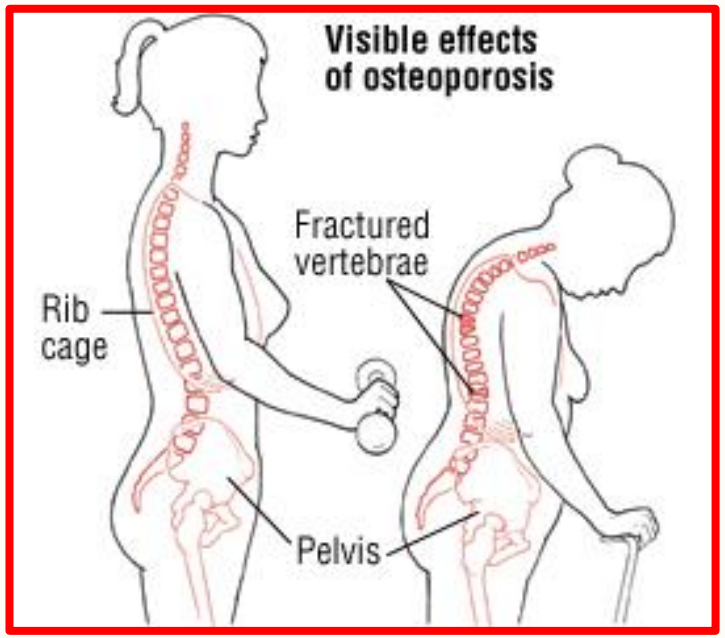
Fatigue or stress fractures:

- Is the one occurring in the normal bone of a healthy patient due to repetitive stress rather than single traumatic evidence.
- Most common sites affected pubic rami , femoral neck , tibial shaft especially in trainee and athletes , distal fibula , metatarsals especially the second (foot bones).

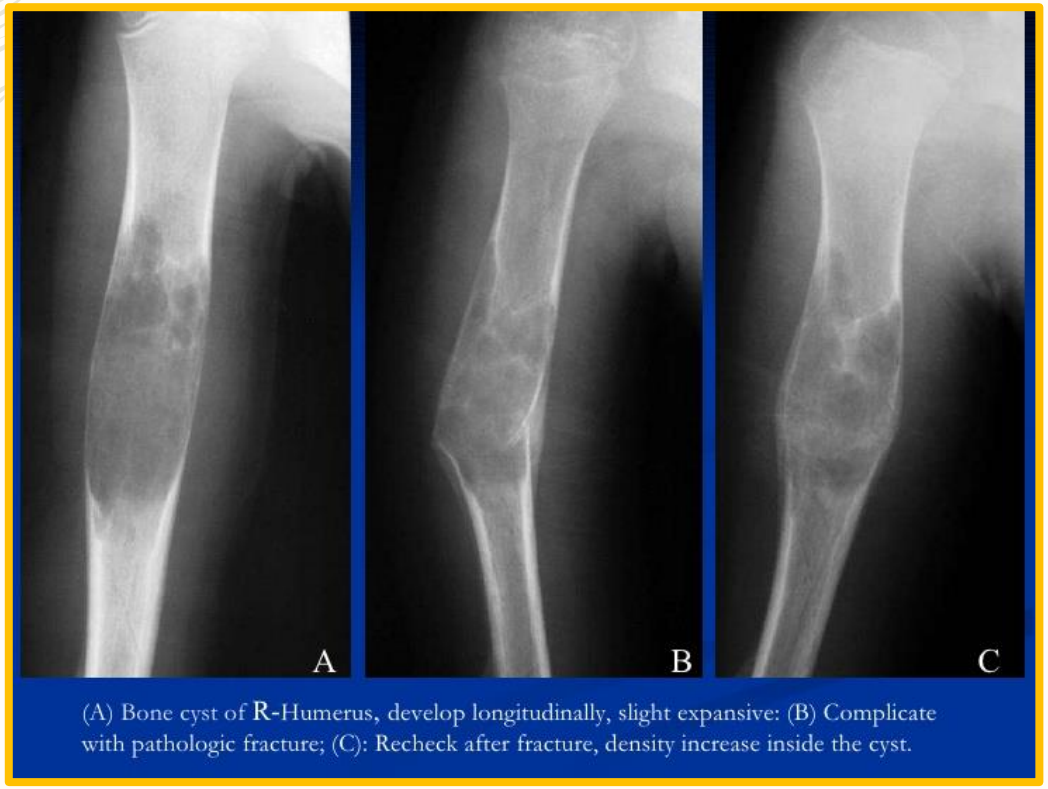
examples on Etiology of Fractures







The weakness of the bone can be caused by many disease processes:: The most common underlying pathologies for pathological fractures include osteoporosis and malignant infiltration of the bone, .



(A) Bone cyst of R-Humerus, develop longitudinally, slight expansive: (B) Complicate with pathologic fracture; (C): Recheck after fracture, density increase inside the cyst.

B- Classification of Patterns of Fracture::

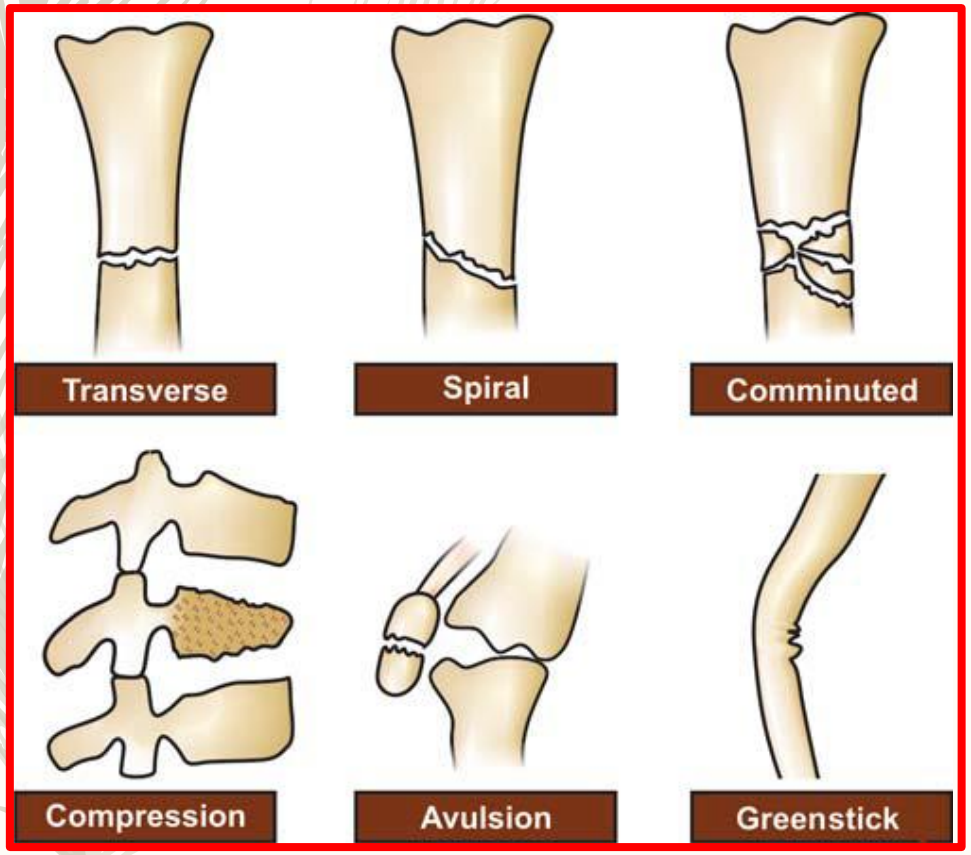
- **Transverse fracture:** It is due to bending of bone along its long axis. It is unlikely to become redisplaced after reduction.

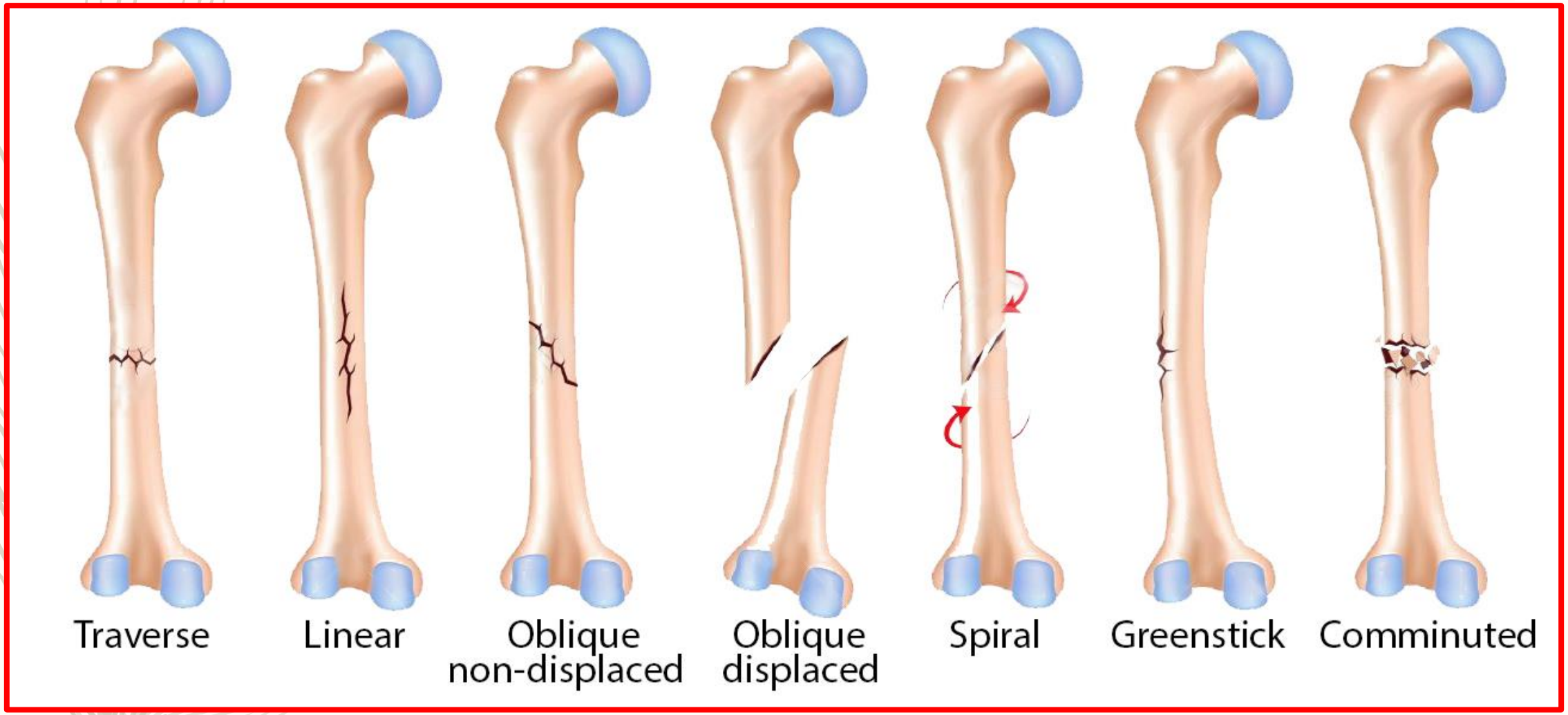
- **Spiral fracture:** It is caused by twisting of long bone along its axis. It is prone to re-displacement after reduction.

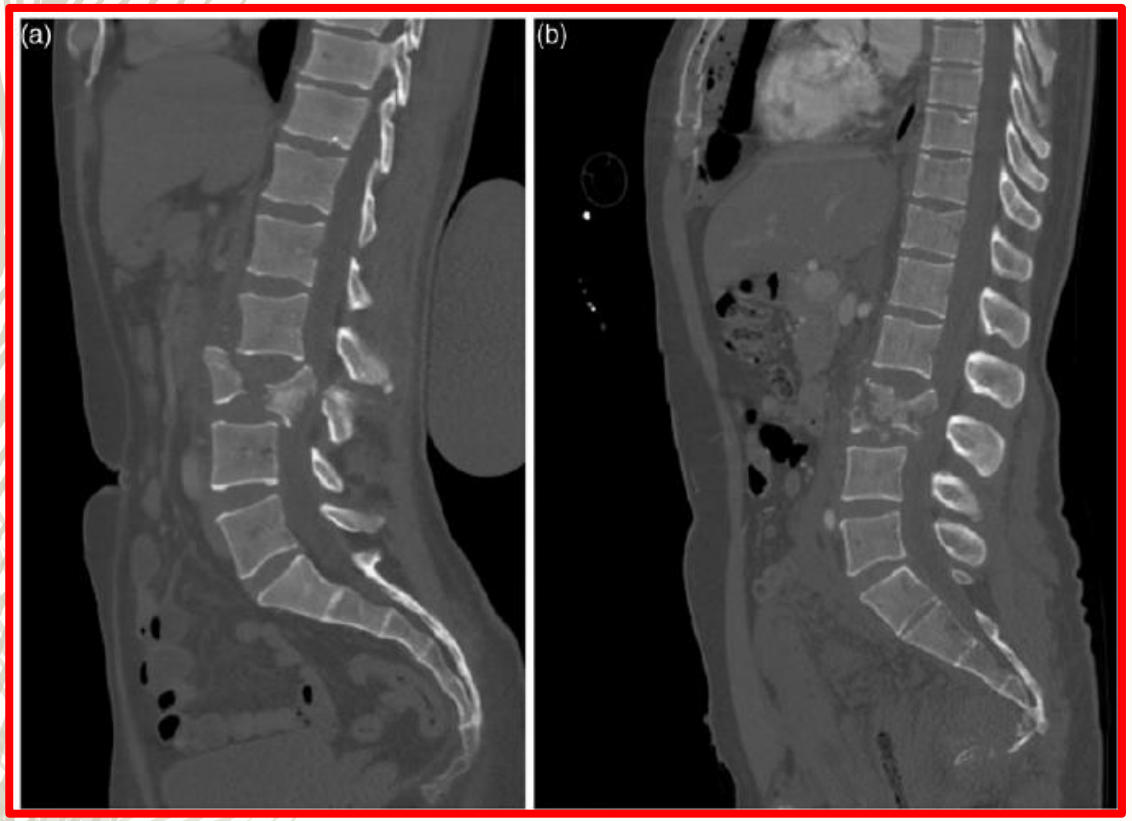
- **Comminuted fracture:** It is due to severe injury that breaks the bone into fragments.

- **Compression fracture:** It is caused by force applied along the length of a bone and the bone collapses into itself, e.g. compression fracture of vertebral body due to fall from a height. As the spongy bone is crushed so it cannot be restored to its original form.

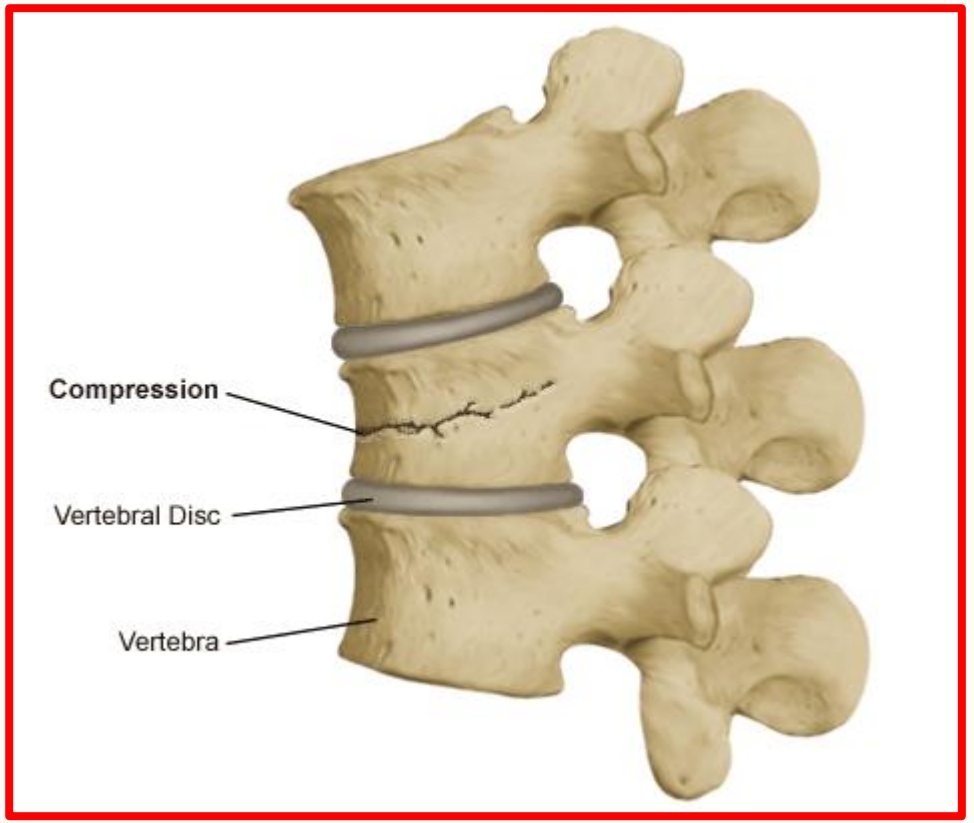
- **Avulsion fracture:** It is caused by severe traction on a ligament that breaks the bone on which it is inserted. It is commonly seen in small bones attached with strong muscles, e.g. patella (attached to quadriceps muscle).
- **Greenstick fracture:** It is seen in children whose bones are flexible. An angulation force bends the bone at one cortex and breaks it at the other thus producing an incomplete fracture.




Traverse
Linear
Oblique non-displaced
Oblique displaced
Spiral
Greenstick
Comminuted



fracture of vertebral body



HEALING OF A FRACTURE::

As soon as the bone breaks, the fracture begins to heal. Various stages in healing of fracture in a tubular bone are:

1- Stage of hematoma: The torn vessels form a hematoma between and around the fracture surfaces. The ring of bone immediately adjacent to each side of the fracture becomes ischemic and undergoes necrosis.

2- Stage of subperiosteal and endosteal cellular proliferation:

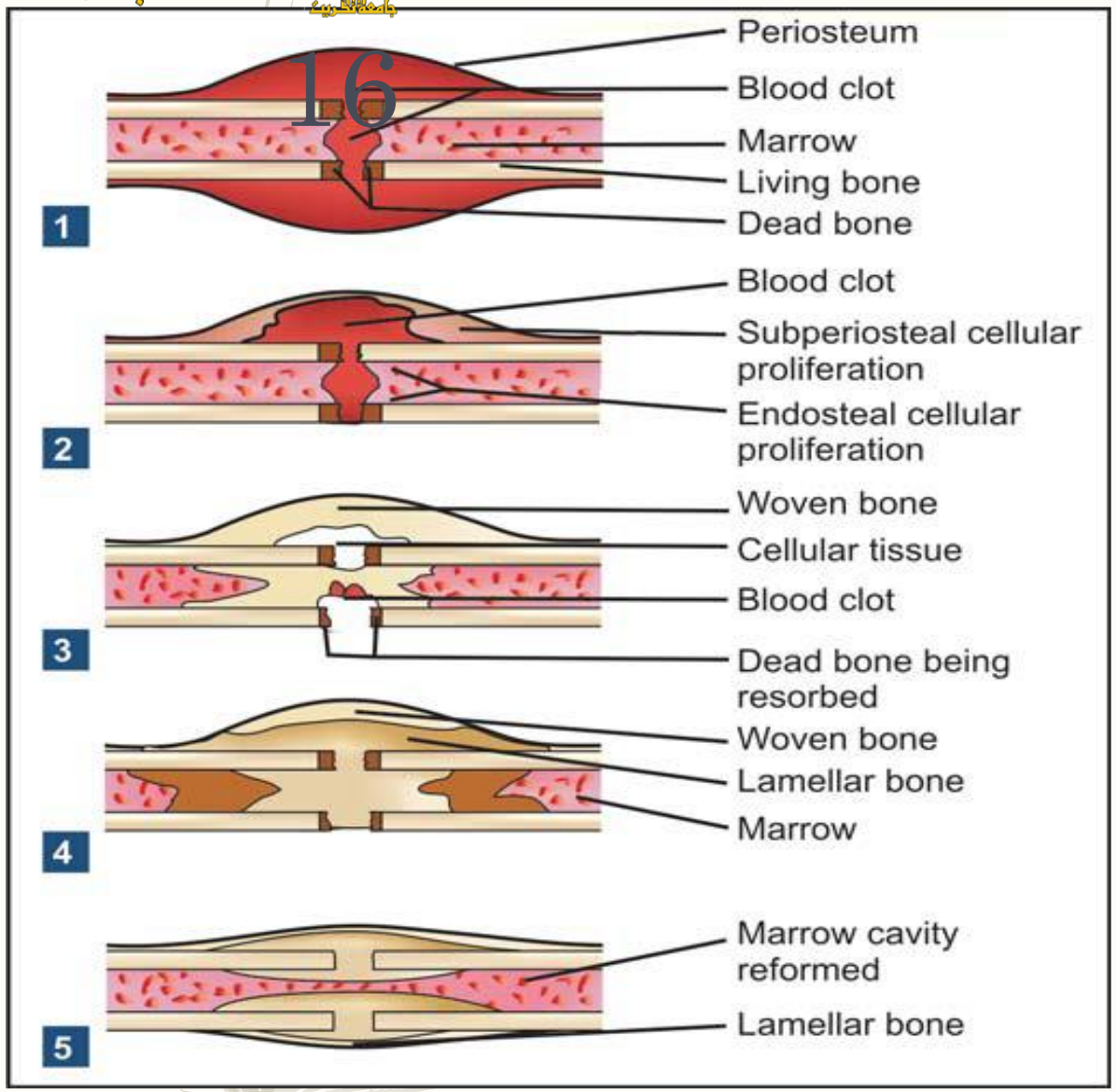
These cells are precursors of osteoblasts. They form a collar of active tissue that grows towards the other fragment. The blood clot is pushed aside by the proliferating tissue and gets absorbed.

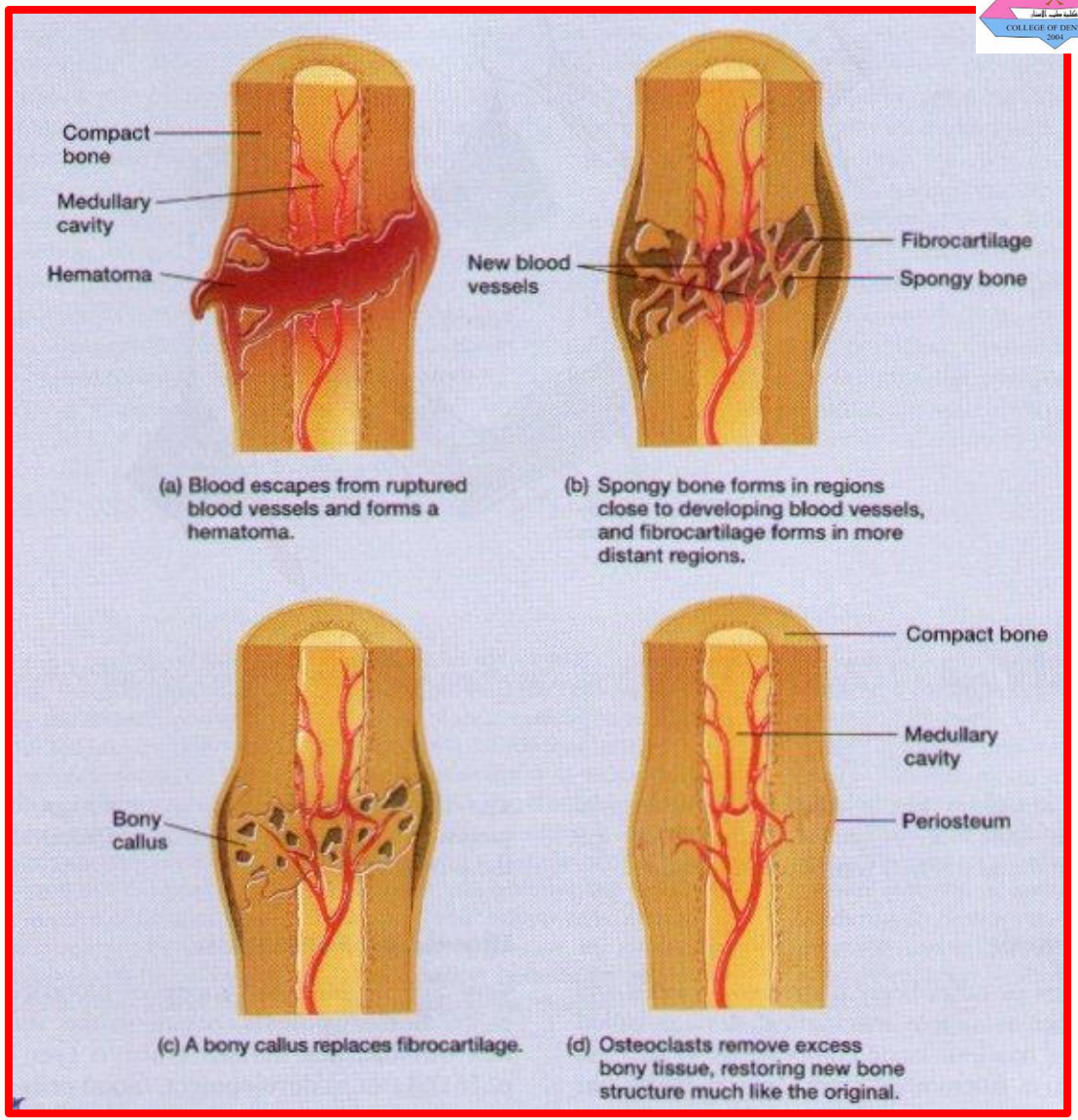
3- Stage of callus: The proliferating cells give rise to osteoblasts that form the immature woven bone of fracture callus. This mass of callus is visible in radiographs and can be felt as a hard mass surrounding the fracture site in superficial bones.

4- Stage of consolidation: The woven bone gradually transforms into mature bone that has typical lamellar structure.

5- Stage of remodeling: The bone is gradually strengthened along the lines of stress and surplus bone is resorbed outside the lines of stress. Thus, the bone is restored to more or less of its original form.

In cancellous bone, as the bone has uniform spongy texture and no medullary canal, there is broad area of contact at fracture site. So healing occurs without medium of callus. However, pathological events are similar to that of fracture tubular bone.


Periosteum
Blood clot
Marrow
Living bone
Dead bone
1
Blood clot
Subperiosteal cellular proliferation
Endosteal cellular proliferation
2
Woven bone
Cellular tissue
Blood clot
Dead bone being resorbed
3
Woven bone
Lamellar bone
Marrow
4
Marrow cavity reformed
Lamellar bone
5


Compact bone
Medullary cavity
Hematoma
(a) Blood escapes from ruptured blood vessels and forms a hematoma.
New blood vessels
Fibrocartilage
Spongy bone
(b) Spongy bone forms in regions close to developing blood vessels, and fibrocartilage forms in more distant regions.
Bony callus
(c) A bony callus replaces fibrocartilage.
Compact bone
Medullary cavity
Periosteum
(d) Osteoclasts remove excess bony tissue, restoring new bone structure much like the original.

CLINICAL FEATURES AND DIAGNOSIS::

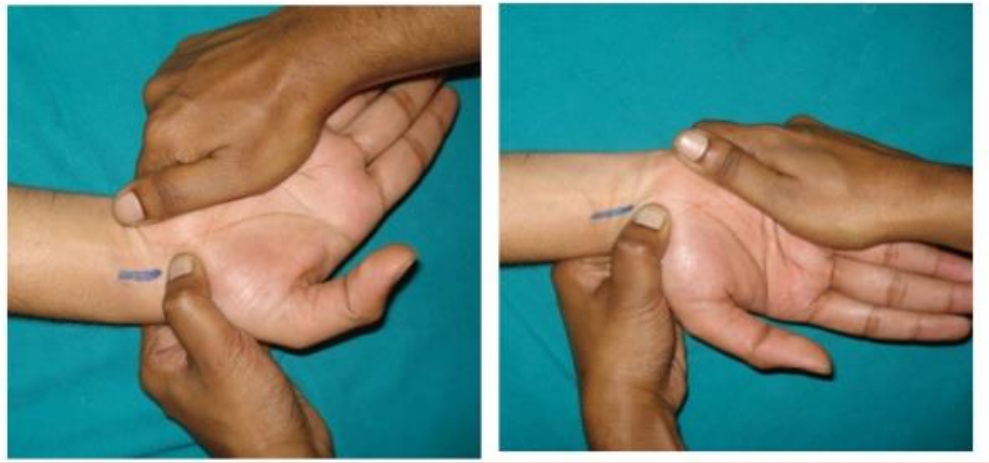
A- History

- Mostly there is history of injury except in pathological or stress fracture.
- The patient complains of pain at site of fracture.
- There is loss of function in the injured area, e.g. in limb fracture, patient is reluctant to move it.
- The patient may complain of weakness in the limb or loss of sensation due to neurological damage.

B- Examination

- Swelling and bruising at the site of injury.
- There may be external wound suggesting compound fracture.
- Localized tenderness at the site of fracture.
- Local temperature is raised due to inflammatory response.
- On limb movement, abnormal mobility or crepitation may be elicited. However, vigorous efforts should not be made to elicit this sign as it causes severe pain and further soft tissue damage and blood loss.
- Examine for neurovascular damage in the injured limb by checking distal circulation and any neurological deficit.

Painful attempted Scaphoid shift test



C- Radiological Examination

- The X-ray should include the whole bone including the joint above and below.
- X-rays should be taken in two planes at right angle to each other (anteroposterior and lateral).
- Sometimes oblique view is also required to detect fracture.
- The information provided by X-ray is shown

Principles of management

First Aid::

At the site of accident, the aim of management is to keep the patient alive and to minimize the chances of further damage. The measures include:

- Maintenance of adequate airway and breathing.
- Maintenance of circulation by control of bleeding.

The external bleeding is controlled by application of pressure dressing (using cloth, bandage, handkerchief or manual pressure).

•• The limb should be splinted with whatever method is available (piece of wood, plastic, umbrella, etc.).

++ If spinal injury is suspected, the patient should be moved without rotating and flexing the spine (log roll).

Local Management of the Fracture

The aims of local treatment of fracture are:

- Pain relief.
- Reduction of fracture.
- Immobilization to promote fracture healing.
- Preservation and restoration of function.

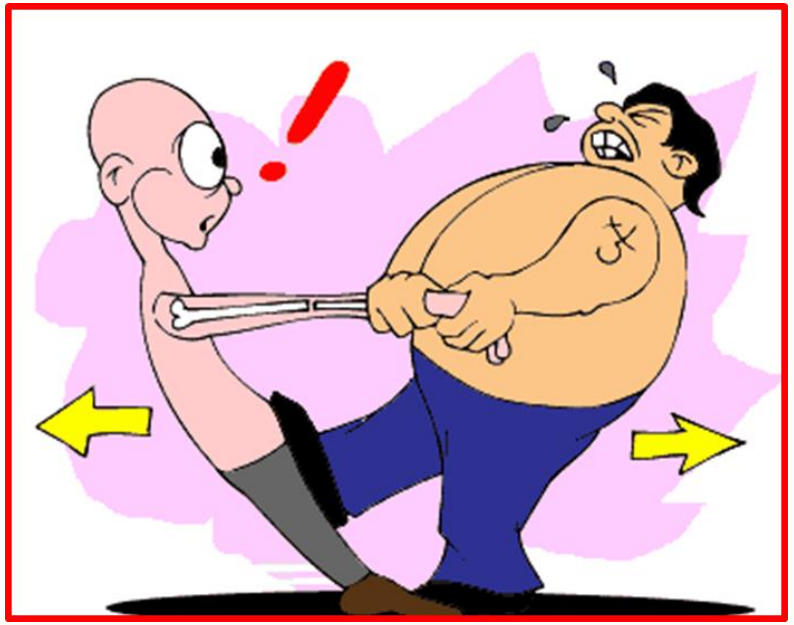
Treatment varies from individual to individual and should not be guided by X-ray findings alone. The aim is ‘to treat the patient, not the radiograph

A- Treatment of Uncomplicated Closed Fractures::

The treatment of closed fractures:

1- Reduction:: Reduction should be carried out without any delay if vascular compromise is present, and should take precedence over investigation including radiographs.

Provided the blood supply is unaffected reduction can be carried out under more considered circumstances.



Reduction is often not required: This is the case with minimally displaced fractures where the process of remodeling will compensate in the long term.

Where reduction *is* required, it is ideally effected by closed manipulation, thereby minimizing the risk of introducing infection to the fracture site. It is important to provide adequate analgesia for reduction and this can involve regional or general anesthesia, with their attendant risks.

These risks of reduction might outweigh the benefits where the displacement or deformity will result in no loss of function.

Reduction should aim for adequate apposition and normal alignment of the bone fragments.

The greater the contact surface area between the fragments the more likely the healing to occur. So gap lead to delay union or non union.

- This rule is not true for the fractures involve the articular surfaces.

There are two methods of reduction

closed reduction: under proper anesthesia and muscle relaxation the fracture reduced by

1. the distal part of the bone is pulled in line of the bone
2. as the fragments disengaged ,they are repositioned

open reduction: by operation

indications:

1. failure of closed reduction
2. displaced articular fractures which need accurate reduction.
3. for traction fractures where the fragments are hold apart.

Open reduction requires a form of anesthesia and - importantly - breaches the protection against infection that the skin provides.

2- Immobilisation::

A degree of movement at the fracture site is beneficial for fracture healing, by providing a stimulus to callus formation.

Splintage can be thought of as artificial callus put in place early on. It prevents excessive movement at the fracture site, relieving pain and keeping the fracture ends in close proximity to undergo healing and union, and therefore also minimizing deformity.

The aims of immobilization are:

- To prevent movement
- To prevent displacement
- To relieve pain.

The methods of immobilization are:

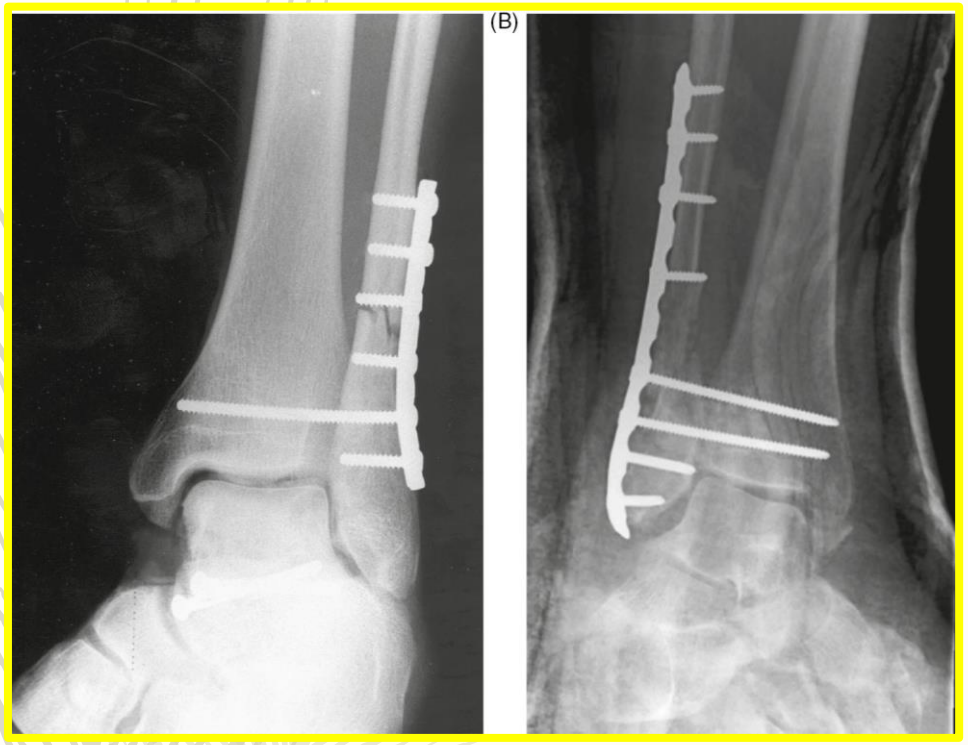
a. **Plaster of Paris (POP)** cast or splint

b. Immobilization by continuous traction: It is required in spiral fracture to prevent overlap of the fragments due to muscle pull.

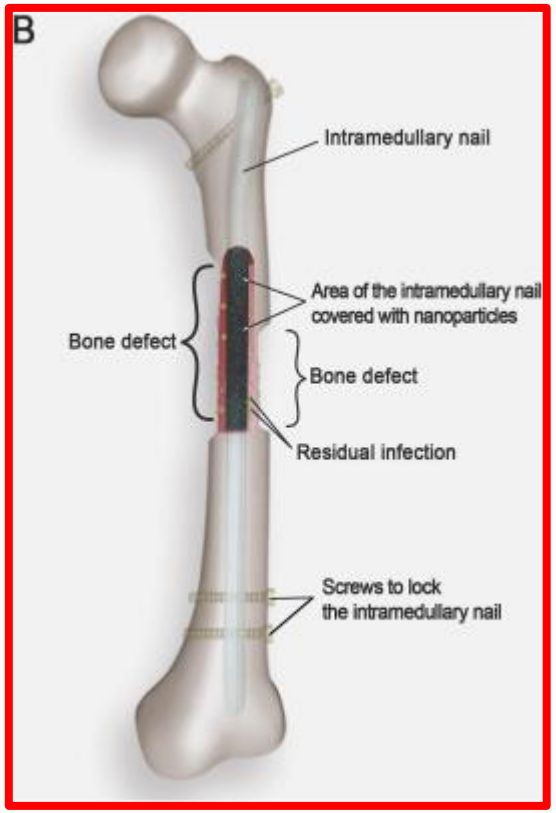
c. **Immobilization by internal fixation:** It is done when POP cast or traction is unable to give immobilization. Also, it is used in case fracture requires open reduction. For internal fixation, the bone on either side of fracture site is exposed by dissecting soft tissues and immobilization is achieved by one of the following ways:

- Plate held with screws
- Trans fixation screws
- Intra-medullary nail
- Circumferential wires

D- Immobilization by **external fixation:** It is done in case of open fracture



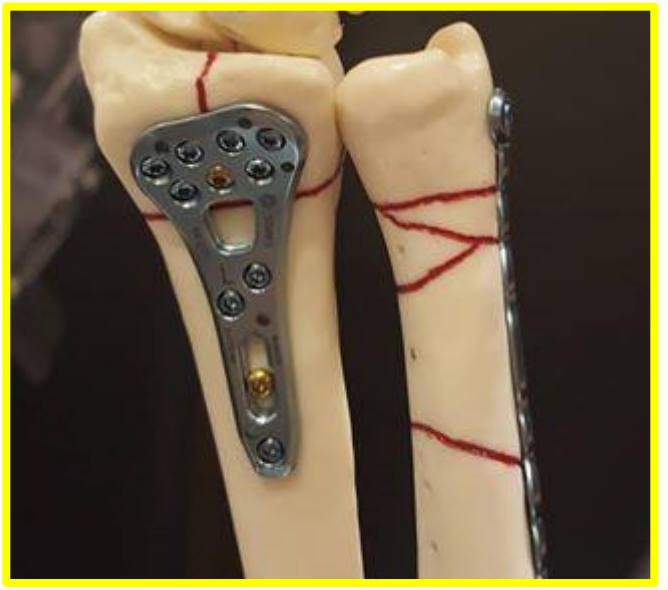
Trans fixation screws



Intra-medullary nail

Circumferential wires

Plate held with screws



Plaster of Paris (POP)

Plaster::

Plaster casts are easy, cheap and safe. Modern plaster materials are light, waterproof and easy for the patient to manage. They allow patients to mobilize and go home early and maintain the fracture in good position. However, they allow little movement, particularly of the joints surrounding the fracture, and therefore predispose to stiffness.

Plaster casts are most suitable for fractures that are minimally displaced, or those that have been adequately reduced and whose new position is stable.

The main dangers of casts are if they are applied incorrectly. A tight cast can act as a constraint and hence cause a kind of iatrogenic compartment syndrome, and often a 'backslab' (i.e. a plaster that does not go around the whole circumference of the injured part) is applied.

Pressure sores can occur within the plaster and skin breaks can be induced by the patient trying to relieve the itch in the plaster.

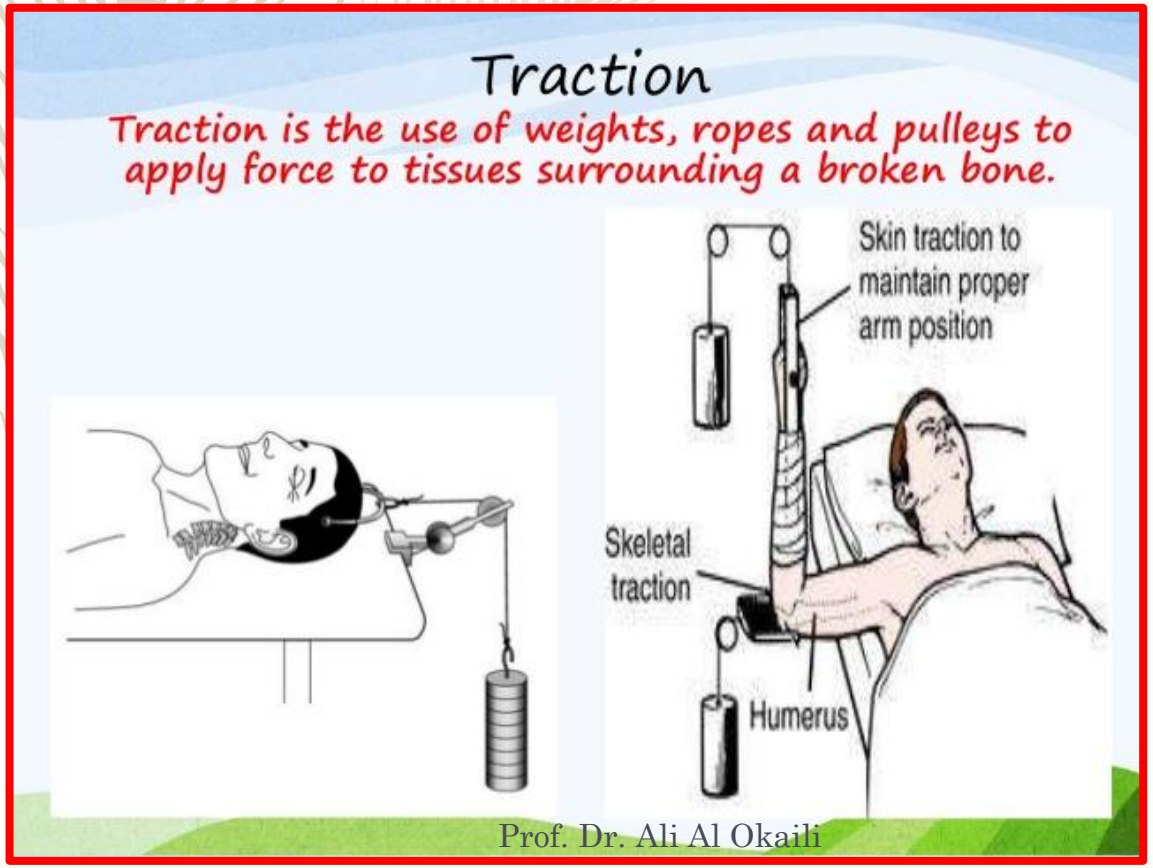
Complications:

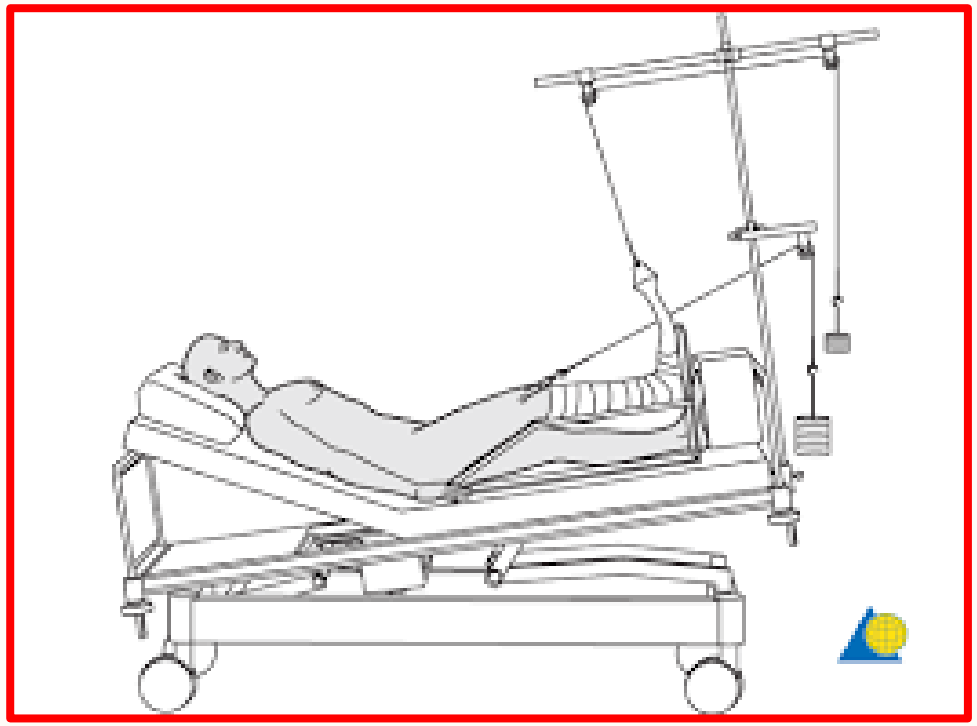
1. Stiffness of the joints 'fracture disease' this avoided by avoiding long unnecessary splintage and early physiotherapy.
2. Tight cast this either because the cast applied tight, or the limb swells. The patient complain from diffuse pain, or some time compartment syndrome may happens.
3. Pressure sores usually over the bony prominences , the patient complain from localized pain precisely over the pressure spot..
4. Skin abrasion or laceration this usually during removal so should be careful.
5. Lose cast this after swelling subside, so should be replaced

Traction

This is used to immobilize some long bone fractures. Force is applied along the long axis of the fractured bone, distracting the fracture ends and keeping them aligned.

Traction devices can be attached to bone, skin or bandaging on the injured body part.

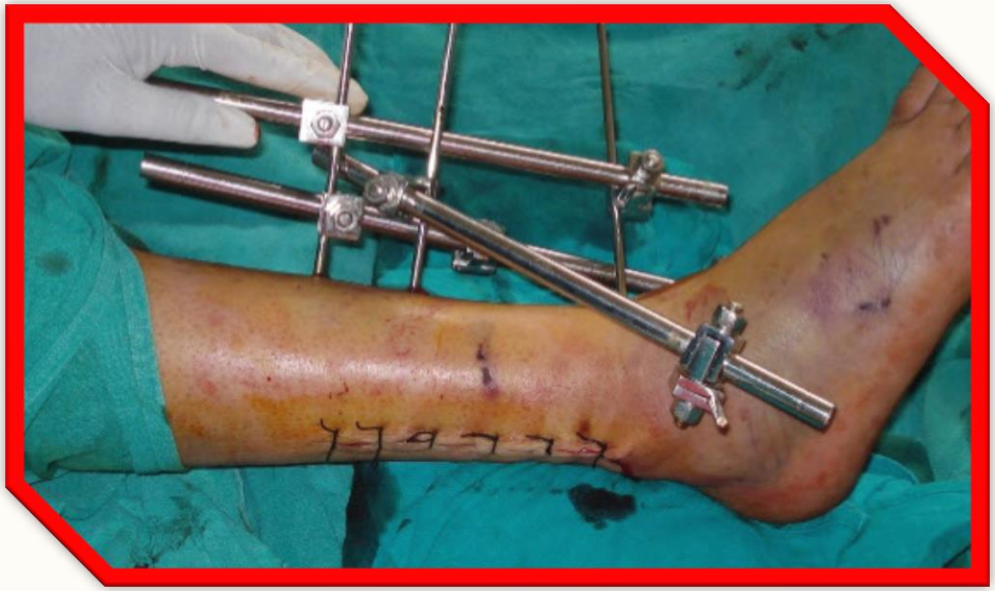




External fixation::

Pins or screws are inserted proximal and distal to the fracture site, and these 'anchors' are attached to a rigid external device. This allows unique manipulation and can also act as a form of localized traction device, or even provide a force compressing the fracture ends together, helping to bridge a fracture gap. Wounds can be left open to drain and to be easily inspected with external fixation, and skin reconstruction can be carried out around it.

The types of fractures best treated by external fixation are those that would benefit from the above features, particularly fractures at risk of infection or with significant soft tissue damage, such as open fractures.



Indications:

1. Fractures associated with sever soft tissue damage. So it makes dressing easier.
2. Fractures associated with sever nerve or vessels damage.
3. Severely comminuted and unstable fractures.
4. Ununited fractures which can be excised and compressed , and some times combined with bone elongation.
5. Pelvic fractures if cannot controlled by other methods.
6. Infected fractures.
7. Sever multiple injuries.

Complications

1. Damage to soft – tissue structures if the transfixing pins injure the nerves or vessels. Or may tether ligaments or muscles.
2. Over distraction
3. Pin – tract infection

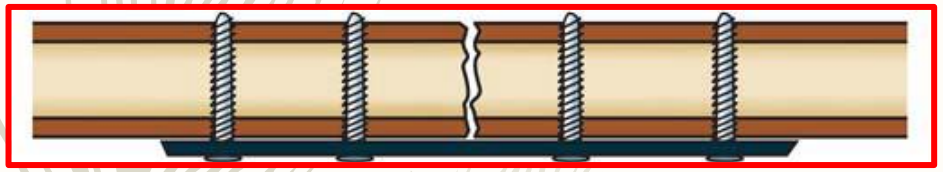
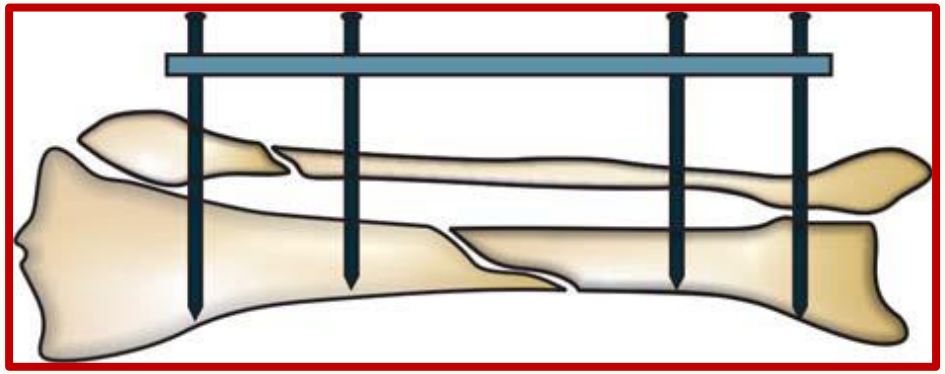


Plate held with screws

Intramedullary nail

Circumferential wires



External fixation

Internal fixation::

This form of immobilization is achieved by open, operative reduction of the fracture, which is then held in place by any number of devices, most of which are metal, that are left in place and the wound closed over them. The variety of products available is enormous and includes pins, plates and screws. The main advantage of this form of treatment is the accuracy of reduction that can be achieved and indeed maintained by the firm immobilization provided.

However, the main disadvantage of internal fixation is the higher risk of infection. Not only is the skin's barrier to infection breached at operation but microorganisms also tend to stick to prosthetic materials, including metal. Infection on metal implants is hard to clear, as little systemic antibiotic gets to the site, as do few of the body's natural defenses. Other complications include fracture of the internal fixation device, particularly if it takes too great a proportion of the load rather than the healing bone.

Indications:

1. failure of closed method.
2. unstable fractures which are likely to displaced, as in ankle fractures , or those liable to muscle pull as in transverse patellar fracture or olecranon.
3. fractures that unite poorly or slowly as in fracture neck femur.
4. pathological fractures.
5. multiple fractures.
6. in patient with nursing difficulties as in paraplegics , and multiple injuries.

Complications:

1. Infection : due to poor technique or poor equipment , or poor tissue conditions.
2. Non – union: if the bone ends fixed rigidly with a gap between the ends, or in stripping of the soft tissues.
3. Implant failure: so the patient should walk with crutches and weight bearing should allowed gradually after the fracture heals.
4. Refracture if the implant removed too soon and care should be taken after removal

Rehabilitation::

The results of fracture treatment are significantly improved by rehabilitation. It should begin as soon as treatment of fracture starts.

The prolonged rest in an injured limb can lead to collection of edema fluid around fracture as well as in the whole limb. Also there is muscle wasting and joint stiffness.

The aims of rehabilitation are:

- To preserve functions while fracture is uniting.
- To restore functions after fracture is united.

The two essential methods of rehabilitation are: active use and active exercises.

Active use implies that the patient should continue to use the injured part as naturally as possible. Although rest is necessary in early days following injury, but the injured part should gradually return to activity as soon as possible.

Active exercises imply doing exercises of muscles and joints under supervision of a physiotherapist

Rehabilitation::

Treatment of Open Fractures::

The open fracture demands urgent attention so as to minimize the risk of wound infection. The principles of treatment are:

1- Wound debridement: All extraneous material is removed. The dead and devitalized tissue is excised leaving healthy and vascularized tissue.

2- If wound is clean and is dealt within few hours of injury, it should be closed primarily.

3- In case of dirty, severely contaminated wound with delayed presentation (more than 8-10 hrs), it should be left open and dressed regularly. Once wound becomes clean, delayed closure is done.

4- Treatment of fracture: Principles of management are same as for closed fractures. However, open reduction and internal fixation of the fracture should be avoided to prevent the risk of infection.

If fracture is unstable and unsuitable for treatment by plaster of Paris alone, external fixation by pins inserted into the bone fragments and fixed to a rigid external bar should be done.

COMPLICATIONS OF FRACTURES::

These can be divided into two groups:

A- Complications related to fracture itself:

- Infection: Osteomyelitis, tetanus and gas
- gangrene.
- Delayed union
- Nonunion
- Mal-union
- Shortening (loss of function)
- Avascular necrosis

B- Complications due to associated injuries:

Injury to blood vessels
Injury to nerves
Injury to tendons
Injury to joints
Injury to adjoining viscera
Fat embolism
Deep vein thrombosis and pulmonary embolism

Infection::

Infection can seriously impair the physiological process of fracture healing described above, and is one of the more common causes of mal-union and non-union described below. Infection is much more common in open fractures.

Compartment syndrome::

This phenomenon generally occurs within hours of injury and is associated with injuries in certain areas. Where as compartment syndrome is most commonly associated with fractures, this is not always the case, as it relates to soft tissue swelling.

Delayed union Loss of function

In delayed union, fracture healing takes longer than expected. This is predominantly a clinical diagnosis with persistent pain and excessive mobility at the fracture site.

Even under normal circumstances, radiological union takes longer than clinical union. There are numerous causes of delayed union and it is less common in cancellous bone than cortical bone. Infection is a common cause and the presence or absence of infection has an influence on management. Other important causes include poor alignment of the fracture (inadequate reduction), poor blood supply to the fracture site and excessive mobility at the fracture site.

Non-union::

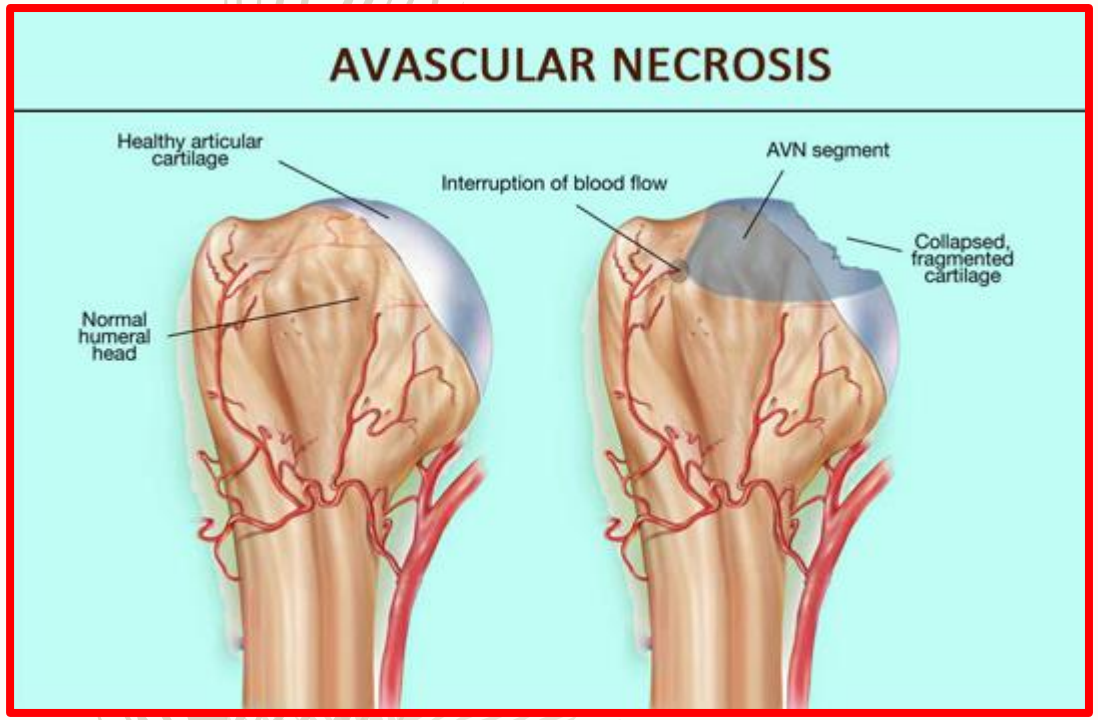
Causes are similar to those of delayed union, with the addition of interposition of soft tissues. A gap remains between the ends of the fracture, which is radiographically visible, and it might also be possible to see that the medullary cavities have sealed off. Clinically, the patient has persistent pain and mobility, with or without crepitus, on stressing the fracture site. The diagnosis is therefore both clinical and radiological.
Treatment of abnormal fracture union depends on whether there is infection present. Healing in the presence of pus and dead bone (sequestrum) is unlikely, and surgical debridement with antibiotic therapy is often required.

Loss of function::

Uncorrected deformity can result in loss of function, as relationships are no longer anatomical. Similarly, prolonged immobilisation can result in soft tissue fibrosis, resulting in contractures, for example, fixed flexion deformity. Other causes of dysfunction include muscle weakness and loose ligament complexes

Avascular necrosis::

Where the fracture disrupts the blood supply to a piece of bone, it can undergo necrosis. An example is the femoral head that derives some of its blood supply through the femoral neck. The head of femur can undergo late death (avascular necrosis) following a fractured neck of femur, particularly if the fracture is displaced.



Compartment syndrome::

HEMORRHAGE, BLOOD TRANSFUSION

- *Haemorrhage means escape of blood outside its containing vessel.*

HAEMORRHAGE

DEFINITION

The term haemorrhage refers to a large amount of bleeding in a short time.

(Thygerson, Gulli & Krohmer 2006; pp:23)

An escape of blood from a ruptured blood vessel.

(Weller & Wells 1990; pp:217)

Haemorrhage is the loss of blood from a vessel.

(Malcolm R. Colmer 1986 ; pp:98)

Pathophysiology

Haemorrhage leads to a state of hypovolemic shock. The combination of tissue trauma and hypovolaemic shock leads to the development of an endogenous coagulopathy called acute traumatic coagulopathy (ATC).

Up to 25% of trauma, patients develop ATC within minutes of injury, Ongoing bleeding with fluid and red blood cell resuscitation leads to a dilution of coagulation factors which worsens the coagulopathy.

Hemorrhage can be classified in following ways:

A- DEPENDING UPON SOURCE OF BLEEDING

- External Hemorrhage: When the bleeding is seen outside, e.g.: epistaxis, bleeding from scalp wound, bleeding during surgery.

- Internal Hemorrhage: When the bleeding is concealed (مخفي) and not seen outside, e.g. intracranial hematoma.

B- DEPENDING UPON VOLUME OF BLOOD LOSS

- Mild Hemorrhage: When blood loss is less than 500 ml (in adult patient). This amount of blood loss is compensated by peripheral vasoconstriction. Hence, there are no significant hemodynamic changes seen in the patient.

- Moderate Hemorrhage: When blood loss is 500-1000 ml. In such a situation, peripheral vasoconstriction is not sufficient for maintaining circulation. Hence, there are hemodynamic changes in form of tachycardia and hypotension. The extremities feel cold and clammy due to peripheral vasoconstriction.

- Severe Hemorrhage:

When blood loss is more than one liter:: The patient has all the features of moderate hemorrhage due to peripheral vasoconstriction viz., cold clammy= moist skin, thin thready pulse, and hypotension.

- If bleeding continues, then due to splanchnic vasoconstriction, there is decreased renal perfusion leading to oliguria (قلة الادرار).
- If not treated, it may lead to acute tubular necrosis and renal failure. If hemorrhage is not controlled, there is decreased cerebral perfusion leading to cerebral anoxia that manifests as irritability, unconsciousness and irregular respiration.
- In next stage, there is decreased cardiac perfusion leading to cardiac ischemia, cardiac arrhythmia followed by cardiac arrest.

DEPENDING UPON TIME OF HEMORRHAGE:

Primary, reactionary and secondary haemorrhage

1- Primary haemorrhage is haemorrhage occurring immediately due to an injury (or surgery).

2- Reactionary haemorrhage is delayed haemorrhage (within 24 hours) and is usually due to dislodgement of clot by resuscitation, normalization of blood pressure, and vasodilatation. Reactionary haemorrhage may also be due to technical failure, such as slippage of a ligature.

3- 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.

DEPENDING UPON SPEED OF BLOOD LOSS:

Acute Hemorrhage

Massive bleeding in a short span of time. It usually occurs after trauma or surgery

Chronic Hemorrhage:

It is slow bleeding that is small in quantity and continues for a long time, e.g. bleeding piles, bleeding peptic ulcer.

The blood volume remains normal because blood loss is replaced by plasma. The patient becomes anemic because blood cells are not replaced.

Due to anemia, there is tissue hypoxia that is compensated by increased cardiac output. For treatment of such cases, packed red cells should be used instead of whole blood to prevent extra burden = load on heart that can cause congestive heart failure.

TREATMENT OF HEMORRHAGE

It has two components:

a. Control of bleeding

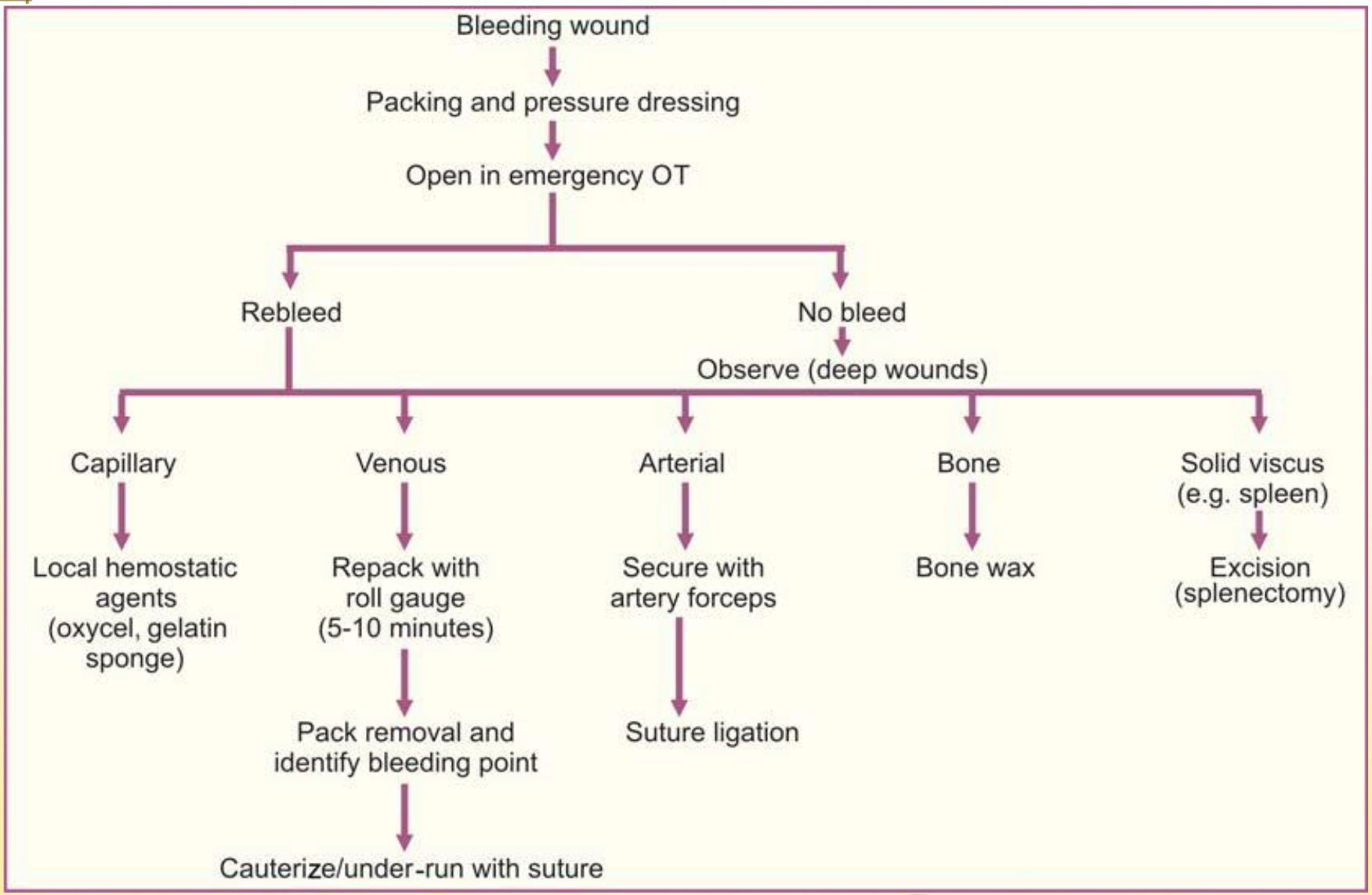
b. Restoration of blood volume

A- Control of bleeding

- Pressure and Packing

Tight packing and pressure dressing is the ‘first aid treatment’ of any bleeding wound. Any clean and soft linen cloth can be used for this purpose. In deep wounds, close observation is required after pack removal even if bleeding appears to have stopped completely.

Control of bleeding

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- Tourniquet : is an elastic pressure bandage applied on the limb away from site of bleeding to control arterial flow to the bleeding site. These days, it is used occasionally in operation theaters as a prophylactic measure to control bleeding, e.g.::

• Limb amputation (peripheral arterial disease is an exception).

• Repair of nerves and tendons, hand surgery

- Position

Raising of the bleeding part above the heart level helps in reducing blood loss by effect of gravity, e.g. bleeding after thyroidectomy is reduced by raising the head end of the bed.

Similarly, bleeding from ruptured varicose veins in the legs is reduced by raising the foot end of the bed (Trendelenburg position).

- **Rest**

Sight of blood makes the patient restless and anxious leading to more bleeding. Hence, patient should be well sedated with drugs like pethidine and diazepam.

Operative Methods:

During surgery any bleeding point must be controlled except minimal capillary ooze. Large vessels should be clipped with artery forceps taking care not to include surrounding tissues into the bite. This is then dealt with diathermy coagulation or by suture ligation.

If end of a vessel cannot be identified and there is rapid venous bleed, it should be packed with roll gauge for 5-10 minutes. Then on gradual removal of roll gauge, bleeding points are identified and cauterized or under-run with sutures.

If there is generalized slow capillary ooze, it is controlled by applying local hemostatic agents like surgicel and abgel.

If there is oozing from bone edges, it is controlled with bone wax.

If a solid viscus is ruptured and bleeds heavily, a part or whole of it may need excision, e.g. splenectomy, nephrectomy.

BLOOD TRANSFUSION

Indications of blood transfusion are :

- Trauma causing severe hemorrhage
- Severe burns
- Preoperatively, in patients of severe and chronic anemia
- Intraoperatively, during major surgery
- Postoperatively, in patients who had excessive bleeding during surgery
- To arrest bleeding in patients with bleeding disorders (hemophilia)

Blood Collection

- The donor should be healthy and free from infections like viral hepatitis, AIDS.
- 410 ml blood is drawn from ante-cubital vein.
- Blood is collected in sterile bag containing 75 ml of anticoagulant solution (Acid citrate dextrose).
- Blood is constantly mixed during collection to prevent clotting.

Blood Storage

- Blood is stored in a refrigerator at 4°C.
- It can be stored for three weeks.
- Don’t keep blood at room temperature for more than two hours (risk of infection).
- Stored blood has reduced ability to release oxygen.
- Stored blood lacks WBCs and clotting factors (V and VIII) because these are rapidly destroyed.
- Stored blood has reduced platelets.
- If massive transfusion is required, give 1-2 units of fresh blood.

Blood Grouping and Cross Matching

There are two main groups of antigens on human red cells—ABO group and Rh group.

ABO Group

- The red cells contain two antigens A and B.
- The serum contains antibodies namely anti A and anti B.
- On this basis, there are four blood groups: For transfusion, red cells of the donor are matched against serum of recipient.
- The person with AB group can receive blood from any body because there is no antibody is serum (universal recipient).
- The person with O group can donate blood to any body because there is no antigen in the red cells (universal donor).

Blood Group	Antigens	Antibodies	Can give blood (RBC) to	Can receive blood (RBC) from
AB	A and B	None	AB	AB, A, B, O
A	A	B	A and AB	A and O
B	B	A	B and AB	B and O
O	None	A and B	AB, A, B, O	O

Rh Group:

- When red cells contain D antigen, it is called as Rh positive group (seen in 85% of population).
- When red cells lack D antigen, it is Rh negative group (seen in 15% of population).
- If Rh positive blood is given to Rh negative person, anti D antibodies develop against D antigen.
- The first transfusion may be asymptomatic but further transfusion will cause serious incompatibility reactions.
- A similar condition develops when Rh negative mother bears Rh positive fetus.

Autotransfusion::

- Patient's own blood is used for transfusion.
- No risk of transfusion reaction or infection like Hepatitis B and AIDS.
- In elective cases, patient's blood is withdrawn up to 3 weeks before surgery and stored.
- In emergency cases (e.g. ruptured spleen), blood is collected from peritoneal cavity, filtered through autotransfusion apparatus and then transfused.

Complications of Blood Transfusion :

1- Transfusion Reactions: These may range from mild pyrexial reaction to severe incompatibility.

- It is due to human errors in collection, labeling and dispatching of blood.

2- Infections

3- Coagulation failure

4- Congestive heart failure

5- Acute renal failure

6- Jaundice

7- Thrombophlebitis

8- Air embolism

9- Immunosuppression

These errors lead to mismatched blood transfusion.

- The patient complains of
  - ☐ Fever with chills
  - ☐ Nausea and vomiting
  - ☐ Dyspnea
  - ☐ Headache
- If patient is undergoing surgery under anesthesia, there is sudden hypotension and increased bleeding through wound following mismatched transfusion.
- In severe cases, there is hemoglobinuria and decreased urine output.
- Transfusion should be stopped immediately.
- Intravenous fluid should be rushed along with intravenous frusemide (80-120 mg) to induce diuresis.
- In extreme cases dialysis may be needed.
- Sample of patient's venous blood and urine along with remaining blood should be sent to blood bank for rechecking.

Infections

Various infections transmitted by blood transfusion are:

- Serum hepatitis
- AIDS
- Malaria
- Bacterial infection

These infections can only be prevented by proper screening of the donor.

Coagulation Failure

- It usually occurs following massive transfusion or incompatible blood transfusion.
- There is excessive bleeding through wounds, petechial hemorrhages, hematuria, hematemesis, melena, etc.
- Treatment is by replacement of clotting factors with FFP, cryoprecipitate and platelet concentrate.

Congestive Heart Failure

- It usually follows rapid transfusion in patients with chronic anemia.
- It can be avoided by

☐ Giving slow transfusion.

☐ Giving packed cells.

☐ Giving diuretics.

Immunosuppression

Blood transfusion has shown to depress the immune response of the patient.

Hence, blood transfusion should be avoided unless clearly indicated.

Problems of Massive Transfusion

Massive transfusion is defined as replacement of patient's whole blood volume with stored RBCs in 24 hrs or transfusion of more than 10 units within a few hours. It can cause following problems:

- Hypothermia
- Acid-base imbalance (metabolic alkalosis)
- Hyperkalemia
- Citrate toxicity (Hypocalcemia)
- Coagulation failure.

Fractions of Blood

In certain conditions, fractions of blood are more useful than transfusing whole blood. These fractions are:

1- Packed red cells: Useful in patients with chronic anemia and in elderly patients with poor cardiac reserve.

2- Platelet rich plasma (PRP): Useful in patients with thrombocytopenia. It is prepared by slow centrifugation of fresh donated blood.

3- Platelet concentrate: It is prepared by centrifugation of platelet rich plasma. It is also useful in patients with thrombocytopenia. If stored frozen, it remains effective for many months.

4- Fresh frozen plasma (FFP): Plasma is removed from fresh blood and is rapidly frozen and stored at –40°C. It preserves all coagulation factors and is useful in treatment of coagulopathies (hemophilia).

5- Human albumin: It is rich in protein and due to heat treatment; it is free from risk of viral hepatitis. It is useful as plasma expander, e.g. in severe burns.

Infections

Tissue invasion by organisms following breakdown of local and systemic host defenses is defined as infection.

Host defenses against infection are:

- Skin
- Mucosa
- Humoral immunity (Antibodies)
- Cellular immunity

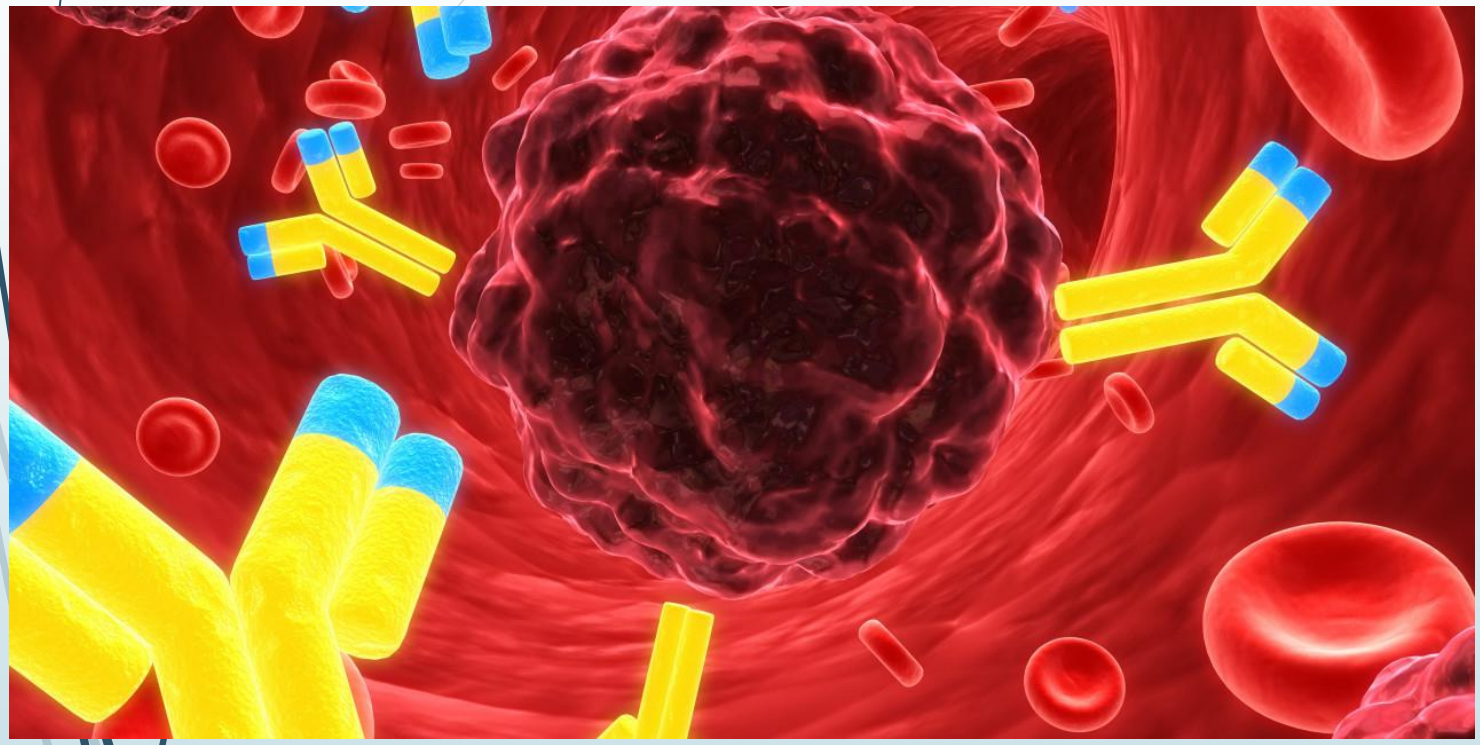
(Macrophages, Polymorphs, Lymphocytes)

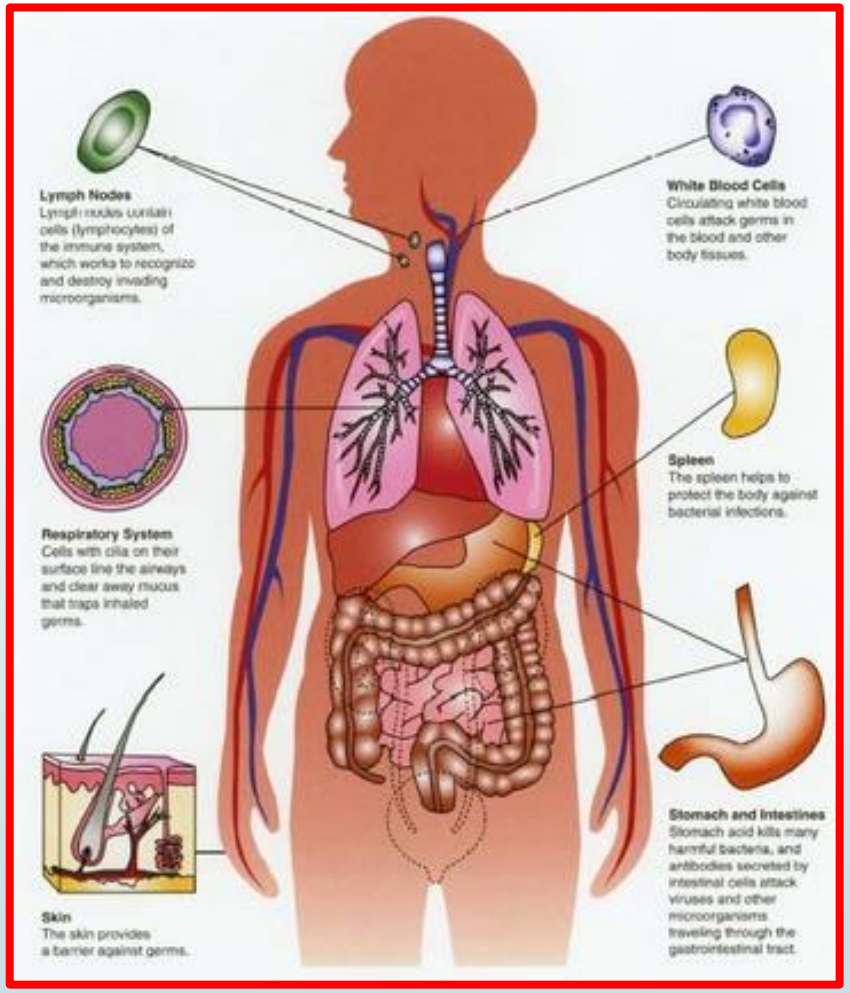
PHYSIOLOGY

Microorganisms are normally prevented from causing infection in tissues by intact epithelial surfaces, most notably the skin. These surfaces are broken down by trauma or surgery. In addition to these mechanical barriers, there are other protective mechanisms, which can be divided into:

- **chemical**: low gastric pH
- **humoral**: antibodies, complement.
- **cellular**: phagocytic cells, macrophages, polymorphonuclear cells and killer lymphocytes.

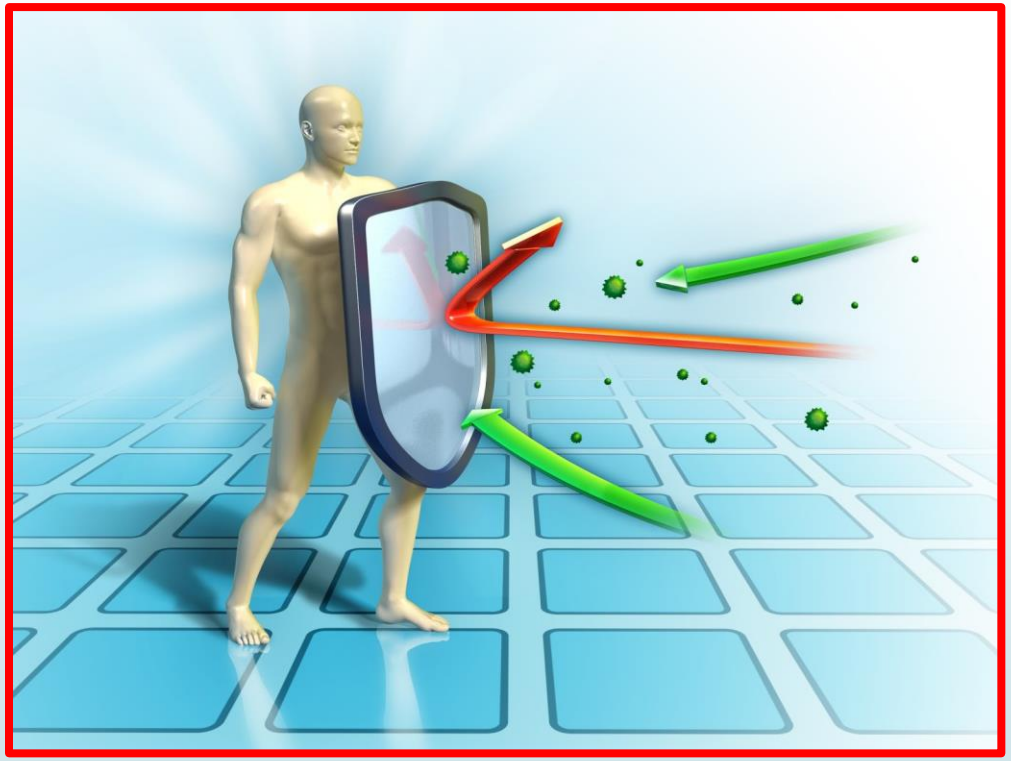
All these natural mechanisms may be compromised by surgical intervention and treatment.




Lymph Nodes
Lymph nodes contain cells (lymphocytes) of the immune system, which works to recognize and destroy invading microorganisms.
White Blood Cells
Circulating white blood cells attack germs in the blood and other body tissues.
Spleen
The spleen helps to protect the body against bacterial infections.
Respiratory System
Cells with cilia on their surface line the airways and clear away mucus that traps inhaled germs.
Skin
The skin provides a barrier against germs.
Stomach and Intestines
Stomach acid kills many harmful bacteria, and antibodies secreted by intestinal cells attack viruses and other microorganisms traveling through the gastrointestinal tract.

The body possesses a complex system of mechanisms to protect itself from infection. These include:

- methods to prevent entry of bacteria into the body, such as skin and mucous membranes, which act as a barrier to penetration by organisms
- the mucociliary apparatus in the respiratory tract, which washes bacteria from the respiratory tract
- methods to deal locally with organisms if they manage to invade the body tissues, for example, the local inflammatory reaction resulting in cellulitis and abscess formation
- methods to deal with organisms if they start to invade tissues, including lymph node reaction and systemic lymphocyte response.



Risk factors for increased infection:

Systemic:

- Malnutrition
- Metabolic (uremia, diabetes, jaundice)
- Lowered immunity (steroids, chemotherapy, cancer, AIDS)
- Shock

Local :

- Poor vascularity
- Neuropathy
- Poor surgical technique (Necrotic tissue, hematoma, dead space)

PATHOPHYSIOLOGY:

Once bacteria invade the tissues, they release various toxins, these toxins act on macrophages which in turn release various cytokines, e.g. Interleukin, tumor necrosis factor (TNF), etc….These cytokines are responsible for causation of systemic manifestation of sepsis. Various signs and symptoms of sepsis are:

- Hyper/Hypothermia
- Tachycardia
- Hypotension
- Leukocytosis

Appearance of these manifestation in a case of sepsis is called as (1) Systemic Inflammatory Response Syndrome (SIRS).

The infection can spread to local areas or systemic circulation. If it remains uncontrolled, it leads to one or more organ dysfunction involving respiratory system, cardiovascular system, renal system and central nervous system.

This stage is called as (2) Multiple Organ Dysfunction Syndrome (MODS). If still not controlled, it leads to (3) Multiple System Organ Failure (MSOF) and death

Spread of infection

- Local spread — Cellulitis
- Regional spread — Lymphangitis, Lymphadenitis
- Systemic spread — Blood (Bacteremia, Septicemia)
  - Body cavities (Meningitis, Peritonitis)

1- WOUND INFECTION

- It is defined as collection of pus in the wound that is discharged spontaneously or requires surgical drainage.
- Wound infection is called major infection if it has associated systemic manifestations of SIRS.
- If systemic manifestations are not there, it is called as minor wound infection.
- Source of wound infection can be endogenous or Exogenous

The exogenous infection is usually hospital acquired infection and is known as Nosocomial infection/ The two main exogenous organisms responsible for wound sepsis are *Staphylococcus aureus* and *Streptococcus pyogenes*

Source of nosocomial infection

- Surgeon's hands
- Patient's skin
- Surgical instruments
- Contaminated air

- To prevent wound infection, apart from aseptic measures, prophylactic antibiotics are used to kill the bacteria. However, following trauma/surgery, host defenses do not start in initial 4 hours. Hence, ideal time for giving prophylactic antibiotics is at induction of anesthesia so that antibiotic levels in blood and tissues are maximum during surgery.
- Once infection is established, the treatment is drainage, regular dressing and antibiotics according to culture and sensitivity report of the pus.

Neck wound infection

Post-surgery wound infection

2- Common types of infections are:

A- BOIL (FURUNCLE):

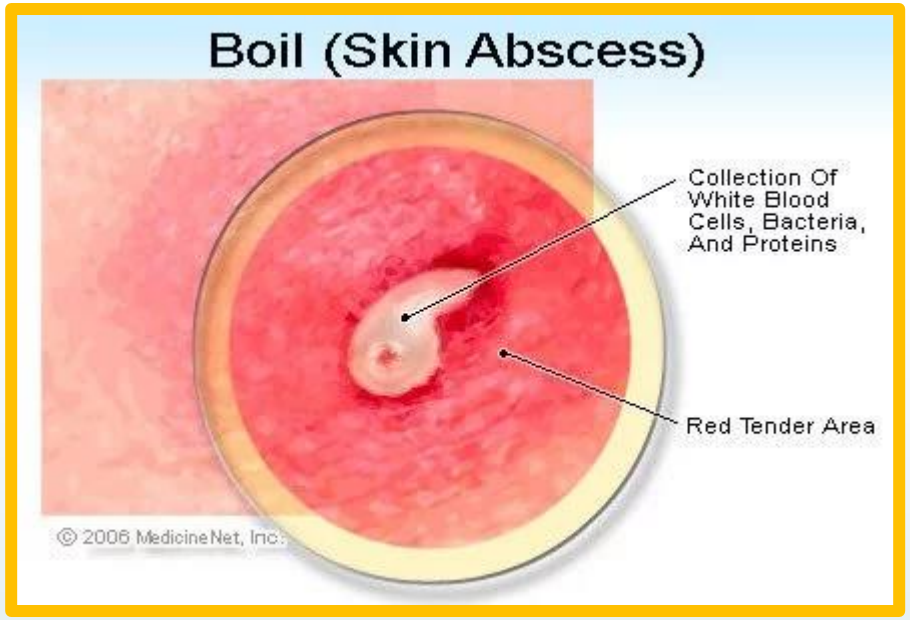
It is the abscess in sweat gland or hair follicle. It is caused by *Staph aureus*. There is intense inflammatory reaction leading to tissue necrosis and formation of central core of pus.

It is surrounded by a peripheral zone of cellulitis. The patient complains of acute onset swelling with throbbing pain.

There are usually no systemic features of sepsis. Most of the times, overlying skin undergoes necrosis and small pustule gets drained spontaneously, if the boil subsides without suppuration, it is called 'blind boil'.

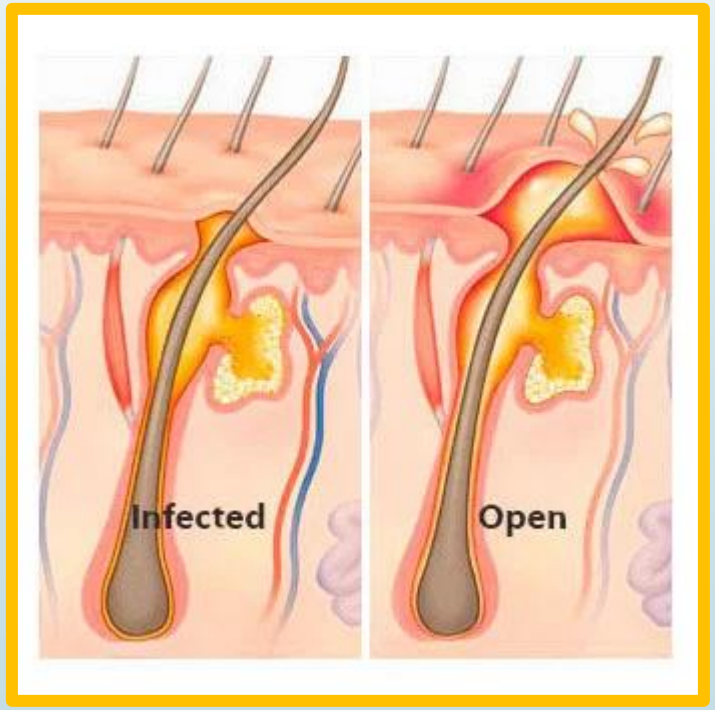
Boil of external auditory canal is extremely painful because skin is adherent to underlying cartilage and there is no space for expansion. In case of intense pain and inflammation, antibiotics (Cloxacillin), anti-inflammatory and analgesics are given along with local antiseptic application.

Sometimes incision and drainage is required if boil is big sized and not resolving with antibiotics, in case of recurrent boils, diabetes should be ruled out.


Boil (Skin Abscess)
Collection Of White Blood Cells, Bacteria, And Proteins
Red Tender Area
© 2006 MedicineNet, Inc.

Skin boils


Prof. Dr. Ali Al Okaili


Infected
Open

Example: Boil of external auditory canal is extremely painful because skin is adherent to underlying cartilage and there is no space for expansion

Complications of boils

- Necrosis and sloughing of skin
- Scarring
- Excruciating pain in external auditory canal
- Cavernous sinus thrombosis in boil upper lip and nose ('dangerous area')
- Abscess leading to pyemia and septicemia

B- ABSCESS:

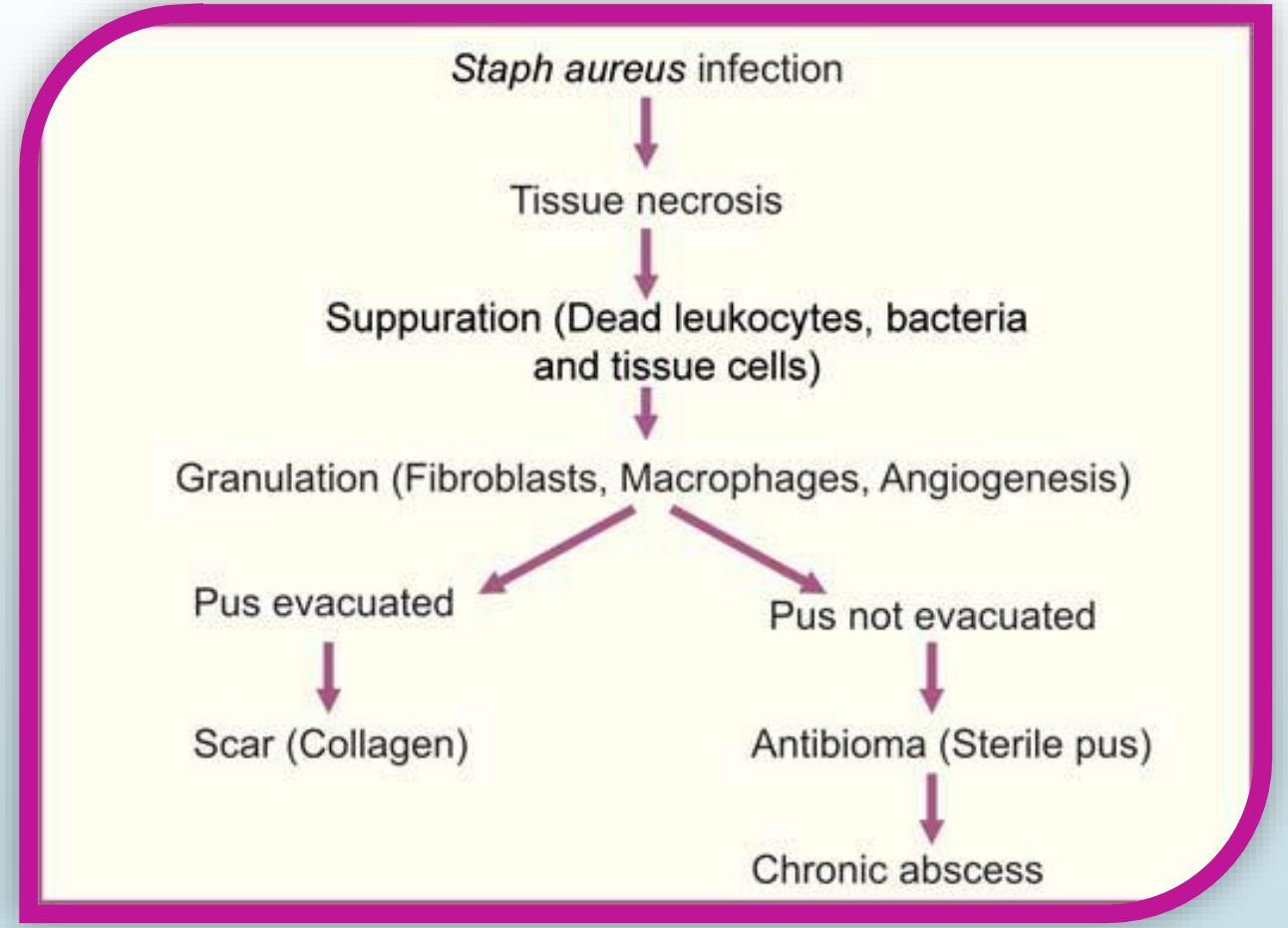
It is a localized collection of pus surrounded by an area of inflammation. It is usually caused by staphylococcal infection. The organisms reach the infected area by following routes:

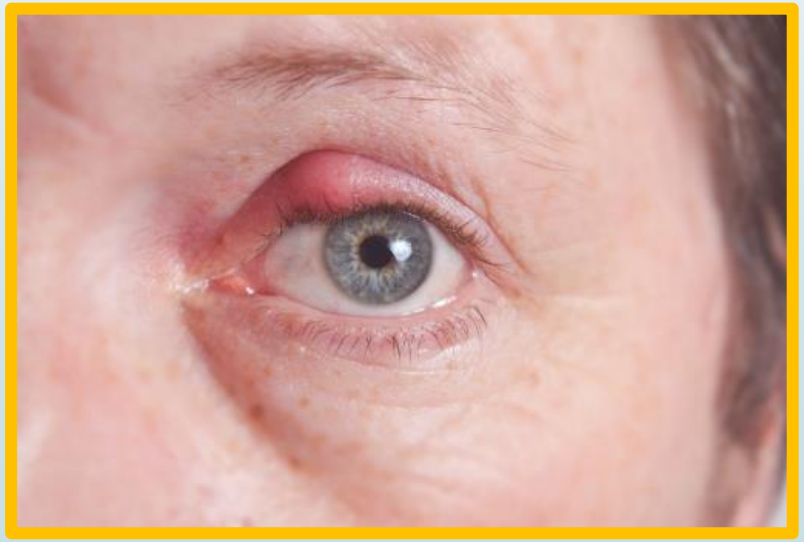
- Hematogenous route
- Local extension from adjoining area of infection
- From outside (penetrating wounds)

Pathophysiology:

- There is collection of polymorphonuclear leukocytes at the site of infection, which release proteolytic enzymes, these enzymes cause liquefaction of tissues leading to pus formation.
- The area around the pus is infiltrated by leukocytes and bacteria and is called pyogenic membrane. As abscess grows, it tracks along the plane of least resistance towards skin.

Formation and progress of abscess





Symptoms

Malaise, fever, localized swelling with throbbing pain.

Signs

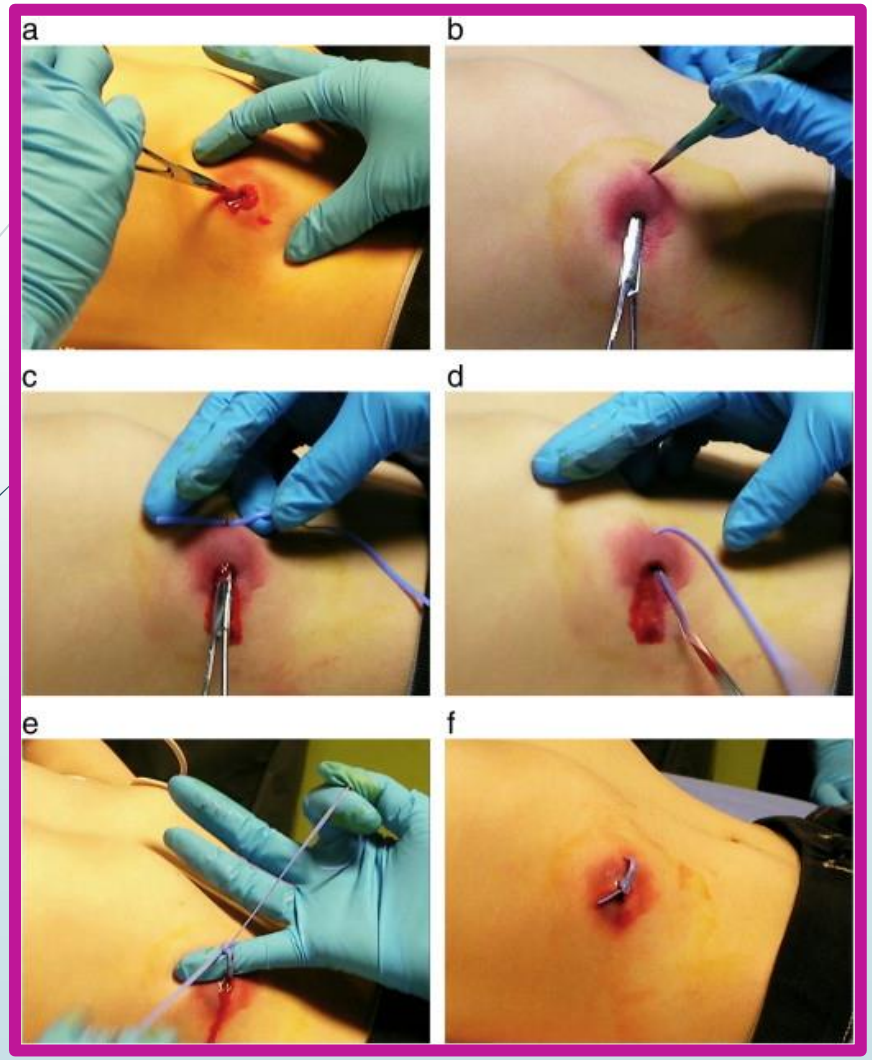
The five classical signs of inflammation are seen:
(1) Heat, (2) Redness, (3) Tenderness, (4) Swelling, and (5) Loss of function.
Fluctuation is a late sign and should not be elicited in an acute abscess because of intense pain and inflammation.

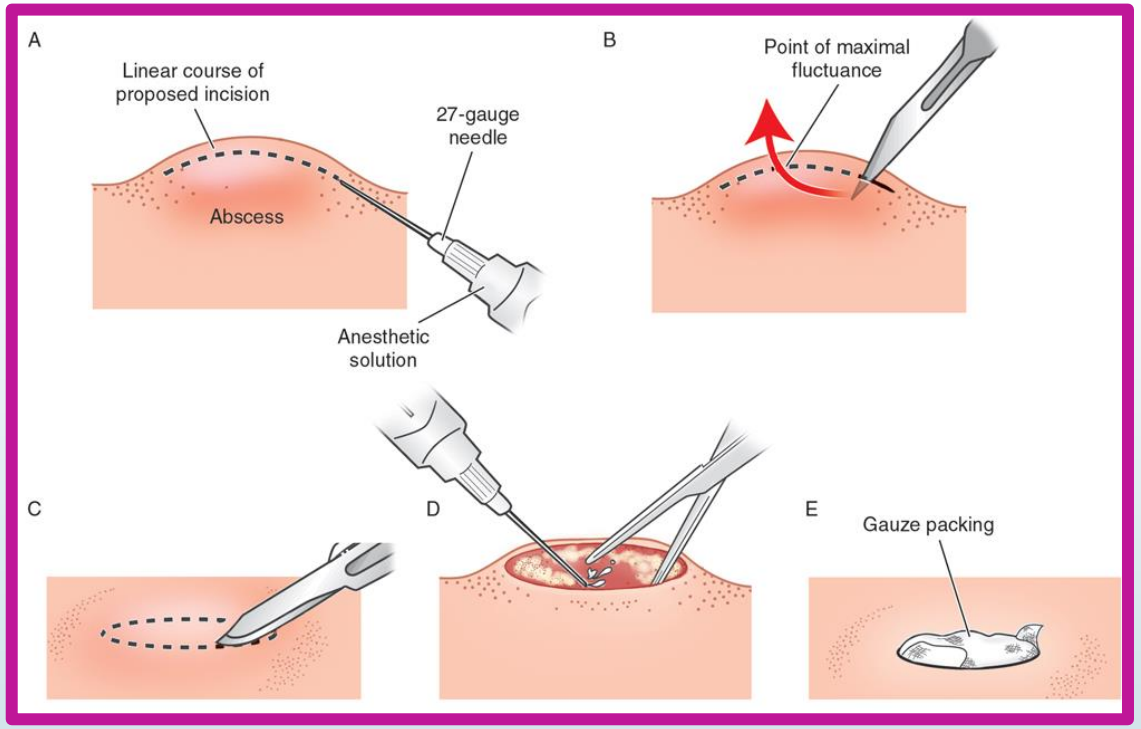
Treatment

Once pus formation occurs, it should be surgically drained because penetration of pus by antibiotics is poor.

Incision and drainage of abscess should ideally be done under general anesthesia since it is very painful and local anesthesia is not as effective in areas of acute inflammation

- A liberal stab incision is made on the most prominent part of the abscess and pus is drained.
- The fibrous loculi within the abscess cavity are broken with blunt dissection (finger or artery forceps) to make it a single cavity. It helps in better drainage of pus. The cavity is irrigated with antiseptic solution.
- The granulation tissue in the wall of abscess cavity bleeds profusely, the bleeding is controlled by packing the abscess cavity with a roller gauge soaked in antiseptic solution (povidone iodine) and wound is dressed. The pack is removed after 48 hrs and bleeding stops by that time.
- After that daily dressing is done with antiseptic solution and the cavity is lightly packed with gauze till the abscess heals. This gauze prevents early closure of skin wound and the wound cavity heals from the floor and thus abscess does not recur.
- Amoxycillin with clavulinic acid is given in dosage of 1 gm BID for 5-7 days. However, antibiotics can be changed according to report of pus culture and sensitivity.





Steps of incision& drainage

Cautions in abscess drainage:

If an abscess is located in a high-risk area, presence of pus should always be confirmed by needle aspiration before attempting surgical drainage.

Deep-seated abscess is usually difficult to diagnose since classical signs of inflammation are missing. It is best localized by radiological imaging (USG, CT or MRI) and aspirated with a wide bore needle.

High-risk' anatomical areas of abscess:

Neck: Carotid and subclavian vessels

Axilla: Axillary vessels

Groin: Femoral vessels

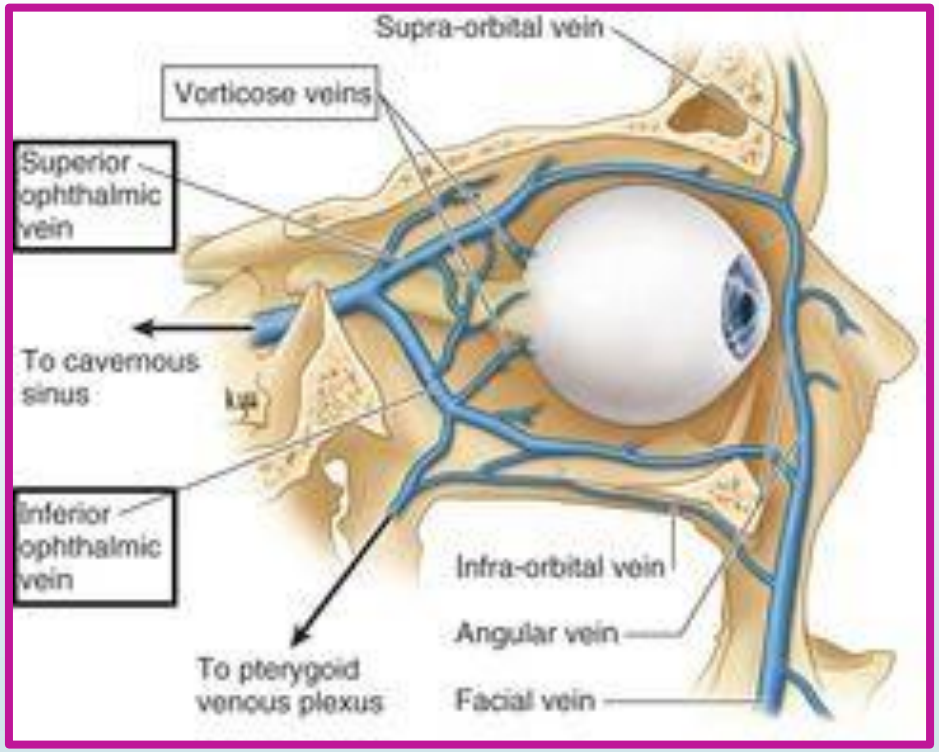
Parotid region: Facial nerve

ANTIBIOMA

If pus is not drained and abscess is treated with prolonged antibiotics, it leads to formation of sterile pus surrounded by thick fibrous tissue. It makes a hard lump which becomes clinically difficult to differentiate from malignancy, e.g. breast antibioma mimics carcinoma breast.

What is the Dangerous Area of the Face?

It is a triangular area bounded by: **the side of nose, medial angle of the eye and upper lip.**



Hilton's method of incision and drainage should be used in 'high-risk' anatomical areas. Areas like neck, axilla and groin have vital vessels and nerves, which are likely to be injured during abscess drainage.

Hence, skin and subcutaneous tissue (only) are incised with stab knife and abscess cavity is then opened by gently thrusting a pair of sinus forceps into the abscess cavity

Cautions in abscess drainage: A ruptured thrombosed aneurysm has local signs of inflammation and mimics an abscess. If it is drained by mistake, it can cause fatal hemorrhage. Hence, if an abscess is located in a high-risk area, presence of pus should always be confirmed by needle aspiration before attempting surgical drainage

Parotid region abscess

Abscess axilla. Beware of ruptured aneurysm…Always aspirate before incising

C- CARBUNCLE

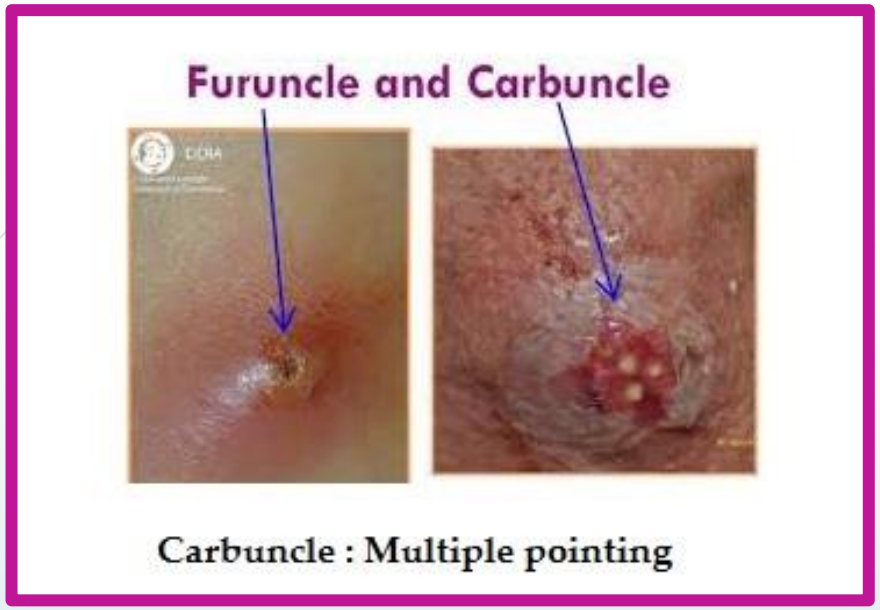
- Carbuncle is a multilocular extension of a boil into the subcutaneous tissue.
- A **carbuncle** is collection of boils that develop under the skin. When bacteria infect hair follicles, the follicles can swell and turn into boils and **carbuncles**.

It is caused by *Staphylococcus aureus* infection.

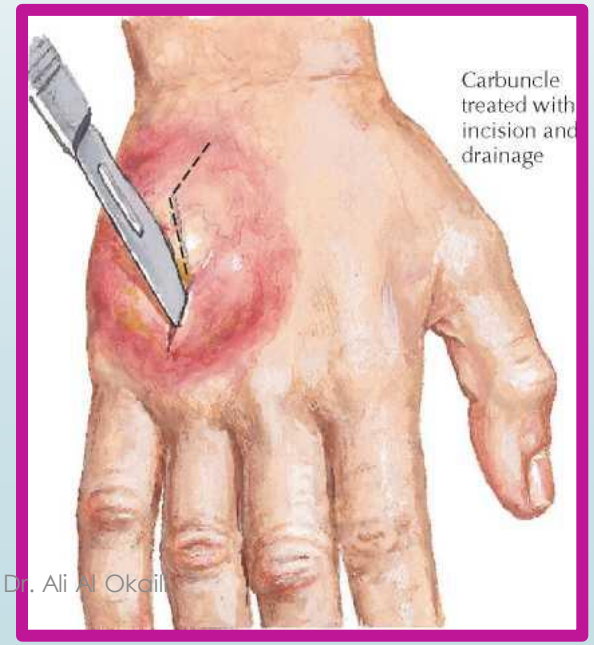
- It is usually seen in males after the age of 40 years who have **underlying diabetes mellitus, the common sites are nape of neck and dorsum of trunk**

Outlines of Carbuncle 'C':

Definition: **C**utaneous and subcutaneous infective gangrene
Etiology: **C**occi
Pathology: **C**ommunicating abscess
Clinical features: **C**entral necrosis
Cribriform appearance
Treatment:
Control diabetes
Clavulinic acid with amoxycillin
Cruciate incision and wound debridement


Furuncle and Carbuncle
Carbuncle : Multiple pointing

Carbuncle


Carbuncle
treated with
incision and
drainage

Clinical Features

The patient complains of diffuse painful swelling; and within a few days overlying skin becomes necrosed and starts discharging pus. Multiple small necrotic skin areas develop around central necrotic area and these all join to form large area of ulceration.

Treatment

- General measures to improve health and control of diabetes.
- Amoxycillin with clavulinic acid is given and antibiotics may be changed according to pus culture and sensitivity.
- During initial stage, local antiseptic cleaning and osmotic paste (glycerine with magnesium sulphate) may abort the carbuncle and it may heal without skin ulceration.

Once skin ulceration occurs, it requires debridement and regular wound dressing.

- **Small wounds will contract and heal with scarring while large wounds may require skin grafting.**

D- CELLULITIS:

It is the non-suppurative inflammation of subcutaneous tissues, it is usually caused by hemolytic streptococci or staphylococci which gain entry into the tissues through a scratch, abrasion or surgical wound.

- Cellulitis is the non-suppurative invasive infection of tissues, there is poor localization in addition to the cardinal signs of inflammation.

- Lymphangitis is part of a similar process and presents as painful red streaks in affected lymphatics, lymphangitis is often accompanied by painful lymph node groups in the related drainage area

Clinical Features:

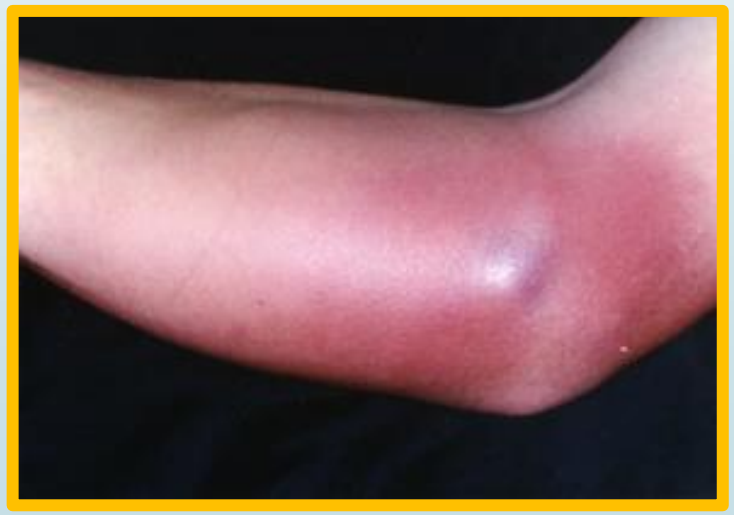
There is widespread swelling, redness and pain without definite localization. Soon the skin becomes shiny especially in areas having loose skin (face, scrotum). To differentiate it from abscess, the cellulitis is said to have:

No edge……. No limit

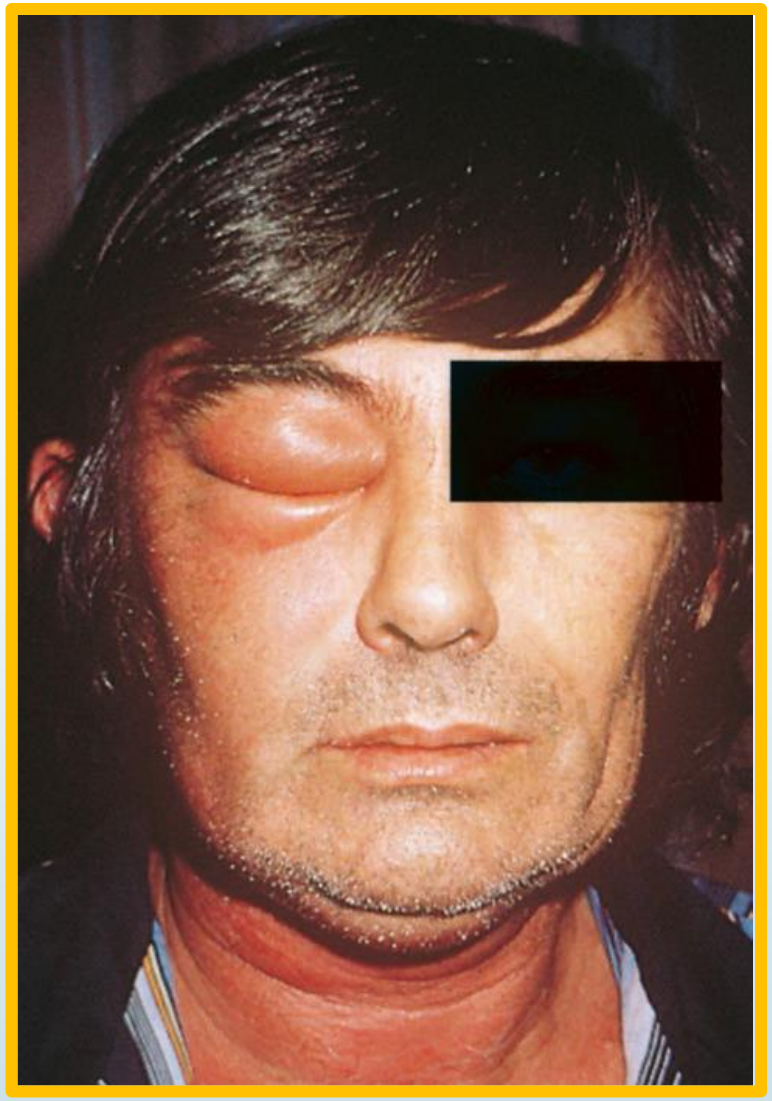
No pus ……No fluctuation

In untreated and neglected cases, cellulitis may progress to:: abscess formation, skin necrosis and even septicemias

Cellulitis leg



Streptococcal cellulitis of the leg following a minor puncture



Staphylococcal cellulitis of the face and orbit

Difference between cellulitis and abscess

Characteristics	Cellulitis	Abscess
Duration	Acute phase	Chronic phase
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/mixed

Treatment

- Bed rest and elevation of the part to reduce edema.
- Local application of osmotic paste of glycerin with magnesium sulphate to reduces edema.
- Injection crystalline penicillin 10 units, intravenous, 6 hourly after sensitivity test for five days is useful in spreading streptococcal infection.
- Amoxycillin with clavulinic acid 1 gm. twice a day for 5 days (oral or injectable) is effective for staphylococcal infection.
- Analgesics and anti-inflammatory drugs for control of pain and inflammation.

CELLULITIS IN SPECIAL SITES

Neck

Cellulitis of submental and submandibular region occurring beneath deep cervical fascia is called as Ludwig's angina.

The infection is caused by virulent streptococcal infection along with anaerobes. The precipitating factors are 4 'C':

- Caries teeth
- Carcinoma oral cavity
- Chronic sialadenitis (involving submandibular gland)
- Chemotherapy

Clinical Features

- There is brawny swelling of submandibular region along with inflammatory edema of mouth

The patient looks toxic, is febrile and always has putrid halitosis (foul smelling breath).

- Edema of floor of mouth displaces the tongue upwards and backwards causing dysphagia.
- In untreated cases, patient may have laryngeal edema presenting as stridor and choking….

Complications of cellulitis in neck

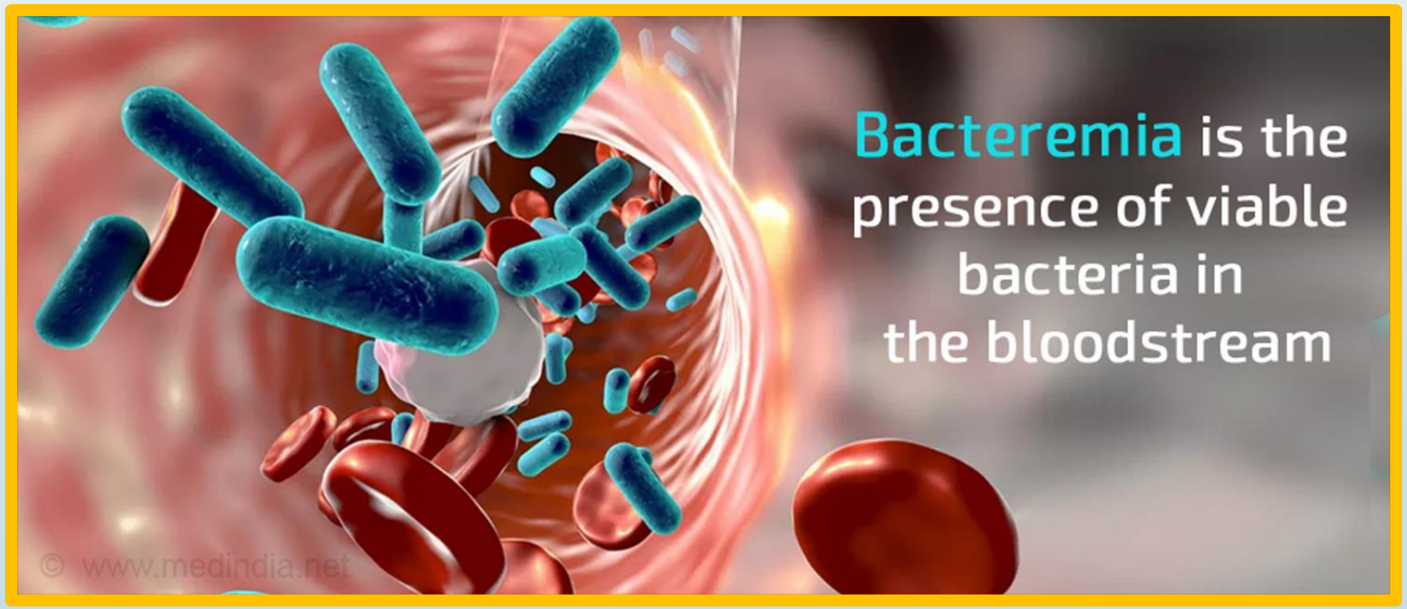
- Laryngeal edema
- Stridor
- Mediastinitis
- Septicemia

Treatment

- Hospitalization and early use of parenteral antibiotics (cefuroxime, amoxycillin with clavulinic acid) and metronidazole for anaerobes.
- If patient does not improve with conservative treatment, surgical drainage should be done.
- Under GA or LA, a curved incision is given below the mandible to incise deep cervical fascia liberally.
- The mylohyoid muscle may also be incised to decompress the floor of mouth, wound is irrigated and sutured loosely over subcutaneous drain.
- Rarely tracheostomy may be required in cases of laryngeal obstruction.

BACTEREMIA:

It is defined as bacteria circulating in the blood without toxins or clinical manifestations. It is usually transient and may last for a few minutes since body defenses destroy these organisms. It may follow dental procedures, debridement of infected wounds, etc….., it can be dangerous when patient has prosthetic implant since the implant can get infected. Hence, a surgical procedure should be done under cover of antibiotics.



Bacteraemia and sepsis

Sepsis is common after anastomotic breakdown .. Bacteremia is dangerous if the patient has a prosthesis,

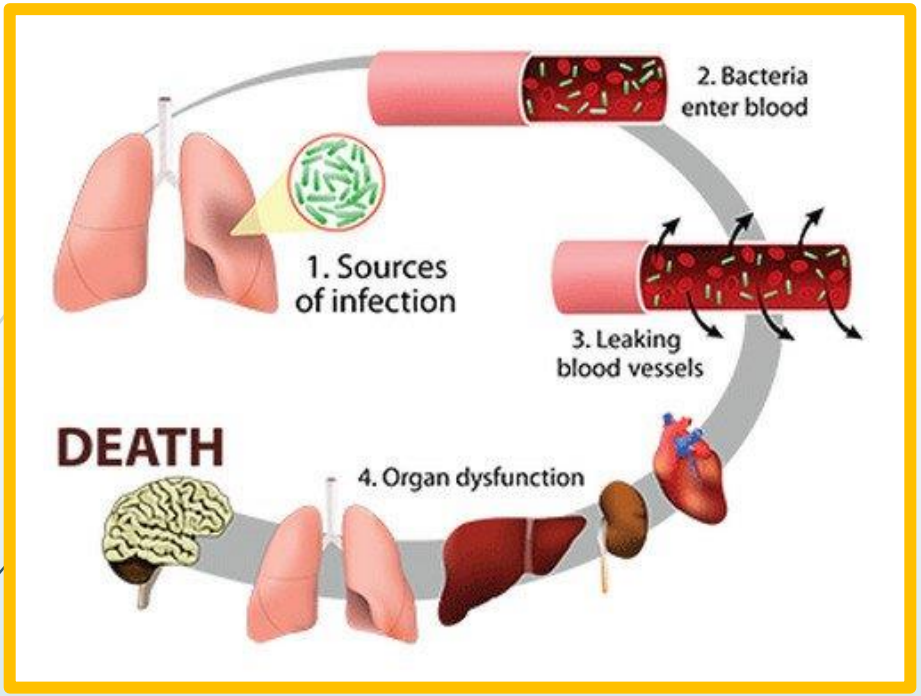
SEPTICEMIA

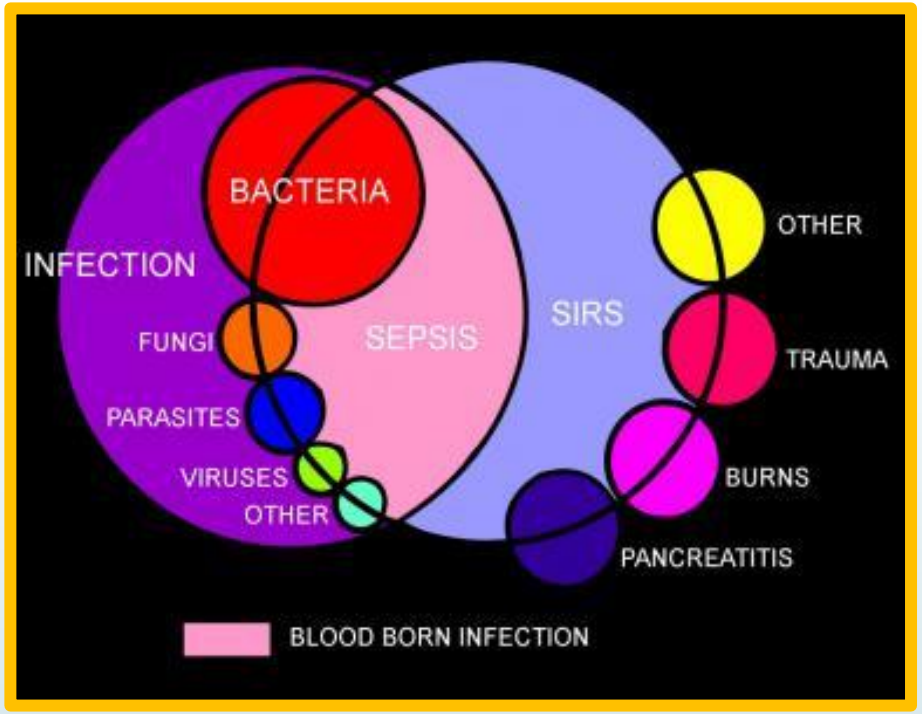
It is defined as bacteria as well as their toxins circulating in the blood. It has systemic manifestation in form of fever, rigors, chills, tachycardia and hypotension.

It is caused by streptococci, staphylococci and gram negative bacilli. The organisms enter the circulation when procedures are performed in infected tissues (e.g. tooth extraction in abscess).

Treatment

- Systemic antibiotics, change antibiotics according to blood culture and sensitivity report.
- Hydrocortisone.
- Plasma expanders, blood transfusion.





Causes of septicemia: severe infections& injuries

Complications: decreased blood flow, gangrene, septic shock

Mortality rate: 10%-40%

SEPTICEMIA

Bacteremia	Septicemia
Bacteremia is the simple presence of bacteria in the blood.	Septicemia is the presence and multiplication of bacteria in the blood.
Bacteremia is not as dangerous as Septicemia.	Septicemia is a potentially life-threatening infection.
Less amount of bacteria are present in blood.	Large amounts of bacteria are present in the blood.
This may occur through a wound or infection, or through a surgical procedure or injection.	It can arise from infections throughout the body, including infections in the lungs, abdomen, and urinary tract.
Toxins are not produced.	Toxins may be produced by bacteria.
Bacteremia usually causes no symptoms or it may produce mild fever.	It shows symptoms like chills, fever, prostration, very fast respiration and/or heart rate.
It can resolve without treatment.	Untreated septicemia can quickly progress to sepsis.
Rapidly removed from the bloodstream by the immune system	.Antibiotics will be used to treat the bacterial infection that is causing septicemia.
Caused by *Staphylococcus, Streptococcus, Pseudomonas, Haemophilus, E. coli*, herpes, urinary tract infections, peritonitis, *Clostridium difficile*	*Staphylococci*, are thought to cause more than 50% of cases of sepsis. Other bacteria include *Streptococcus pyogenes, Escherichia coli, Pseudomonas aeruginosa, Klebsiella* species and even *Candida* spp .

TOXEMIA

Toxins are circulating in the blood without presence of bacteria (producing these toxins) in circulation. For example, toxins produced by *Clostridium welchii* causing gas gangrene.

PYEMIA

It is septicemia in which bacteria and their toxins are carried in the blood stream and subsequently they produce multiple focal abscesses in different parts of the body. The features of these abscesses are:

- These are multiple and deep seated.
- Local signs of inflammation (redness, tenderness, pain) are minimal.

It is usually seen in malnourished children and organism responsible is *Staph aureus*.

Treatment

- Antibiotics.
- General measures to improve nutrition.
- Multiple incisions to drain the abscesses.

SINUS

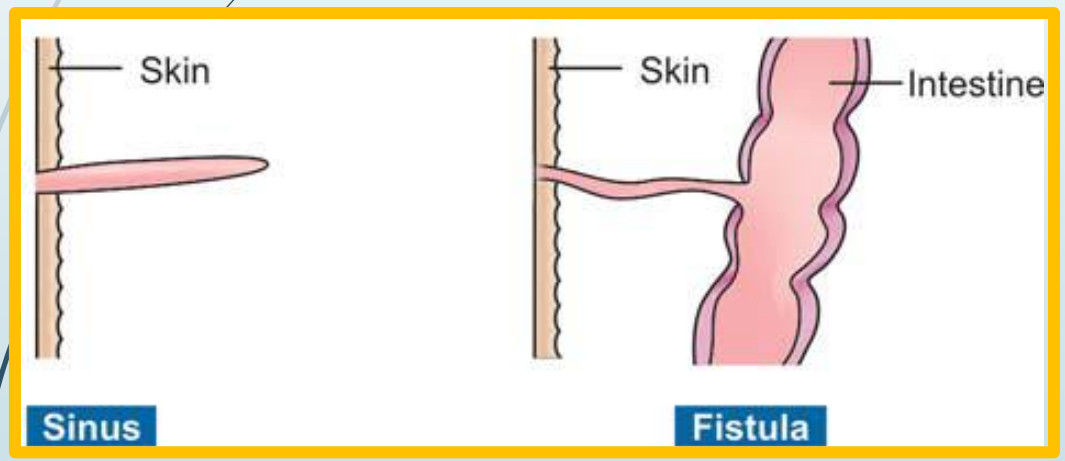
It is a blind tract extending from epithelial surface to surrounding tissues, it has one opening. It is lined by granulation tissue or epithelium (in Latin: Hollow).

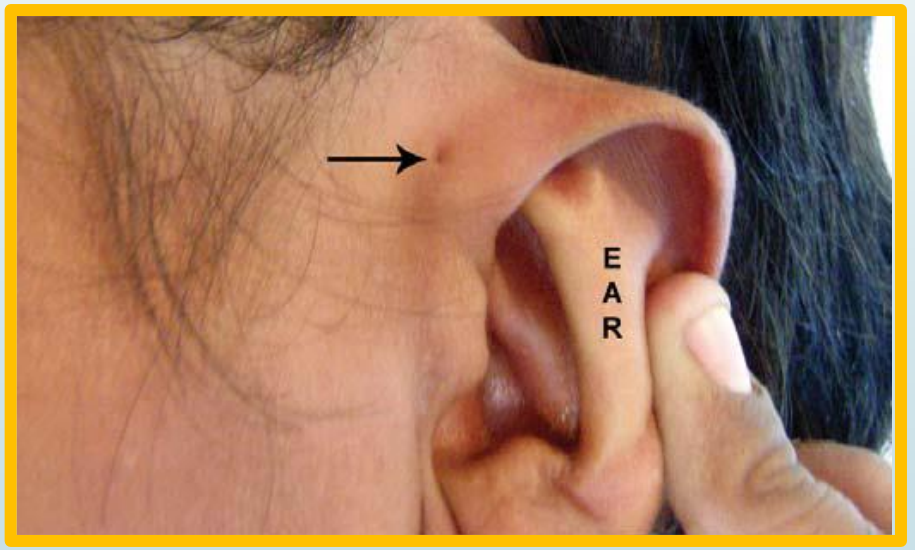
1- Anatomical Sinuses

These are normally present in the body, e.g. frontal sinus, maxillary sinus.

2- Congenital Sinus

It is present since birth, e.g. pre-auricular sinus





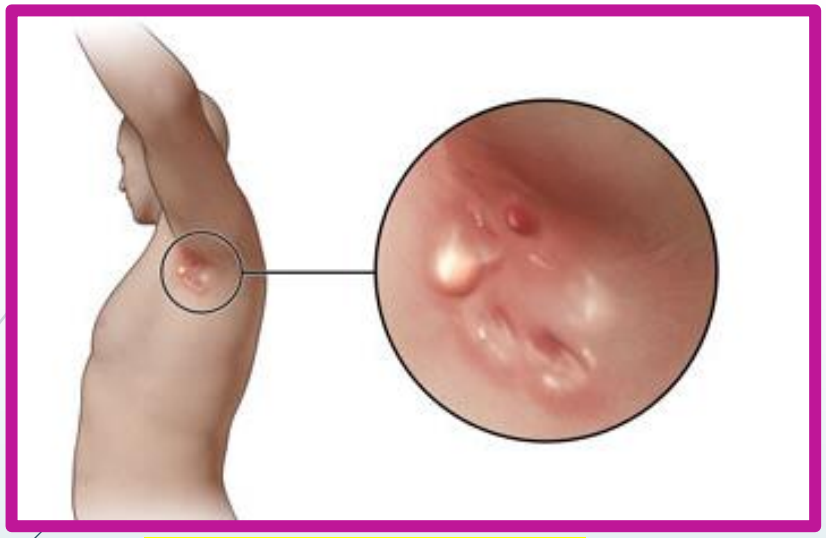
3- Acquired Sinus

Various causes are:

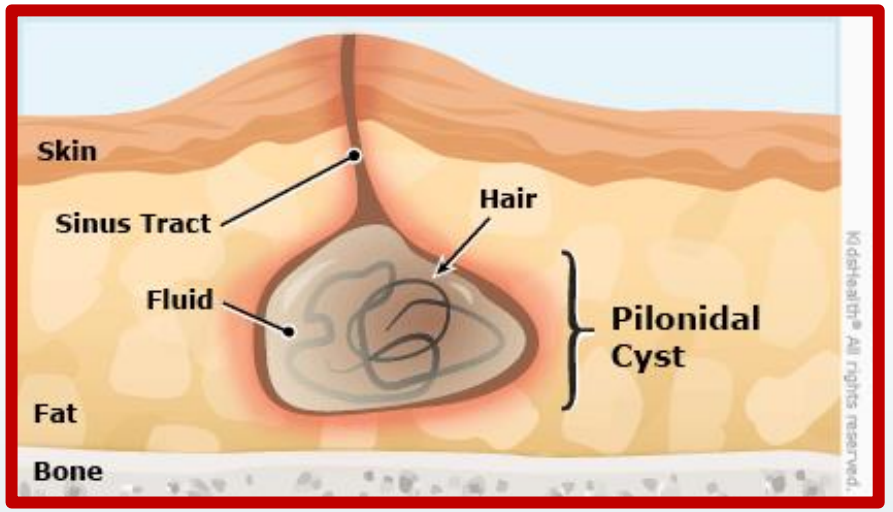
- Tubercular sinus in neck. It occurs following rupture or drainage of cold abscess in the neck. Margins of the sinus are undermined and there is palpable mass of matted lymph nodes.
- Median mental sinus in submental triangle is due to ruptured tooth abscess.
- Pilonidal sinus is a midline sinus in natal cleft. It contains tuft of dead hair with foul smelling discharge.
- Hidradenitis suppurativa. It is abnormality of apocrine glands present in axilla and groin. It presents with recurrent abscesses and multiple discharging sinuses.

Non-healing sinus cheek following accident

Median mental sinus



Hidradenitis suppurativa



Tubercular sinus in neck

Non-healing sinus forehead due to osteomyelitis of vault

FISTULA

It is an abnormal tract between two epithelial surfaces, it has two openings, the tract is lined by granulation tissue or epithelium (in Latin: pipe or tube)

Or abnormal communication between lumen of one viscus& lumen of another

Classification of Fistula

1 - External Fistula:

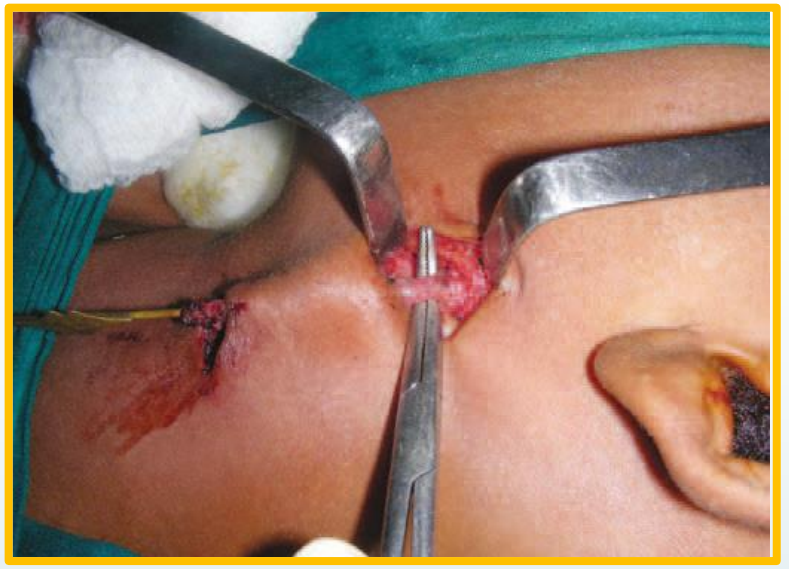
When the tract communicates a hollow viscus (e.g. intestine) to the skin. Examples are: Parotid fistula, thyroglossal fistula, branchial fistula.

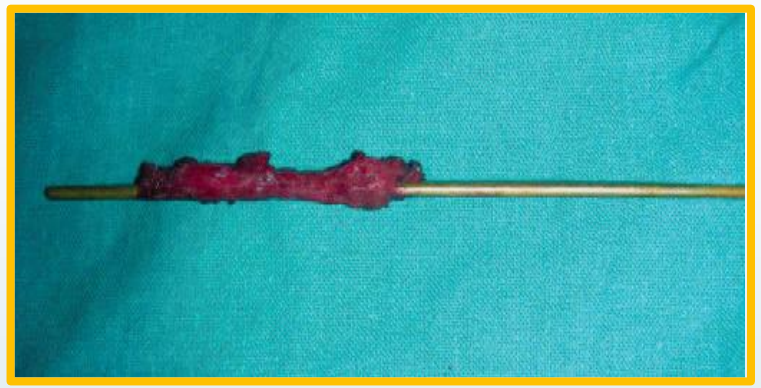
2 - Internal Fistula:

When the tract communicates with two hollow viscera (e.g. two intestinal lumens, two blood vessels). Examples are: Tracheo-esophageal fistula, oro-maxillary fistula. Or

A - Congenital Fistula:

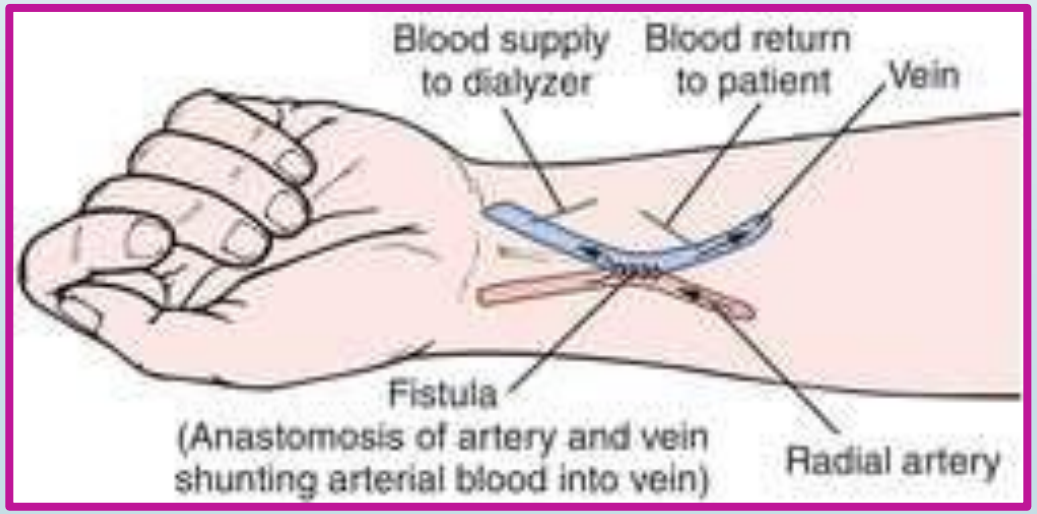
It is present since birth. Examples are: Branchial fistula, Tracheo-esophageal fistula, Arteriovenous fistula.





Branchial fistula

Arteriovenous fistula



Thyroglossal fistula

Parotid fistula

B- Acquired Fistula:

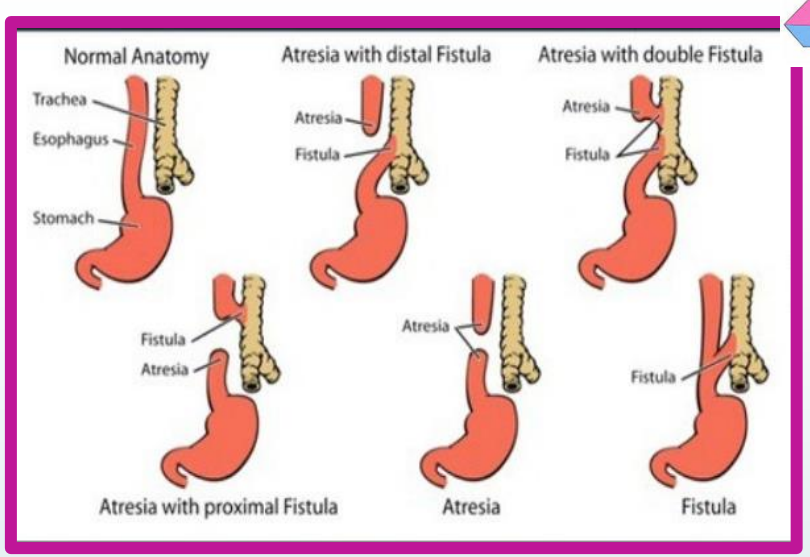
Example are:

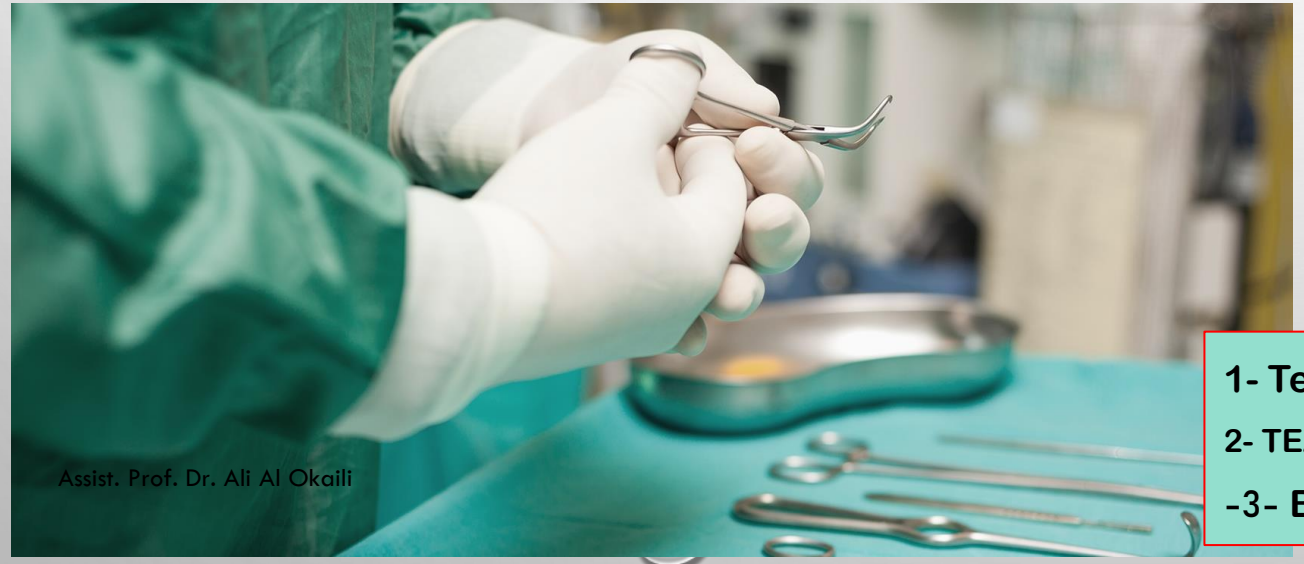
- Fistula in anal tract.
- Arteriovenous fistula: Following trauma, created surgically for dialysis in renal failure.
- Parotid fistula: Following drainage of parotid abscess.

A sinus or fistula may not heal despite treatment.

Causes of non-healing sinus/fistula

- Foreign body in tract
- Non-dependent drainage
- Epithelialization/fibrosis of tract
- Lack of rest to the affected part
- Chronic specific infection (e.g. Tuberculosis)
- Malignancy
- HIV
- Persistent discharge (urine, stool, pus)
- Malnutrition
- Drugs (steroids, chemotherapy)
- Radiotherapy





1- Textbook of Surgery for Dental Students/ Sanjay Marwah

2- TEXTBOOK OF **GENERAL AND ORAL SURGERY**

-3- Bailey & Love's SHORT PRACTICE of SURGERY

The General Surgeon is a Master Surgeon. A broad training ensures mastery in head and neck, breast, gastrointestinal, pediatric, oncologic and minimally invasive surgery while taking a leadership role in trauma and critical care.

VeryWell.com's definition of General Surgery is "Definition: General surgery is the surgical specialty that primarily focuses on the abdominal organs but may include many other types of surgical procedures performed on blood vessels, glands, surgical treatment, trauma surgery, skin procedures and cancer treatment."

Surgery is: The treatment of injuries or disorders of the body by incision or manipulation, especially with instruments.

HISTORY OF SURGERY

There have been evidences that the art and craft of surgery was developed even during prehistoric cultures.

In ancient Egypt, a mandible shows two perforations just below the root of first molar indicating drainage of tooth abscess during 2650 BC.

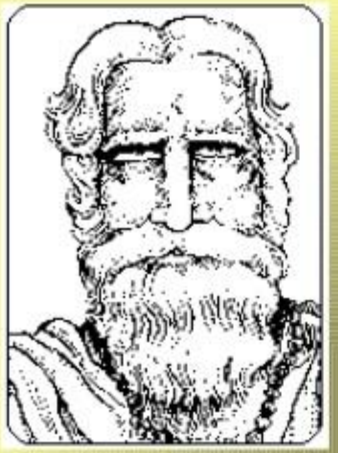
Sushruta was well-known Indian physician who taught and practiced surgery during 600 BC. He wrote volumes of surgical text books (***Susrutha Samhita***) and is known as **Father of Surgery**. His books described method of examination, diagnosis, treatment and prognosis of various illnesses. He also described detailed operative techniques of plastic and cosmetic surgery.

In ancient Greece, Hippocrates was the Greek physician who innovated the famous **Hippocratic Oath**.

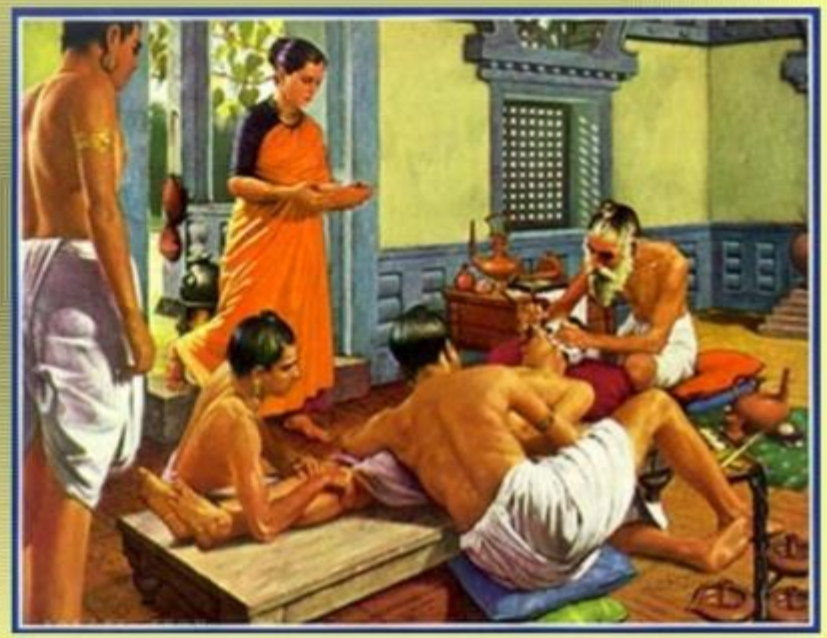
In middle ages, surgery was developed in the Islamic world. Abulcasis was a great medieval surgeon who wrote comprehensive textbooks and is often regarded as **Father of Surgery**.

Control of infection: The concept of infection control was unknown till early modern times. In 1847, Hungarian doctor Ignaz Semmelweis noticed that medical students coming from dissection hall were causing excessive maternal death compared to midwives. He introduced compulsory handwashing for everyone entering the maternal wards leading to significant decrease in maternal and fetal death.

Control of pain: In earlier times, surgery was traumatic and very painful procedure. Control of pain or anesthesia was first discovered by two American Dental Surgeons, Horace Wells (1815-1848) and William Morton: With discovery of anesthetic chemicals (ether and chloroform), surgical practice changed dramatically. Later, discovery of muscle relaxants (curare) allowed prolonged and complex surgeries to be performed effectively.



SUSHRUTA
Father of SURGERY



2600 years ago

Even conducted complicated

BRAIN SURGERY

Anesthesia well known in ancient India.

Over 125 surgical equipment were used.

The Father of Modern Surgery

(Ref. Encyclopedia Wikipedia)

His greatest contribution to history is the ***Kitab al-Tasrif***, a thirty-volume encyclopedia of medical practices. (Ref. Encyclopedia Wikipedia)

دورِ جدید کے علم جرّاحی کے فن کی باقاعدہ ابتدا الزہراوی نے کی، ابوالقاسم نے التصریف کے نام سے ایک طبّی انسائیکلوپیڈیا لکھی جو تیس جلدوں پر مشتمل تھی۔ یہ کتاب صدیوں تک یورپ کی یونی ورسٹیوں میں پڑھائی جاتی رہی۔

ابوالقاسم الزہراوی

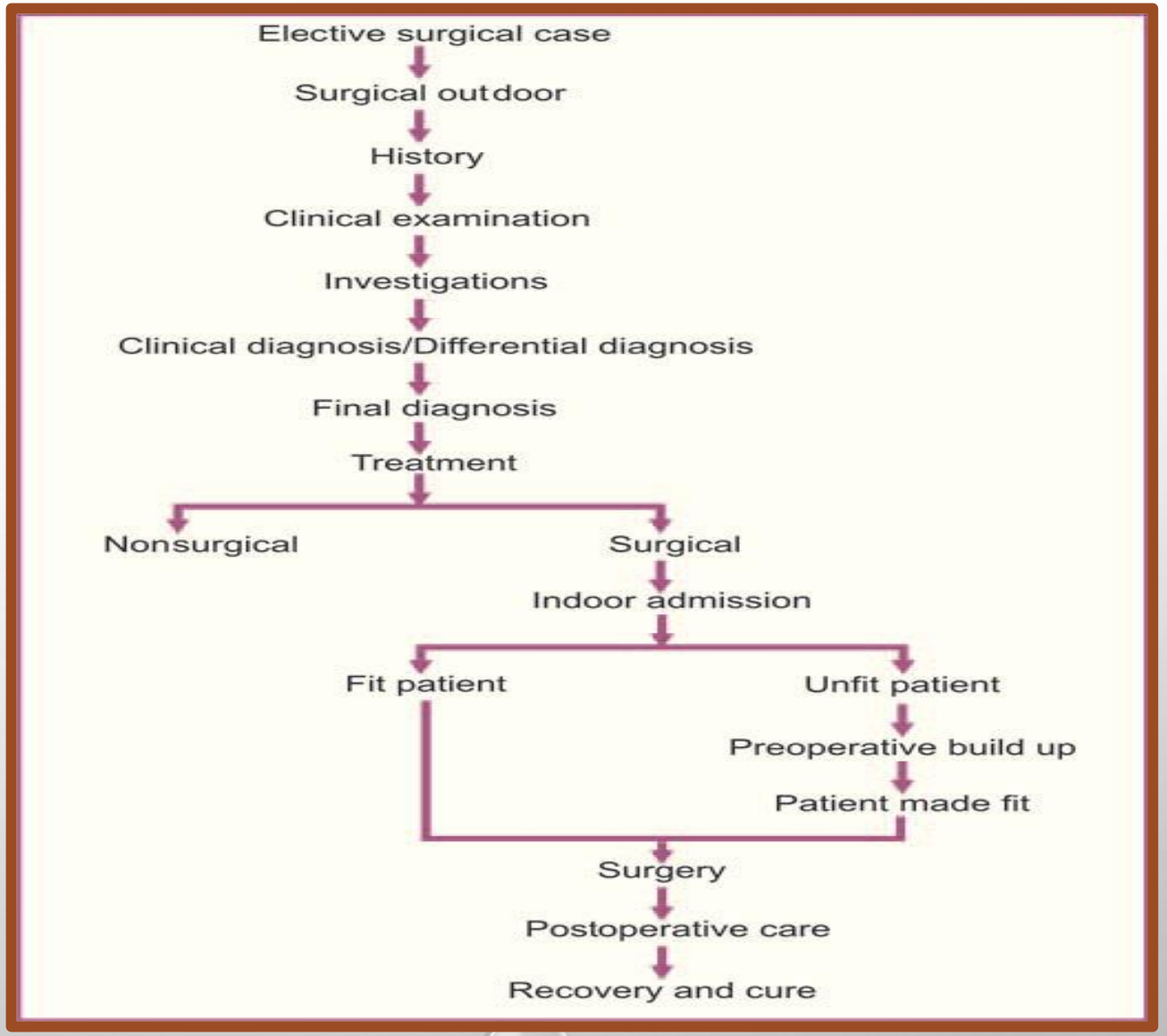
Abu al-Qasim al-Zahrawi (in the West as **Abulcasis**)

Birth:936 CE, **Death:**1013 CE

DEALING WITH A SURGICAL PATIENT

Out of all medical disciplines, surgery is a unique specialty where surgeon, who is primarily a doctor, treats the disease using surgical instruments.

Surgical diagnosis is based on a sound knowledge of anatomy, physiology, pathology, specific histology, examination with confirmation by imaging & operative surgery



A- HISTORY TAKING

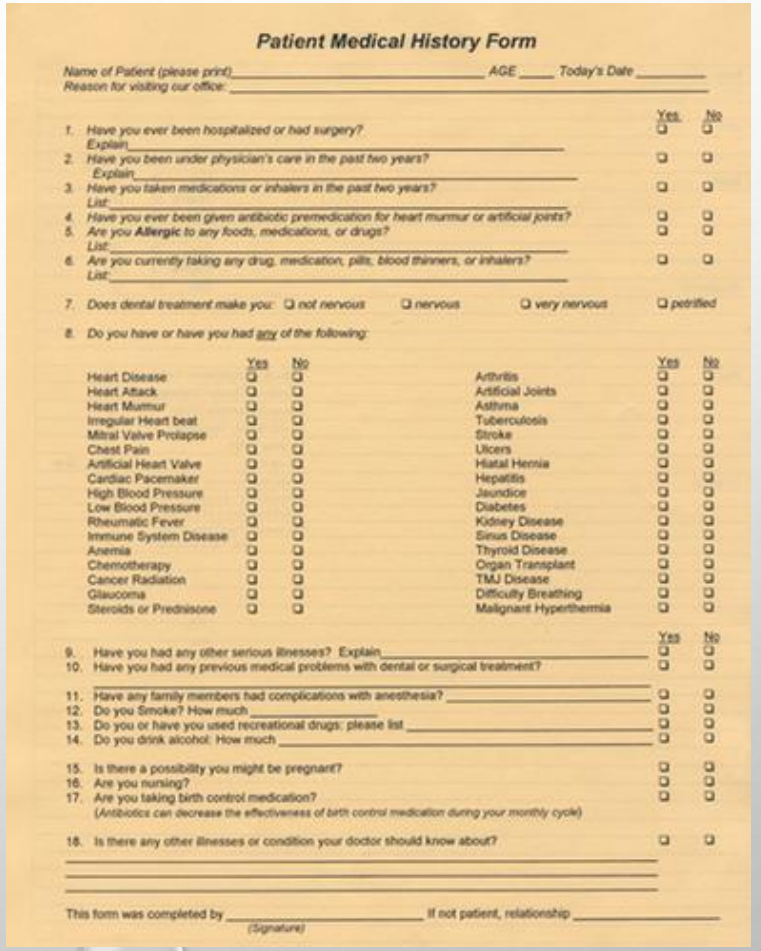
History taken in outdoor or emergency relates to the specific complaints of patient so as to reach the diagnosis.

On the other hand, history taken in the indoor for admitted patient has two objectives:

a. To reach the clinical diagnosis

b. To look for fitness of patient for surgery.

'Symptoms' are the complaints told by the patient while **'signs'** are the features seen by the clinician on clinical examination.



Patient Medical History Form

Name of Patient (please print)_____ AGE ____ Today's Date _____
Reason for visiting our office: _____

	Yes	No
1. Have you ever been hospitalized or had surgery? Explain_____	☐	☐
2. Have you been under physician's care in the past two years? Explain_____	☐	☐
3. Have you taken medications or inhalers in the past two years? List:_____	☐	☐
4. Have you ever been given antibiotic premedication for heart murmur or artificial joints?	☐	☐
5. Are you **Allergic** to any foods, medications, or drugs? List:_____	☐	☐
6. Are you currently taking any drug, medication, pills, blood thinners, or inhalers? List:_____	☐	☐

7. Does dental treatment make you: ☐ not nervous ☐ nervous ☐ very nervous ☐ petrified

8. Do you have or have you had any of the following:

	Yes	No		Yes	No
Heart Disease	☐	☐	Arthritis	☐	☐
Heart Attack	☐	☐	Artificial Joints	☐	☐
Heart Murmur	☐	☐	Asthma	☐	☐
Irregular Heart beat	☐	☐	Tuberculosis	☐	☐
Mitral Valve Prolapse	☐	☐	Stroke	☐	☐
Chest Pain	☐	☐	Ulcers	☐	☐
Artificial Heart Valve	☐	☐	Hiatal Hernia	☐	☐
Cardiac Pacemaker	☐	☐	Hepatitis	☐	☐
High Blood Pressure	☐	☐	Jaundice	☐	☐
Low Blood Pressure	☐	☐	Diabetes	☐	☐
Rheumatic Fever	☐	☐	Kidney Disease	☐	☐
Immune System Disease	☐	☐	Sinus Disease	☐	☐
Anemia	☐	☐	Thyroid Disease	☐	☐
Chemotherapy	☐	☐	Organ Transplant	☐	☐
Cancer Radiation	☐	☐	TMJ Disease	☐	☐
Glaucoma	☐	☐	Difficulty Breathing	☐	☐
Steroids or Prednisone	☐	☐	Malignant Hyperthermia	☐	☐

	Yes	No
9. Have you had any other serious illnesses? Explain_____	☐	☐
10. Have you had any previous medical problems with dental or surgical treatment? _____	☐	☐
11. Have any family members had complications with anesthesia? _____	☐	☐
12. Do you Smoke? How much _____	☐	☐
13. Do you or have you used recreational drugs: please list _____	☐	☐
14. Do you drink alcohol: How much _____	☐	☐
15. Is there a possibility you might be pregnant?	☐	☐
16. Are you nursing?	☐	☐
17. Are you taking birth control medication? (*Antibiotics can decrease the effectiveness of birth control medication during your monthly cycle*)	☐	☐
18. Is there any other illnesses or condition your doctor should know about? _____ _____ _____	☐	☐

This form was completed by _____ If not patient, relationship _____
(Signature)

History of Present Illness

Duration of illness It is very important to ask 'When were you perfectly well before the present illness'? The patient is likely to tell about mild episodes of similar illness in the past which otherwise he may ignore to mention. However, in reality, it may be of great importance in making the diagnosis.

- *Mode of onset:* How the illness started, e.g. a swelling appearing on scalp after trauma is likely to be a hematoma.
- *Progress:* Whether illness is improving or worsening, e.g. an inflammatory pathology is likely to improve with analgesics and anti-inflammatory drugs.
- *Aggravating and relieving factors,* e.g. an inflammatory pathology is likely to be aggravated with movement of the part and relieved with rest and analgesics

Personal history: Smoking, dietary habits, alcoholism are enquired. Marital status of the patient is asked and if married, number of children and their health is recorded. If some child has died, age and cause of death is noted.

Menstrual history: It is asked in female patients. Age at menarche, any menstrual irregularity, vaginal discharge, age at menopause, postmenopausal bleeding, etc. are recorded.

Family history: Whether any family member has suffered from similar illness. It can help in finding out genetic disorders (hemophilia) and communicable diseases (tuberculosis).

B- EXAMINATION

General Physical Examination

Make the patient sit or lie in the bed comfortably. Examine the patient with warm hands.

Look for:

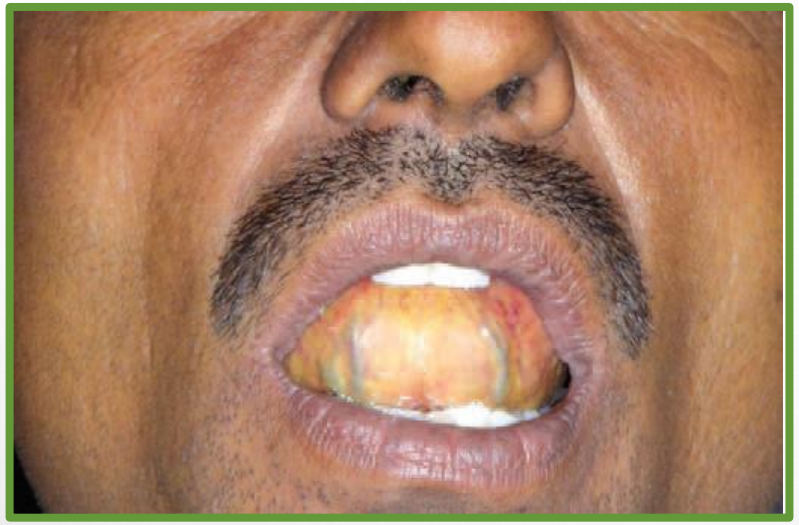
- General appearance, viz.
  - ☐ Level of consciousness (decreased in head injury).
  - ☐ Patient cooperative/uncooperative.
  - ☐ Patient anxious/lying comfortably in bed.
- Build (assessed by skeletal frame work). Skeletal deformities may be seen on exposure.
- Nourishment (assessed by triceps skin fold thickness, subcutaneous fat, skin texture, muscle mass).
- Pulse rate (normal 72/min.), regularity, volume.
- Blood pressure (normal 120/80 mm Hg).
- Temperature (normal 37°C).
- Respiratory rate (normal 12-16/min.), regularity, type (abdominal or thoracic).
- Look for various clinical signs from head to toe:

Anemia in palpebral conjunctiva, nailbeds, tongue (areas rich in capillaries).

Jaundice in upper sclera, undersurface of tongue, palmar creases (these areas are rich in connective tissue and bilirubin has great affinity for such areas).

Cyanosis Bluish discoloration of tongue (central cyanosis), bluish discoloration of tip of nose, fingers (peripheral cyanosis).

Clubbing Drumstick appearance of fingers and toes



C- Local Examination:

• Side of the lesion (right or left) should always be recorded carefully.

• A few simple instruments are necessary as ‘armamentarium’ during patient examination. There are:

Pocket torch
Tongue depressor
Metal scale
Measuring tape
Hammer
Stethoscope
Disposable gloves
Thermometer
Skin marking pen

While examining a lesion, be particular in noting its site, external appearance, possible anatomical organ of origin and its effects on surrounding structures.

- The lesion may present as swelling, ulcer, sinus or fistula. Their details of examination are described in the relevant sections.
- Always examine the lymph nodes draining the site of lesion.

fistula

D- Systemic Examination

The aim is to know the patient as a whole. During this, some other pathology related or unrelated to presenting disease may be discovered. Various systems examined are:

CVS

CNS

Respiratory system (chest)

GIT (Abdomen)

Genitourinary system

E- INVESTIGATIONS

Aims of doing investigations are:

- To reach final diagnosis
- To look for fitness for anesthesia and surgery.
- In case of malignancy, staging of disease so as to plan treatment and assess prognosis.

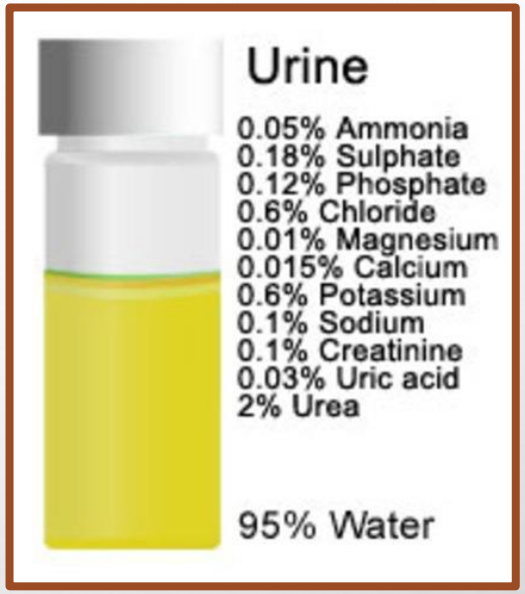
Various investigations are decided according to the site and nature of pathology. These are:

1- Hematological Investigations

- Hemoglobin—for anemia.
- Bleeding time, clotting time—for bleeding disorders.
- Total and differential leucocyte count—raised in infections.
- ESR—raised in chronic infections.
- Blood Sugar—raised in diabetes.
- Blood urea and serum creatinine—raised in renal failure.
- Thyroid function tests—in case of thyroid pathology.
- Liver function tests—deranged in liver dysfunction.

2- Urine examination: For albumin, sugar and microscopy.
3- Stool examination: For ova, cyst, pus cells, occult blood.

4- Imaging
- X-ray—for bony changes, fractures.
- Ultrasound—differentiates solid and cystic lesions.
- Doppler imaging—for blood flow.
- CT Scan with contrast enhancement—for solid organs.
- MRI—for joints, spine.



Clinical Diagnosis

On the basis of history and examination, a clinical diagnosis is made. Aim is to localize the organ of origin, type of pathological process and its extent. Pathological diseases are broadly classified as:

- Congenital
- Inflammatory (Acute or chronic)
- Neoplastic (Benign or malignant)
- Traumatic

Inflammation

It is defined as local response of living tissues to injury due to any agent.

- It is the response of body defense mechanisms to limit or eliminate the agent causing injury.
- It mainly affects vascular and connective tissues.
- <u>Agents causing inflammation are:</u>

1. *Physical agents* Heat, cold, radiation, trauma.
2. *Chemical agents* Organic and inorganic poisons.
3. *Infective agents* Bacteria, virus, parasites, fungi.
4. *Immunological agents* Cell mediated and antigen-antibody reactions.

A- TYPES OF INFLAMMATION/ according to time:

- Acute Inflammation

It is of short duration. There is early body reaction followed by repair.

- Chronic Inflammation

It is of longer duration. Either agent causing acute inflammation persists for a long time or stimulus is such that it causes chronic inflammation from the beginning.

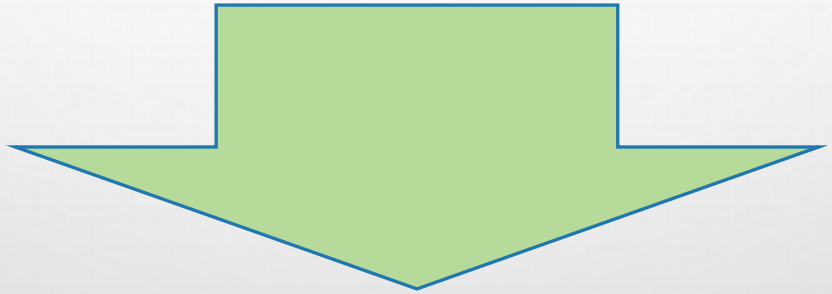
Signs of Inflammation

Classical signs of inflammation are:

- Redness (Rubor)
- Heat (Calor)
- Swelling (Tumor)
- Pain (Dolor)

Treatment of Acute Inflammation

- Analgesics and anti-inflammatory drugs to control pain and swelling, e.g.
  - ☐ Non-steroidal anti-inflammatory drugs like: diclofenac sodium.
  - ☐ Chymotrypsin, trypsin.
- Rest to the affected part.
- Elevation of affected part to relieve edema.
- Local application of Magnesium sulphate based ointment is hygroscopic and reduces edema of skin and subcutaneous tissues.



- Treatment of underlying cause, e.g. antibiotics for bacterial infection.
- Once abscess forms, it needs surgical drainage…….

CHRONIC INFLAMMATION

It is defined as prolonged process in which tissue destruction and healing continues side by side.

It can occur in following ways:

Secondary to Acute Inflammation

When causal agent of acute inflammation is not removed, it can lead to chronic inflammation, e.g. chronic osteomyelitis.

Primary to Chronic Inflammation

The causal agent is of low pathogenicity and leads to chronic inflammation from the beginning, e.g. *Mycobacterium tuberculosis* infection.

B- Morphological types of inflammation

1- Catarrhal Inflammation

It is a surface inflammation associated with greatly increased secretion of clear mucus, e.g. common cold.

2- **Pseudomembranous Inflammation**

It is inflammatory response of mucosal surface (oral cavity, respiratory mucosa) to toxins or irritant gases. A membranous film forms on mucosal surface that consists of necrosed epithelium and fibrin, e.g. diphtheria.

3- Exudative Inflammation

Various types are based on the nature of inflammatory exudates:

a. *Serous inflammation:* There is excessive clear watery fluid with variable protein contents and no fibrin, e.g. blister formation in burns.

b. *Fibrinous inflammation:* The fibrin content of exudative fluid is high. The presence of solid fibrin leads to adhesion formation and tends to inhibit resolution, e.g. fibrinous effusion following pneumonitis

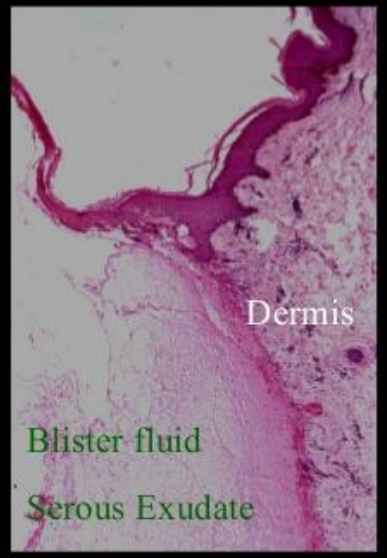
Catarrhal inflammation.

- Inflammation affects mucosa-lined surfaces with the outpouring of **watery mucus**

- Pseudomembranous inflammation: surface necrosis
  - Bacterial toxins damage mucosal lining, producing a membrane composed of necrotic tissue
    - Example — pseudomembranes associated with Corynebacterium diphtheriaeproduces a toxin causing pseudomembrane formation in the pharynx and trachea.

SEROUS Inflammation

- An effusion of thin fluid under acute inflammatory conditions from a surface (often mesothelial) is called serous inflammation.
  - Eg. Blisters of skin
  - Bullous pemphigoid



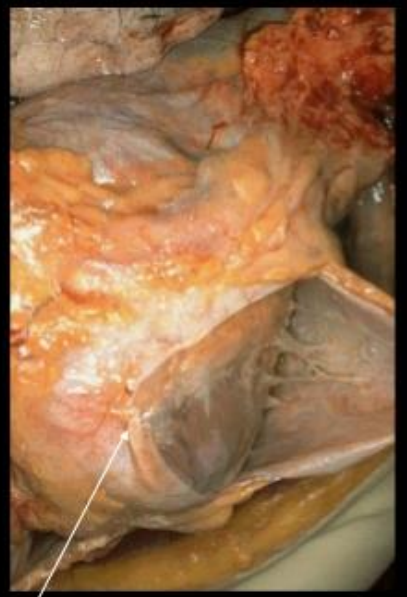
Suppurative Inflammation

Exuded yellowish fluid fluid in this opened pericardial cavity also contains a large number of acute inflammatory cells. So it is a purulent exudate

- **Suppurative inflammation (Purulent)** exudes pus, a mixture of neutrophils and necrotic debris.eg.pyogenic bacterial infection.

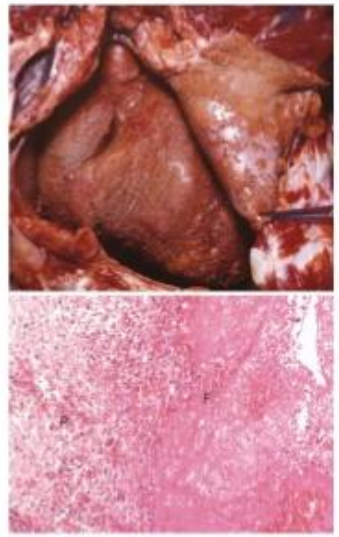
FIBRINOUS Inflammation

- **Fibrinous inflammation** consists of neutrophils admixed with fibrin (e.g., fibrinous pericarditis).
- The fibrin in this fluid can form a fibrinous exudate on the surfaces.
- **Bread & Butter appearance** Here, the pericardial cavity has been opened to reveal a fibrinous pericarditis with strands of stringy pale fibrin between visceral and parietal pericardium



Fibrinous inflammation

- Occurs as a consequence of more severe injuries, resulting in greater vascular permeability and the exudate is rich of fibrinogen⇒ converts to fibrin
- Location
  - Serous cavities
    - Pericarditis, pleuritis, peritonitis
  - Mucosa of respiratory tract
    - Diphtheria of the larynx
    - Lobar pneumonia –alveoli
  - Mucosa of gastrointestinal tract
- Histologically, the accumulated extravascular fibrin appears as an eosinophilic meshwork of threads
  - Cor villosum
  - Weigert staining– violet-blue reaction

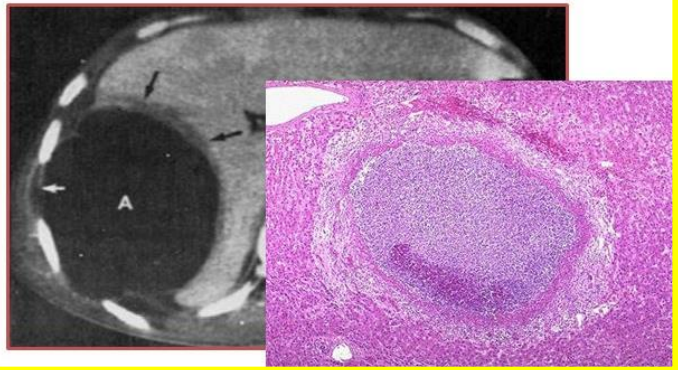


c. *Suppurative inflammation (abscess):* It is caused by infection with pyogenic bacteria. There is tissue necrosis and formation of purulent exudate. A cavity is formed that contains pus, e.g. boil, carbuncle.

d. *Hemorrhagic inflammation:* Due to severe inflammation, there is actual rupture of blood vessels leading to hemorrhage in the exudates, e.g. hemorrhagic pneumonia due to influenza.

However, overlap of various types of exudates is common, e.g. serohemorrhagic, mucopurulent

– **Abscesses : localized collections of purulent inflammatory tissue caused by suppuration buried in a tissue, an organ, or a confined space**



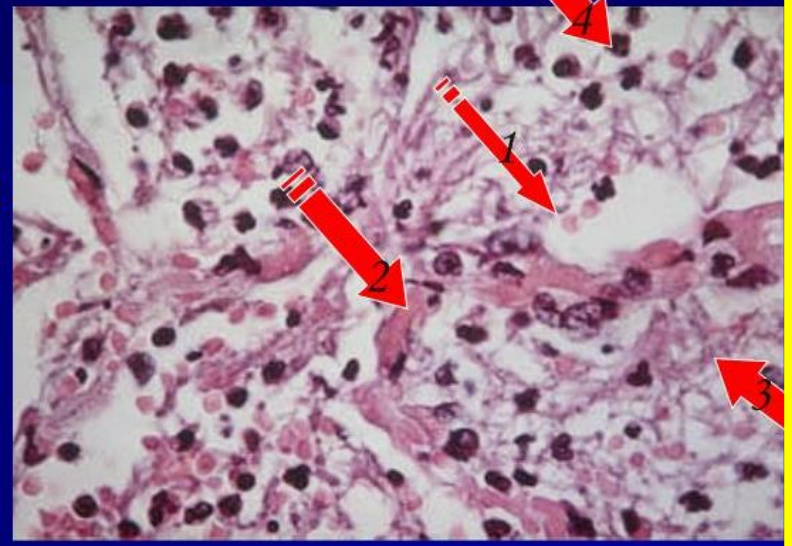
Hemorrhagic inflammation:

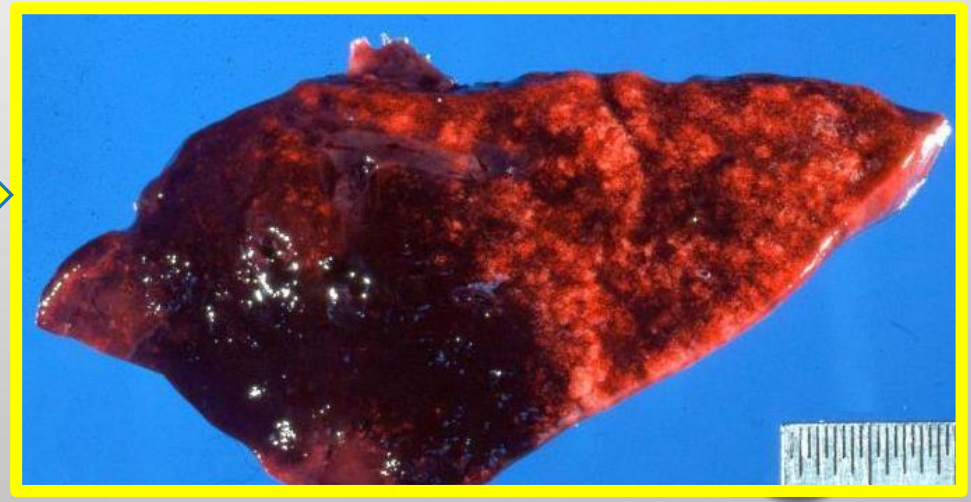
- Destruction of blood vessel walls resulting in leakage of a large number of red blood cells resulting in the red coloration of inflammatory exudate.

6.2 - Lung, fibrinous and hemorrhagic inflammation, pneumonia- High power

the inflammatory exudate consists of

1. Erythrocytes leaked out the permeable
2. and congested capillaries,
3. thin strands of fibrin derived from fibrinogen
4. leukocytes

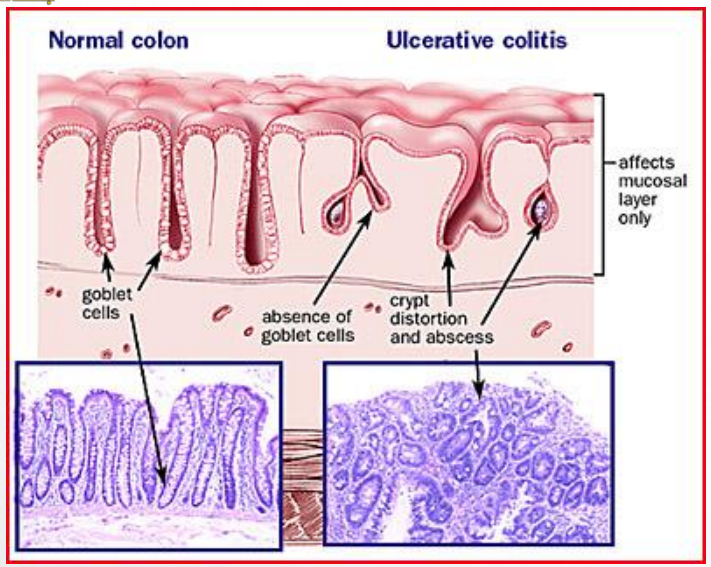


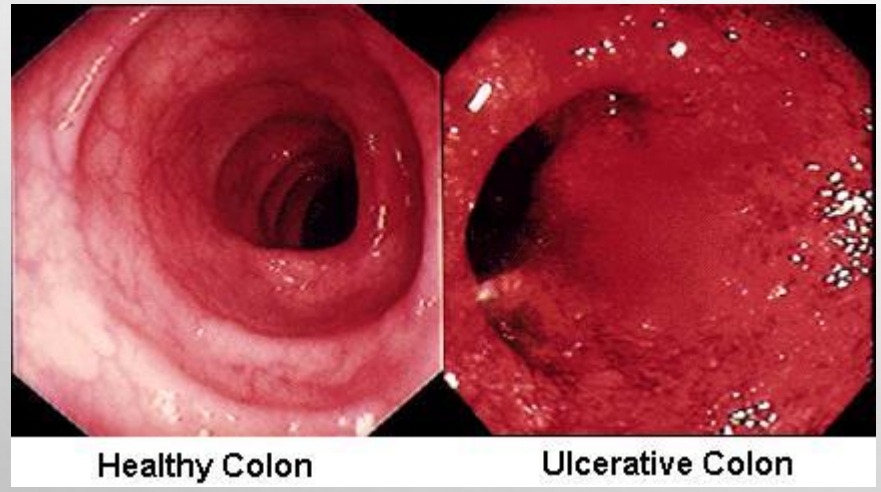


4- Ulceration

When surface epithelium of an organ or tissue is lost due to necrosis and replaced by inflammatory tissue. Common sites are skin, GIT. The ulcer can be *inflammatory* or *malignant*.

The inflammatory ulcer usually heals with treatment. However, if irritation (bacterial infection, trauma) continues, it leads to chronic and non-healing ulcer..





Ulcerative inflammation

- An **ulcer** is a local defect (or excavation), of the surface of an organ or tissue -necrotic tissue
- Ulceration can occur only when tissue necrosis and inflammation exist on or near a surface:
  - inflammatory necrosis of the mucosa of the mouth, stomach, intestines, or genitourinary tract;
  - tissue necrosis and subcutaneous inflammation of the lower extremities
- Peptic ulcer of the stomach, duodenum - acute and chronic inflammation coexist.
  - acute stage - intense polymorphonuclear infiltration and vascular dilation in the margins of the defect.
  - Chronic stage - the margins and base of the ulcer develop scarring with accumulation of lymphocytes, macrophages, and plasma cells.

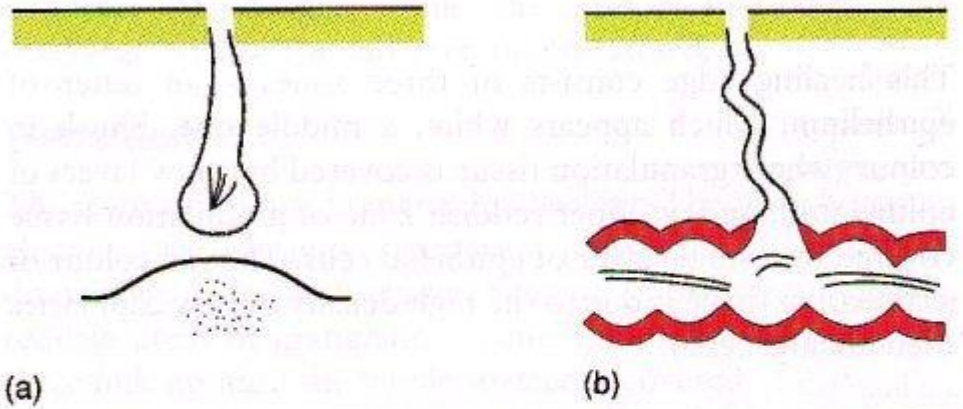


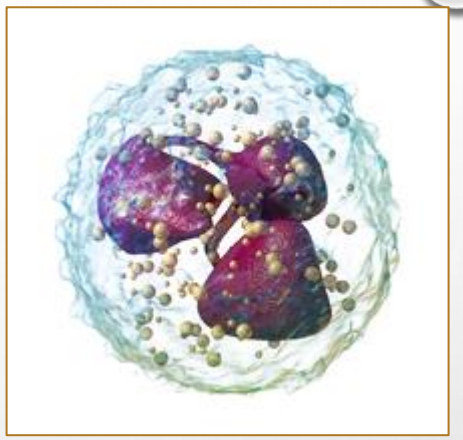
Fig. 12.18 (a) A sinus, and (b) a fistula. Both usually arise from a preceding abscess. (a) This shows that a sinus is a blind track, in this case a pilonidal sinus with its hairs; (b) this shows that a fistula is a track connecting two (epithelial) lined surfaces, in this case a colocutaneous fistula.

A **fistula** is an abnormal passageway or tube between two or more body parts that are not normally joined together. Fistulas can occur in the digestive, urinary and reproductive tracts, and in the circulatory system. Fistulas can be a **congenital** condition, meaning that they develop in utero, or they can develop in the body because of disease, infection, surgery, or injury.

THE INFLAMMATORY CELLS

Neutrophils

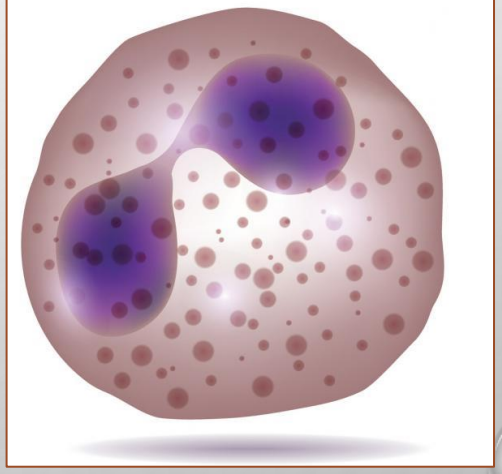
- 40-75% of circulating leukocytes.
- Their number increases during acute bacterial infections (Neutrophilia).
- Their functions are:
  - ☐ Phagocytosis of microorganisms.
  - ☐ Engulfment of non-microbial material.
  - ☐ Destruction of basement membrane of small blood vessels and glomeruli (harmful effect).



Eosinophils

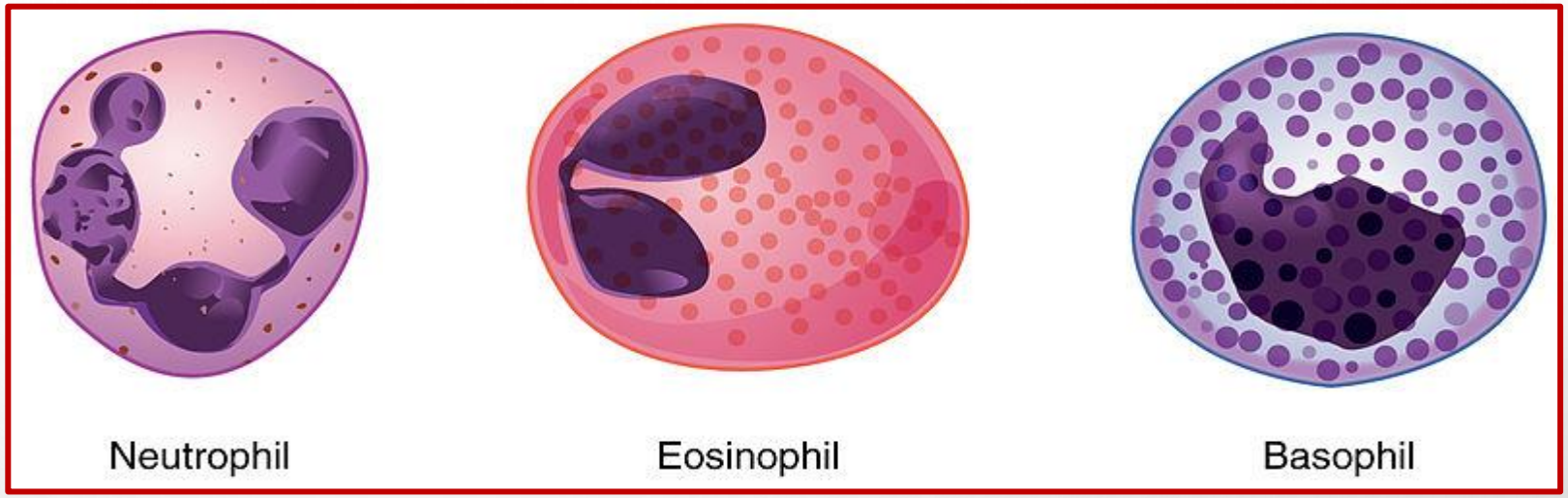
- 6% of circulating leukocytes.
- Increased number of eosinophils (eosinophilia) is seen in:
  - ☐ Allergic conditions
  - ☐ Skin diseases
  - ☐ Parasitic infections

EOSINOPHIL



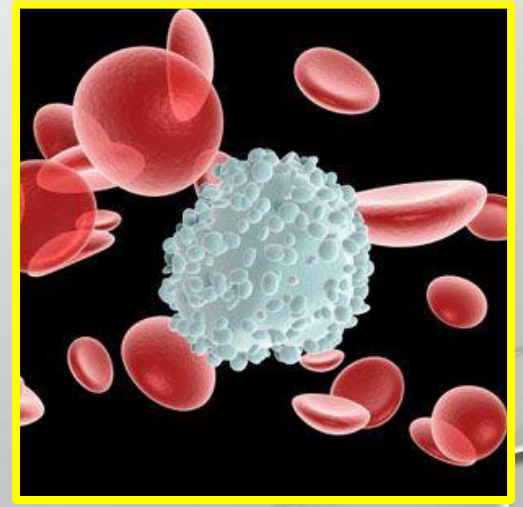
Basophils

- 1% of circulating leukocytes.
- Role in immediate and delayed type of hypersensitivity



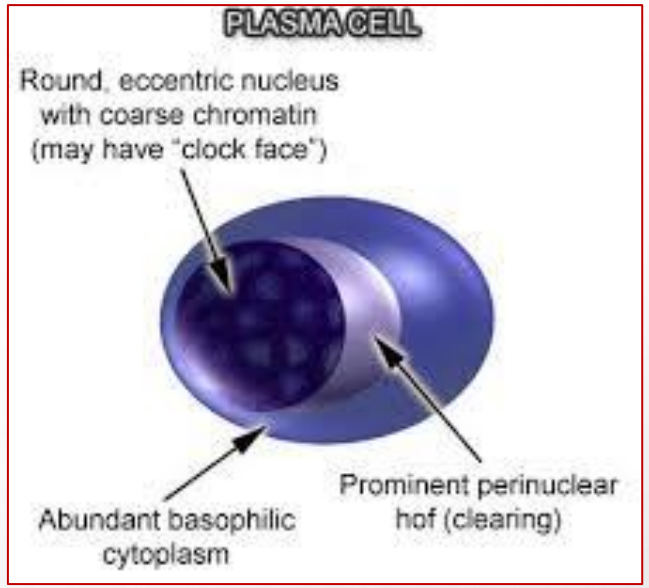
Lymphocytes

- 20-40% of circulating leukocytes.
- Also present in spleen and lymphoid tissues.
- B-lymphocytes help in antibody formation
- T-lymphocytes play role in cell mediated immunity.
- Their level increases in blood in chronic infection like tuberculosis (Lymphocytosis).
- In tissues, lymphocytes are dominant cells in chronic inflammation.



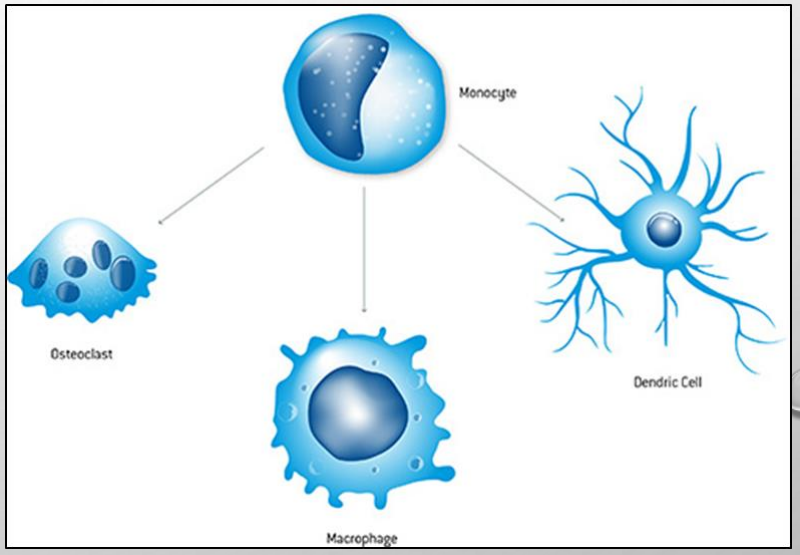
Plasma Cells

- Normally not seen in peripheral blood.
- They develop from lymphocytes and are rich in ©-globulin.
- Their number is increased in:
  - ☐ Multiple myeloma
  - ☐ Hypersensitivity states
  - ☐ Chronic infections like tuberculosis



Macrophages

- These are derived from reticulo-endothelial system.
- Their functions in inflammation are:
  - ☐ Phagocytosis of foreign particles.
  - ☐ Release of enzymes (Proteases) that degrade collagen material.
  - ☐ Release of chemotactic agents.
  - ☐ Activation of fibrinolytic system.
  - ☐ Release of coagulation factors.



Giant Cells

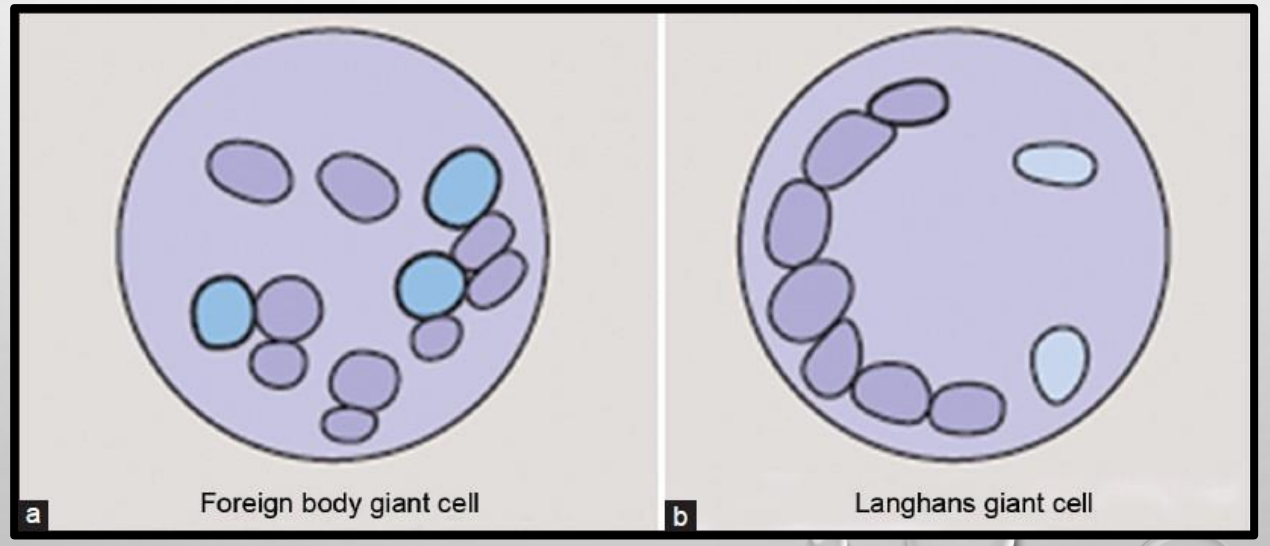
When macrophages fail to remove foreign particles, they fuse together to form multinucleated giant cells, e.g.

Foreign Body Giant Cells

These are cells containing multiple uniform nuclei scattered throughout the cytoplasm. These are seen in tuberculosis, chronic infections.

Langhans' Giant Cells

The nuclei are arranged at periphery to form a 'horseshoe' appearance. These are seen in tuberculosis, sarcoidosis.



OTORHINOLARYNGOLOGY (ENT) SURGERY

PROF. DR. ALI AL OKAILI

Otorhinolaryngology:: more commonly known as ear, nose and throat (ENT) surgery, deals with conditions affecting the head and neck, upper aero-digestive tract and organs of special sense.

Techniques of examination in ENT

ENT practitioners can see most of the organs and areas of interest. Even areas that are not easily or directly visualized, such as the larynx and paranasal sinuses, can be examined indirectly using specialized instrumentation such as mirrors and endoscopes.

Traditionally, the pharynx and larynx have been examined using mirrors and headlight illumination, but recently fibro-optic and rigid endoscopes have superseded these techniques.

Nasal endoscopes

A- Emergency management of upper airway obstruction::

Perhaps the most challenging clinical situation is a patient with sudden, severe airway obstruction. Although this scenario is fortunately rare, it is important that clinicians operating in the oral cavity and pharynx have an awareness of the possible causes of acute airway compromise and have the necessary equipment and skill to deal with it.

The laryngeal airway is a narrow and functionally complex system whose most important role is to separate and protect the airway from the digestive tract.

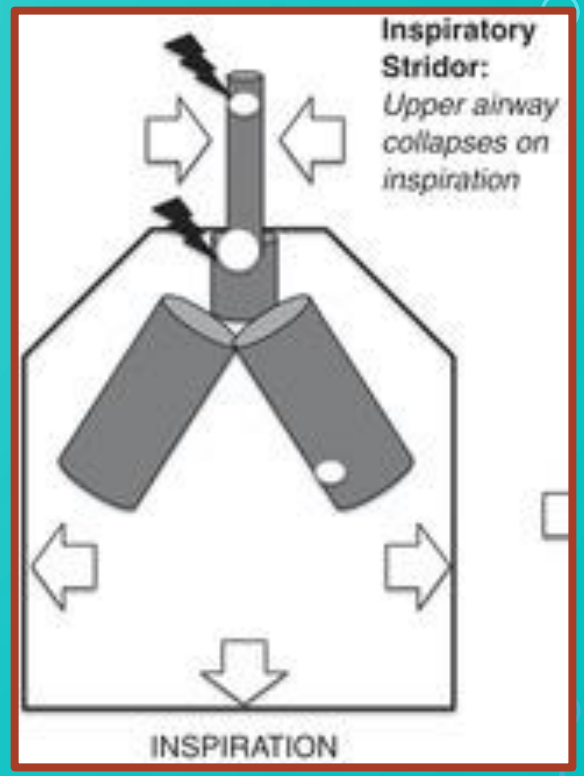
The diameter of the space between the vocal cords is such that even small foreign bodies can cause severe and life-threatening airway obstruction. This risk of airway obstruction is greater in children due to the relatively small dimensions of the juvenile larynx and the natural tendency for children to put toys, beads, pen-lids, etc. into their mouths.

Acute airway obstruction::

Sudden complete laryngeal obstruction is easily diagnosed, as severe respiratory distress is rapidly followed by cyanosis and collapse. More often, however, laryngeal obstruction is incomplete and is signified by a less dramatic increase in respiratory effort, difficulty speaking and stridor.

Stridor (صرير) is a coarse inspiratory noise produced as the patient attempts to inhale forcibly through a narrowing at the level of the larynx.

Stridor is easily distinguished from stertor(شخير) which is a rattling gurgling noise produced by soft tissue obstruction or retained secretions at the level of the oropharynx



Immediate management of laryngeal obstruction::

Emergency management depends on the degree of obstruction and the level of expertise and equipment available to deal with it.

Of these techniques, only the Heimlich maneuver and laryngotomy are appropriate to non-specialist settings.

Endotracheal intubation and tracheostomy require advanced skills and instrumentation.

1- Heimlich maneuver::

The Heimlich maneuver is a technique for relieving airway obstruction caused by an impacted foreign body.

If the patient can cough or speak, then the airway obstruction is incomplete and the Heimlich maneuver is not appropriate.

Stand behind the patient with the arms encircling the patient's abdomen and crossed at the level of the patient's umbilicus. A forcible thrust upwards and backwards is used to compress the patient's abdomen in an attempt to push the diaphragm upwards and expel the lodged foreign bod

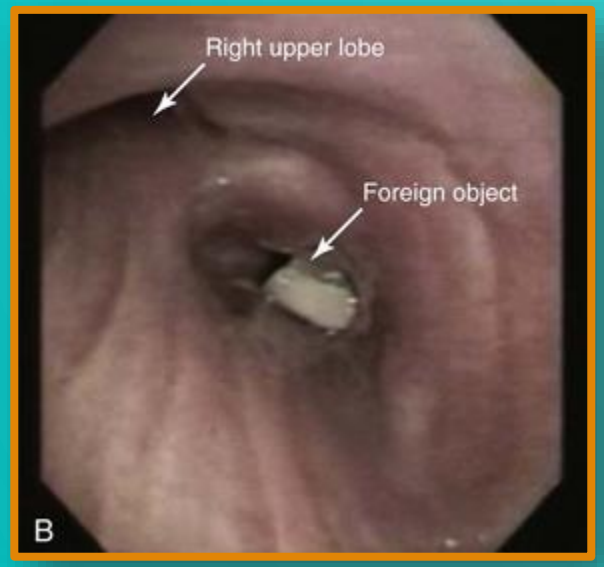
2- Laryngotomy::

An emergency surgical opening into the airway below the level of the vocal cords (most likely level of obstructing lesion) has to be created. The cricothyroid membrane provides an anatomical window for gaining access to the airway.

Anesthesia may not be appropriate as, by the time a decision is made to perform a laryngotomy, the patient is usually semiconscious.

For laryngotomy, (1) full extension of the neck is essential. If the subject is a child, lay the patient across the knee of an assistant with the neck hyperextended and firmly palpate the midline structures of the neck.

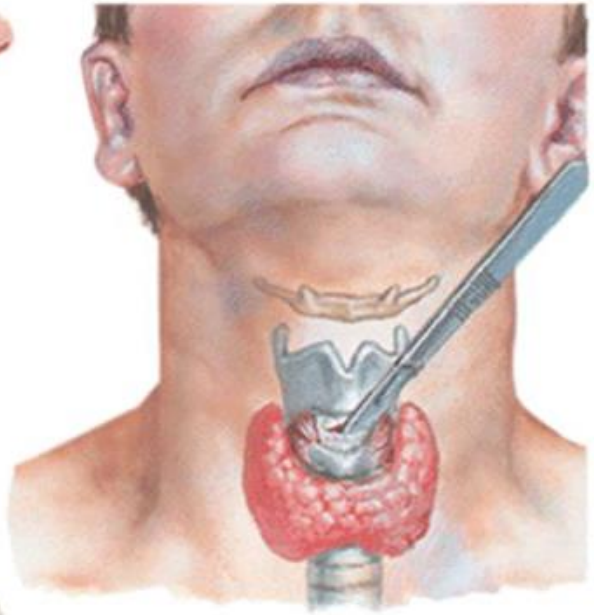
- Starting from the prominence of the thyroid cartilage, run a finger down the midline until the prominent ring of the cricoid cartilage is palpated. Above the cricoid ring and below the lower border of the thyroid cartilage lies the cricothyroid membrane.



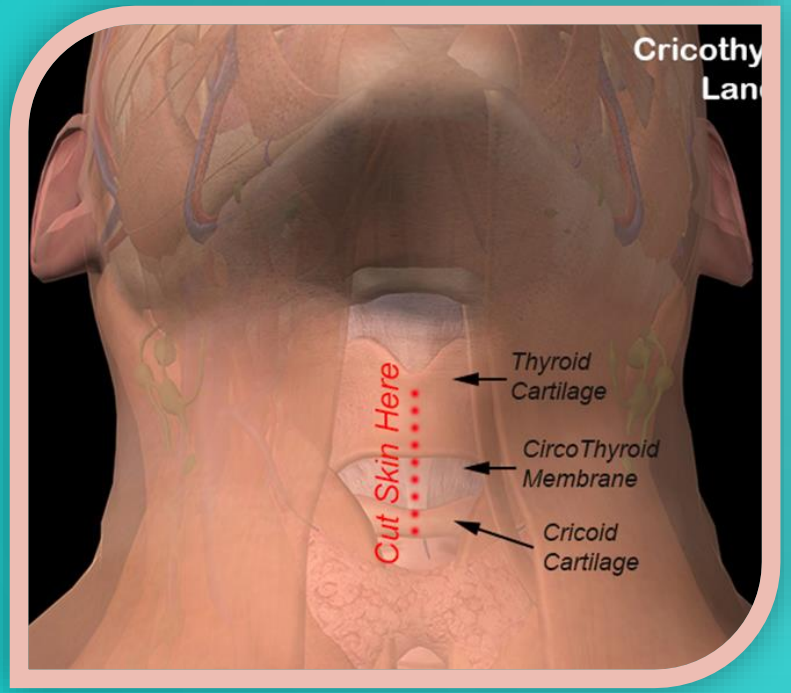
Maintenance of Airway Patency

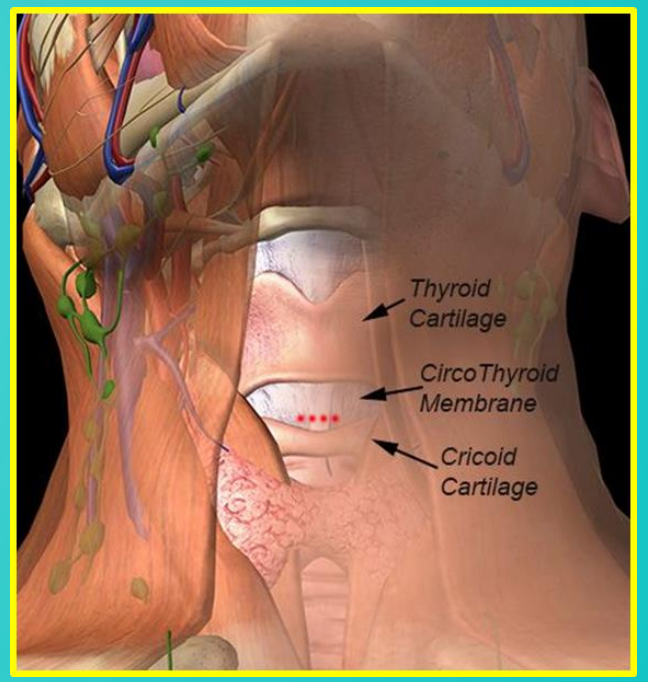
Cricothyroid "Stab" or Cricothyrotomy

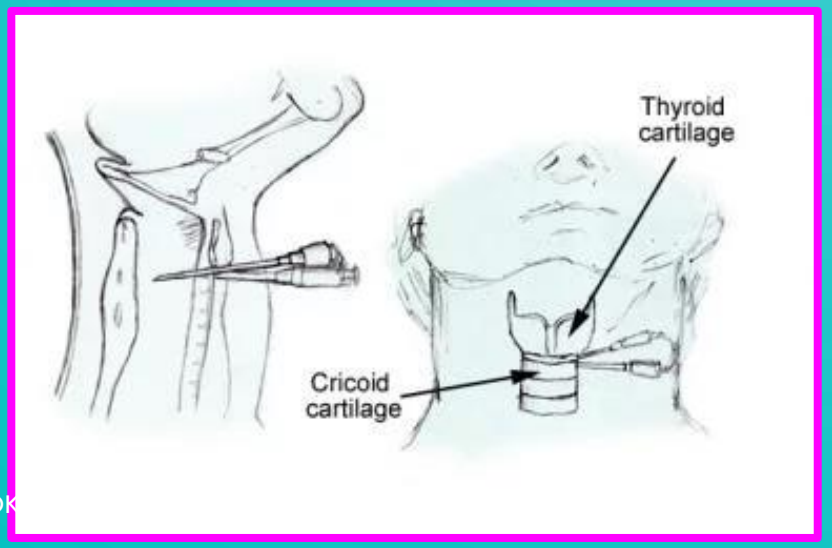
Cricothyroid membrane identified by palpating indentation between thyroid and cricoid cartilages



Skin and cricothyroid membrane incised, with care not to injure larynx or perforate esophagus. Patency then maintained by inserting a tube or, if not available, distending object







Cricothyrotomy kit

- With the neck sufficiently extended, there are no intervening structures between the cricothyroid membrane and the skin. As a first step,(2) a wide-bore needle or cannula can be inserted through the membrane into the airway and this may be sufficient to temporarily relieve the obstruction. A horizontal stab incision is then made using a knife or scalpel and, without withdrawing, the blade is turned through 90° to open the incision. Once the cricothyrotomy has been performed it can be held open using a small tube and, in some extreme situations, the outer cylinder of a pen has been used with success!!!

Specialized cricothyrotomy sets, which include a small-bore endotracheal tube and a specially designed scalpel, are commercially available.

General dental practitioners and others carrying out procedures in the oropharynx in non-hospital settings would be well advised to purchase a cricothyrotomy kit and keep a small emergency tray set up in their surgery to deal with such an unlikely emergency.

Benign conditions of the pharynx::

1- Nasopharynx

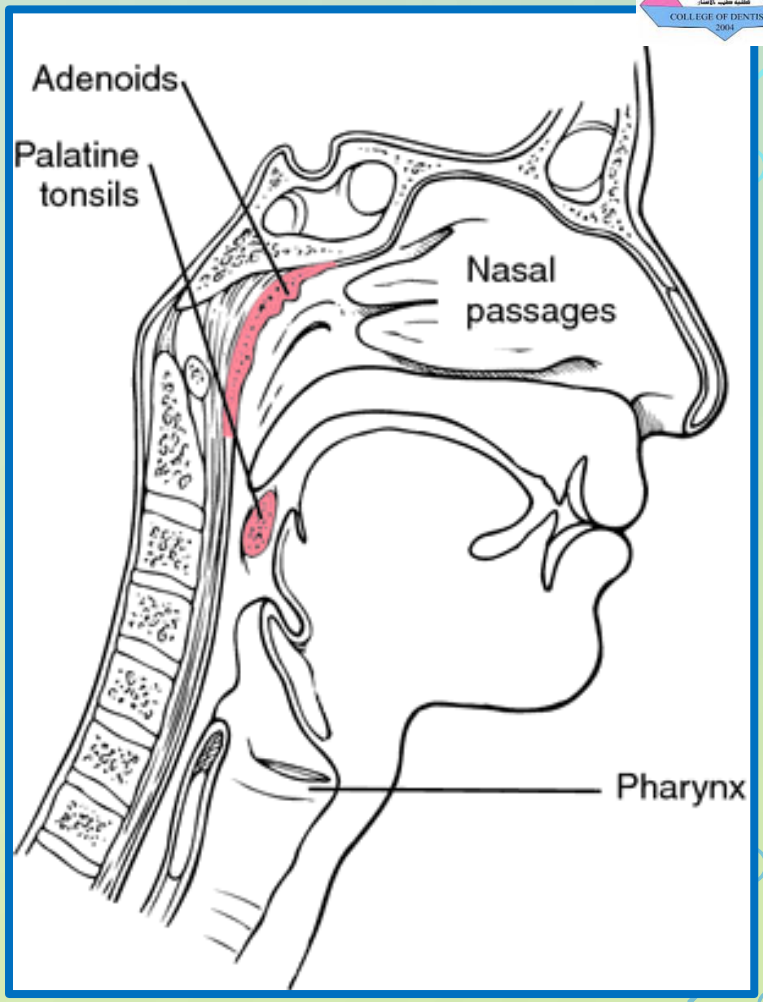
The nasopharynx is often involved in upper respiratory tract infections, and the (a) common cold is usually associated with nasopharyngitis. Symptoms of nasopharyngitis consist of discomfort and pain associated with swelling of the lymphoid tissue, which leads to nasal obstruction and seromucinous secretion more commonly referred to as catarrh.

Nasopharyngitis is usually a self-limiting condition but, in some patients, chronic low-grade inflammation can occur, leading to nasal obstruction and chronic catarrh.

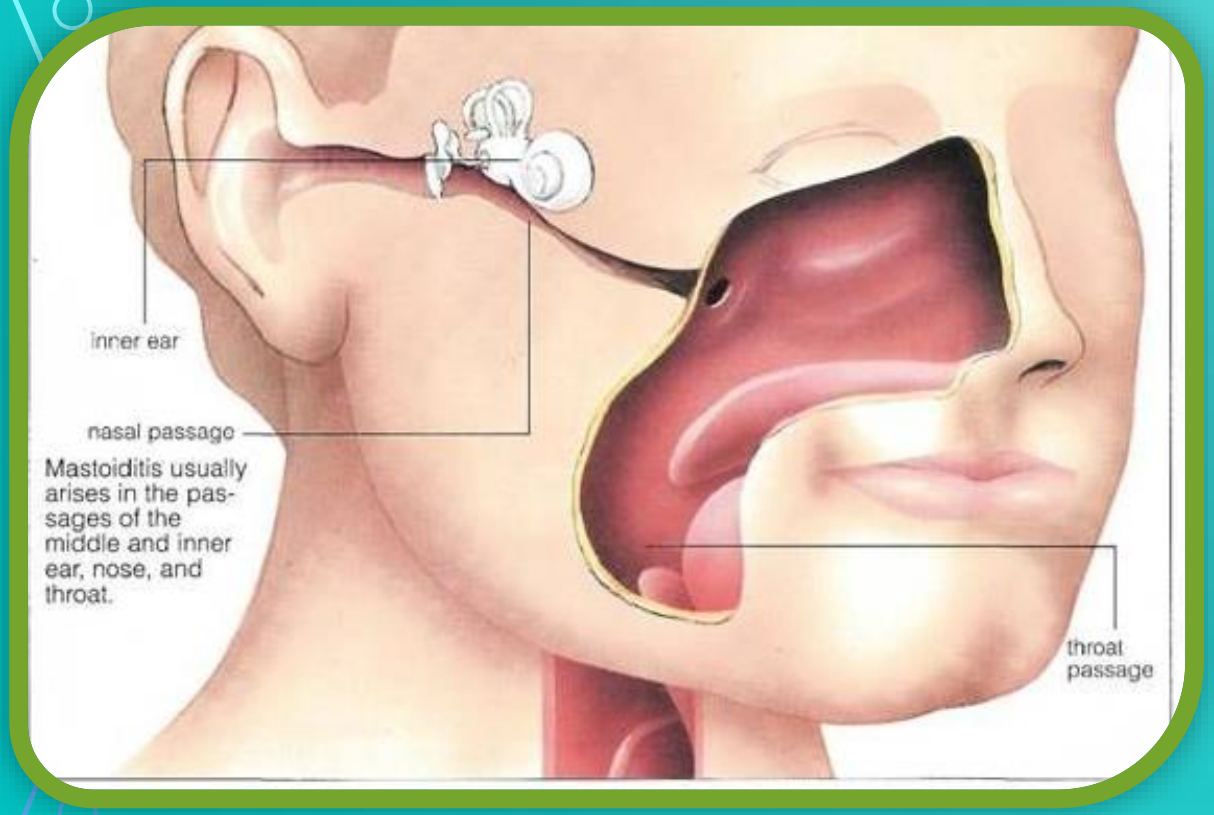
In children, the (b) nasopharyngeal tonsil, or adenoid, can occupy almost all of the nasopharyngeal space. Acute respiratory infections can cause acute adenoiditis with mucopurulent postnasal discharge, nasal obstruction and fever. Such episodes of acute infective adenoiditis are common in childhood and may lead to chronic adenoidal hypertrophy, mouth breathing, nasal obstruction and chronic mucopurulent postnasal discharge.

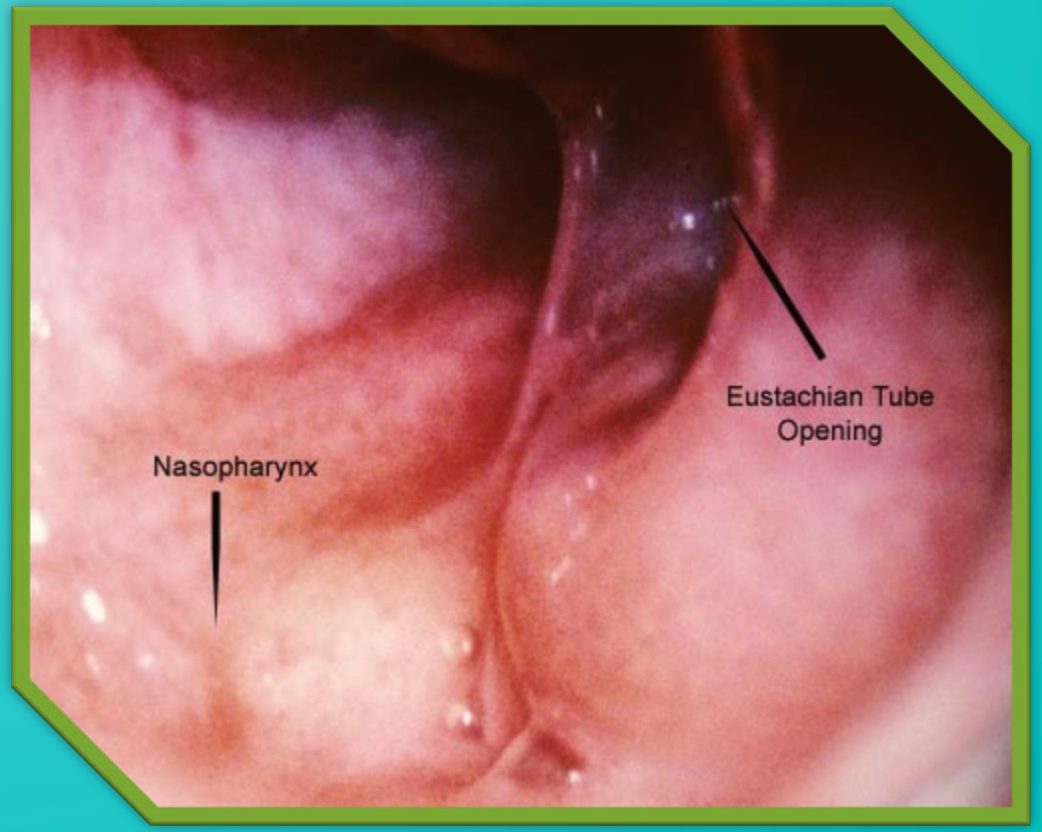
The position of the Eustachian tubes to hypertrophied and inflamed adenoids is thought to be important in the causation of middle-ear effusions (outflow).

The adenoid may therefore be important in the most common cause of hearing impairment in childhood – otitis media with effusion, more frequently known as 'glue ear'.



position of the Eustachian tube:





Nasopharyngeal tonsil, or adenoid

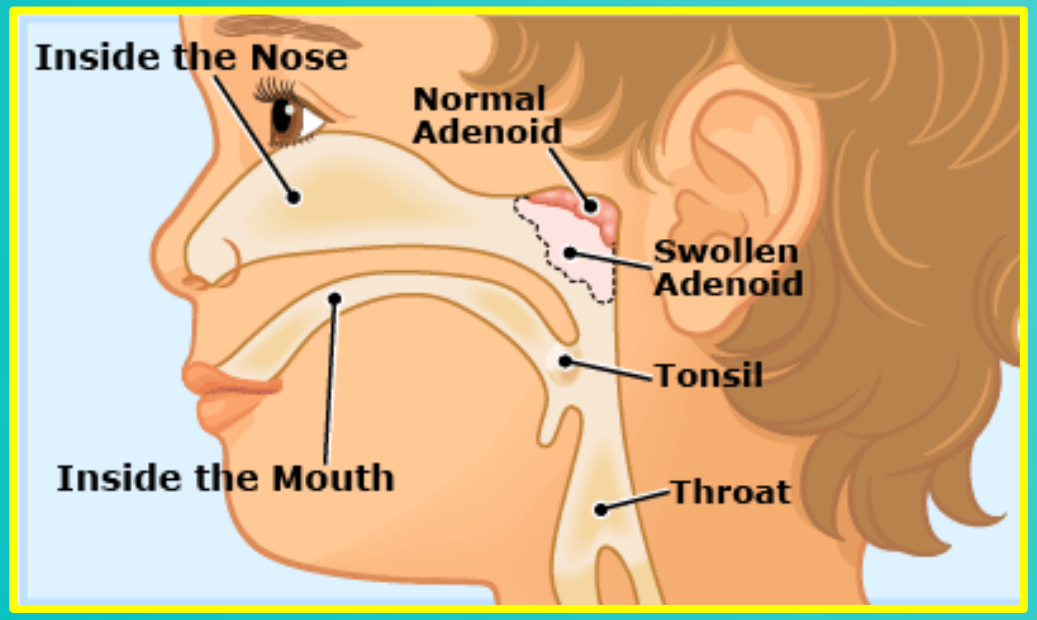
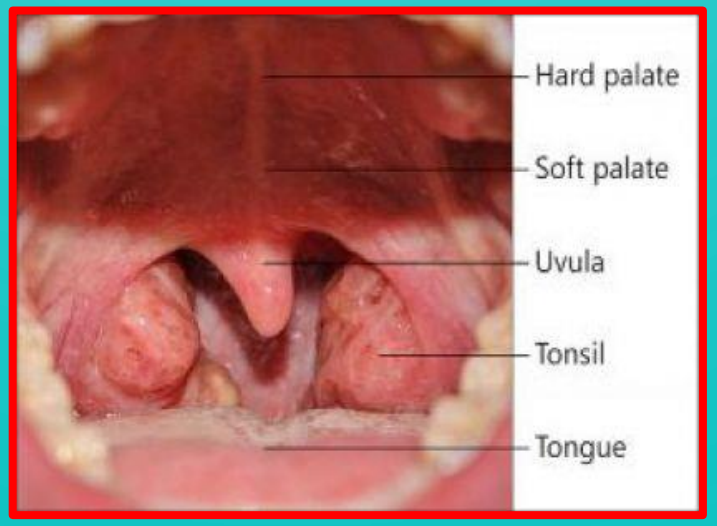


Figure 1A: Patient before

Figure 1B: Patient after



2- Oropharynx::

Acute infective oropharyngitis presents as a sore throat, pain on swallowing and fever. The cause is usually viral and the condition is self-limiting, responding to symptomatic measures such as paracetamol, saline gargles and a high fluid intake. Throat swabs seldom yield any significant growth. Severe, non-resolving pharyngitis should raise the possibility of glandular fever.

Often the cause cannot be confirmed, but there appears to be an association with nasal disease. The treatment of chronic pharyngitis involves identification of the cause, treatment of any nasal disease, increased fluid intake and avoidance of antibiotics.

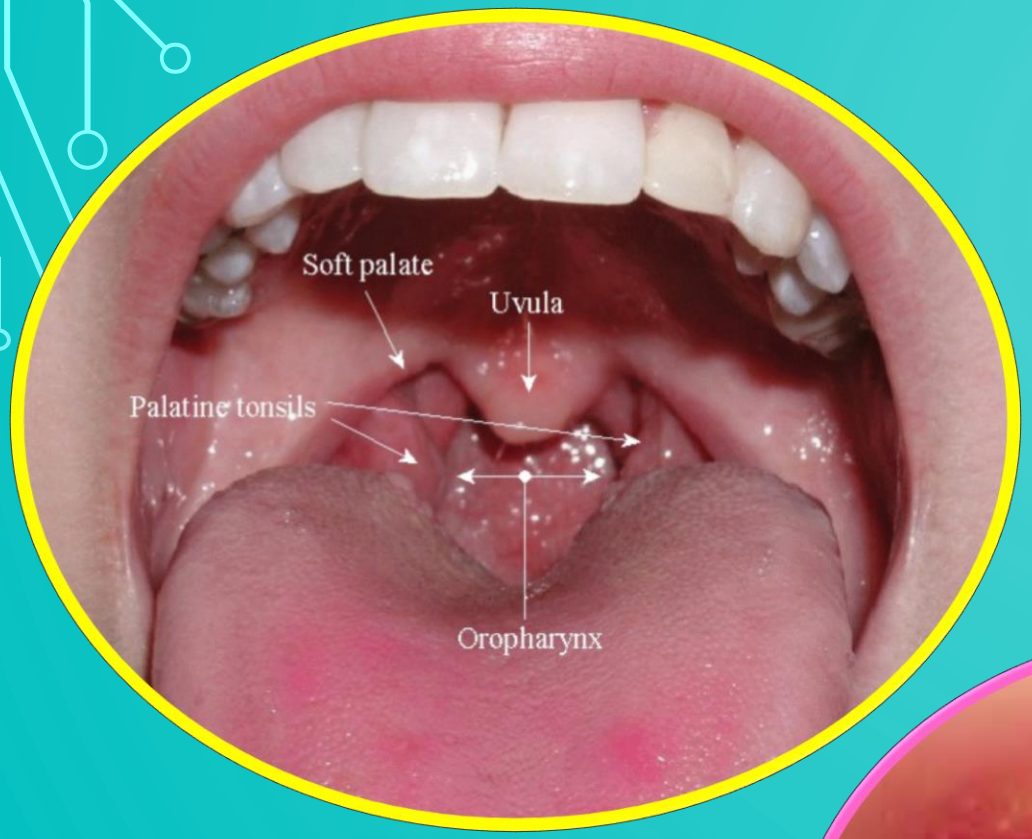
Tonsillitis

Acute tonsillitis is a common cause of a sore throat. Although the initial organism may be viral, superinfection with Streptococcus usually ensues. Acute tonsillitis can also be a complication of glandular fever. The symptoms are sore throat, pain on swallowing (odynophagia), systemic malaise, headache and fever. Because of pain on swallowing, patients tend to avoid eating and drinking and, therefore, can become

- Diagnosis is usually obvious with trismus, tonsillar hypertrophy, and pus visible in the tonsillar crypts; there will be associated cervical adenitis.

Treatment involves high fluid intake, analgesics and penicillin. In severe cases the patient may be unable to swallow oral antibiotics, thus, a short course of intravenous benzyl penicillin may be indicated.

Tonsillitis



Tonsillectomy::

Tonsillectomy used to be an extremely common operation and was often used incorrectly as a treatment for nonspecific sore throat (pharyngitis). Tonsillectomy is carried out by dissecting the tonsils from their fossae and ligating any bleeding points encountered.

The most frequent major complication is postoperative hemorrhage, which occurs in approximately 2% of cases.

Minor secondary tonsillar hemorrhage can also occur up to 2 weeks after the operation and is usually managed conservatively using antibiotics and saline gargles.

Indicatons for tonsillectomy

Current indications for tonsillectomy include: a clear history that the sore throats are due to tonsillitis on five or more occasions per year over a period of at least 1 year, or evidence that these episodes of sore throat are disabling and preventing normal function at school or work.

Patients often complain of white or yellow lesions on their tonsils. These are foul tasting and may be associated with halitosis.

Examination shows numerous white granules occupying the tonsillar crypts; these are often diagnosed incorrectly as food debris.

Indications

A. Absolute

1. *Recurrent infections of throat*
2. *Peritonsillar abscess*
3. Tonsillitis causing febrile seizures
4. Hypertrophy of tonsils causing obstruction
5. *Suspicion of malignancy*

B. Relative

1. Diphtheria carriers,
2. Streptococcal carriers
3. Chronic tonsillitis with bad taste or halitosis
4. Recurrent streptococcal tonsillitis in a patient with valvular heart disease

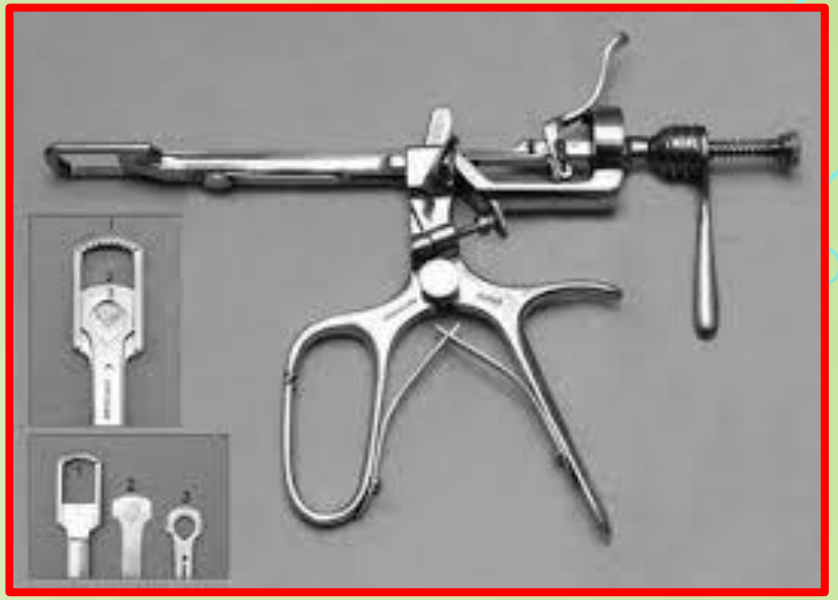
C. As a Part of Another Operation

1. Palatopharyngoplasty
2. Glossopharyngeal neurectomy.
3. Removal of styloid process.

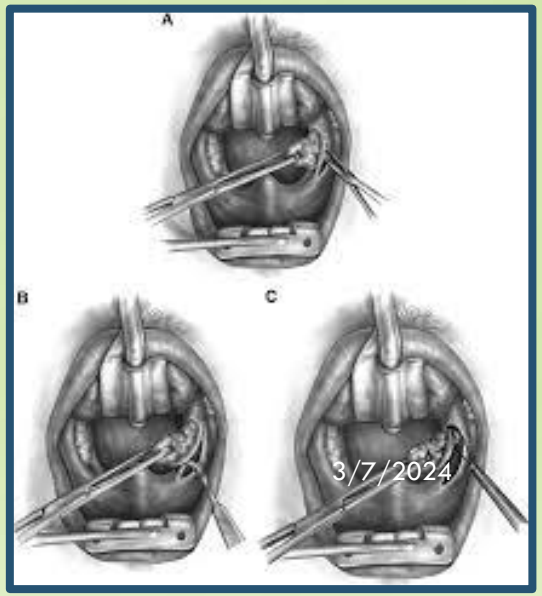
- In dissection, an incision is made in the mucosa of the anterior fold immediately in front of the tonsil; the gland is then freed by blunt dissection until it remains attached only by its pedicle of vessels near its lower pole. This pedicle is then crushed and divided by means of a wire snare (trap).

- In the second method, the guillotine is applied so that the tonsil bulges through the ring in the instrument. The tonsil is then removed by closing the blade of the guillotine.
Unless there have been repeated infections, the superior constrictor lies separated from the palatine tonsil and its capsule by loose areolar tissue which prevents the pharyngeal wall being dragged into danger during tonsillectomy.

- **Similarly, the internal carotid artery, although only 1in (2.5cm) behind the tonsil, is never injured in this operation since it lies safely freed from the pharynx by fatty tissue around the carotid sheath.**



guillotine



Tonsillectomy can also be used in the surgical treatment of snoring: Significant debilitating snoring, which can lead to extreme social distress, is related to obesity and, in some cases, tonsillar hypertrophy. Most surgical procedures for snoring involve modification and stiffening of the soft palate. The uvulo-palatopharyngo plasty (UPPP) operation involves palatal shortening and tonsillectomy.

Nose

1– The skin of the external nose and its surrounds contains many sebaceous glands and hair follicles which may become blocked and infected.

The significance of this fact is that the facial veins, which may become secondarily infected, communicate directly with the ophthalmic veins and hence with the cavernous sinus. For this reason, this zone is often known as the 'danger area of the face'.

2– The extensive relations of the nasal cavity are important in the spread of infection. Observe that it is in direct continuity with (i) the anterior cranial fossa (via the cribriform plate of the ethmoid bone); (ii) the nasopharynx and, through the pharyngotympanic tube, the middle ear; (iii) the paranasal air sinuses; (iv) the lacrimal apparatus and conjunctiva.

3– The septum is frequently deviated to one or other side, interfering both with inspiration and with drainage of the nose and accessory sinuses

1- Foreign body in the nose:

Common in children and common in the right nasal cavity.

Mode of entry:

1. Anterior nares(majority) **common in children and mentally retarded adults.**
2. **Posterior choana. During vomiting, coughing or regurgitation, or palatal insufficiency.**
3. **penetrating wound. Bullet or shell injuries.**

Clinical features:

1. **Unilateral nasal obstruction.**
2. **Fetid purulent nasal discharge.**
3. **Vestibulitis.(excoriation around the nostril)**
4. **Anterior rhino scope.**

Treatment of foreign body in the nose.

*Removal of the F.B.; A: With local anesthesia.

In the case of a cooperative child.*proper position of the child, *use of local decongestant and anesthesia.

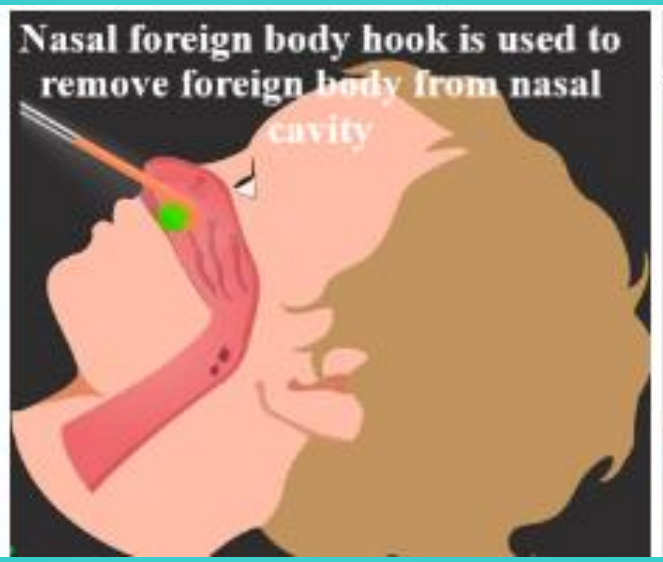
Removed by

A _ grasping forceps to pick up a paper or sponge.

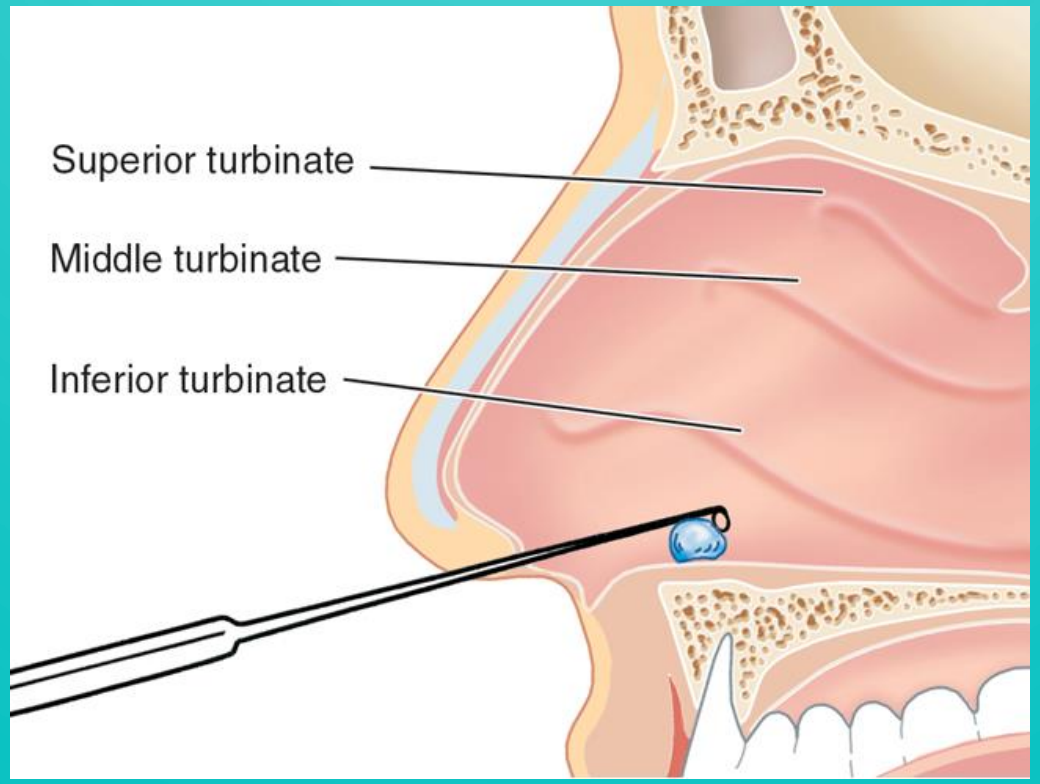
B --curved blunt hook for beas, bean, gravels. button. go posterior to the Foreign body and pull it forward.

(Avoid pushing the foreign body towards the nasopharynx to avoid inhalation of the foreign body.


Foreign body in
right nasal cavity


Nasal foreign body hook is used to
remove foreign body from nasal
cavity


Foreign body
removed


Superior turbinate
Middle turbinate
Inferior turbinate

Removal of F.B. under General anesthesia::

Indications

1. Refractory child.
2. Troublesome bleeding if a foreign body is embedded in granulation tissue
3. posteriorly placed F.B, like a bead with risk of a push to the nasopharynx & inhalation.
4. if the F.B is strongly suspected, but cannot be seen. Do an examination under anesthesia. The foreign body is either removed via anterior nares, or pushed it to the nasopharynx to the oropharynx and removed.))

2- Nasal trauma

I: Fracture of nasal bone:

*Is the most common facial fracture in humans.

*It is more common in Caucasians than Asians and Africans because is more prominent in Caucasians.

* Males more than females.

*Adults more than children.

The causes:

It is due to a blow to the front or side of the nose, during

1. Personal assault. Commonest in young adults (15-30 years).

2. **Sporting**. Like football, and rugby.

3. **Personal accidents**. fall in the home. common in the elderly.

4- accidentsRoad traffic

Clinical features of fractured nasal bones:

1.External deformities:

*External swelling, which may be severe that obscures the bony deformity.

*Deformity of the nose. (Saddle nose, Deviated nose.)

*Black eye. (periorbital and subconjunctival ecchymosis(hemorrhage)

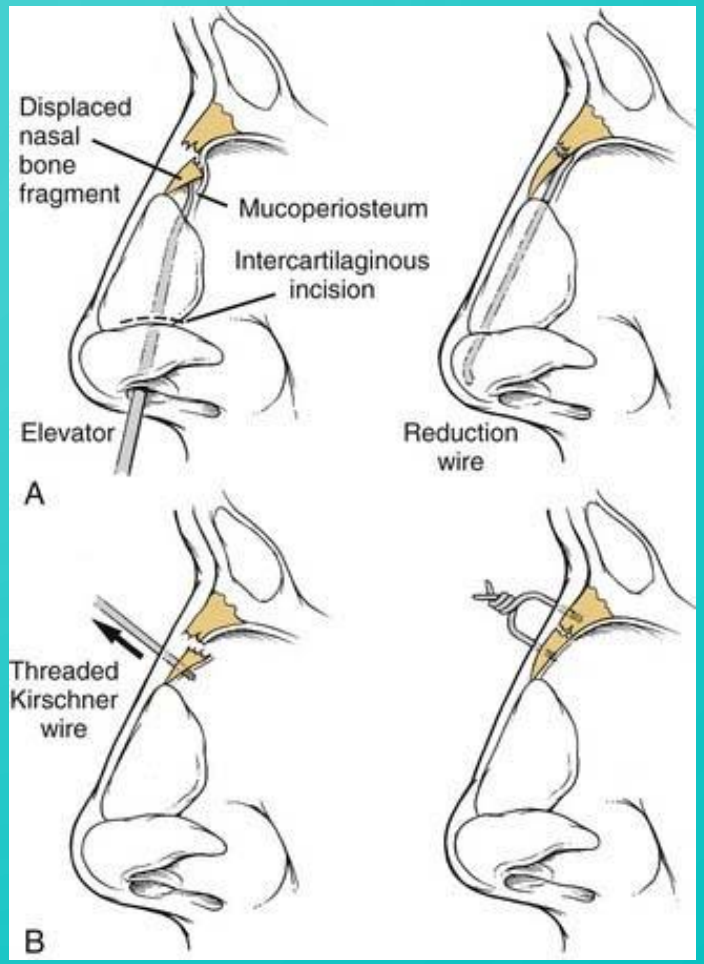
• 2. Epistaxis: Due to mucosal laceration usually simple and stop without packing.

• 3. Nasal obstruction: due to. a. Nasal congestion and edema. b. Septal deviation. c. Septal hematoma, and septal abscess. d. Nasal valve obstruction:

4.Pain :Usually not severe. but there is localized tenderness.

5. Palpation; Elicit bony cripitus with tenderness.


Direction of
nasal
displacement
A


Displaced
nasal
bone
fragment
Mucoperiosteum
Intercartilaginous
incision
Elevator
Reduction
wire
A
Threaded
Kirschner
wire
B

3- Acute sinusitis:

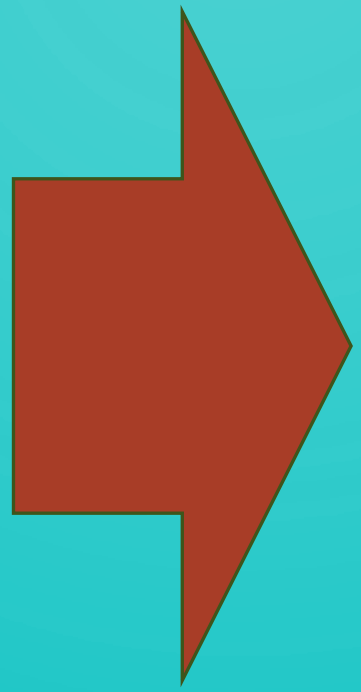
Commonly follow:

1. Cold
2. Dental extraction or infection
3. Trauma or operation
4. Allergy
5. Swimming

Predisposing factors:

1. Septal deviation
2. Nasal polyp sis
3. Enlarged adenoid
4. FB

Signs:
- Copious nasal discharge
- Post nasal drip
- Localize tenderness

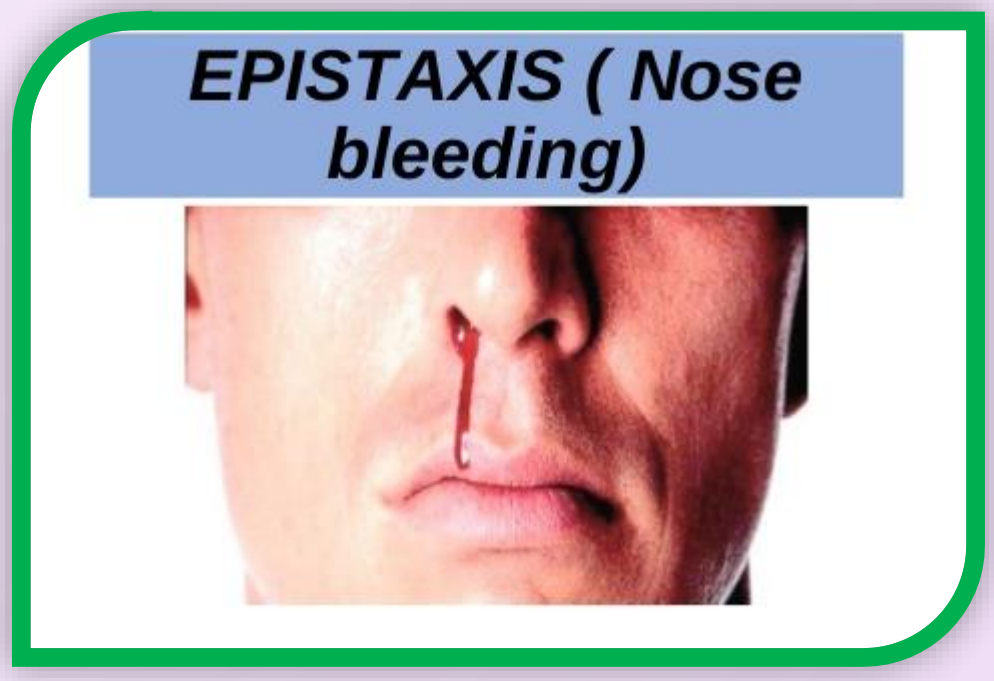


Treatment:
- Analgesia
- AB ❼ oral OR systemic
- Local decongestant.

4- Epistaxis::

Epistaxis is defined as spontaneous bleeding from the nasal cavity. It is an extremely common condition and most people will at some point in their life suffer from a nosebleed.

The range of severity is vast, from the mild self-limiting nosebleed experienced by most people, to severe torrential arterial hemorrhage that carries a significant mortality and morbidity. Epistaxis can be classified into two main groups: childhood and adult.



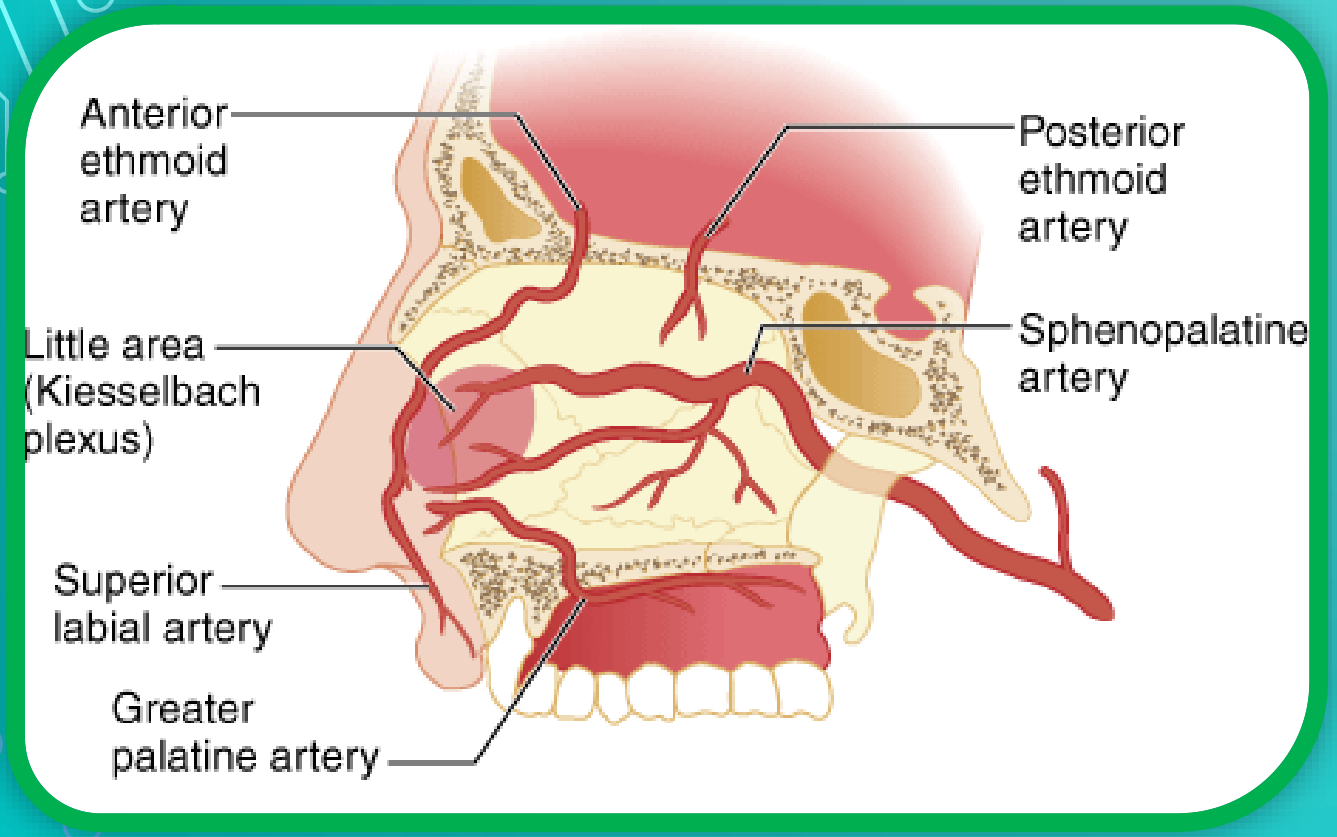
A- Childhood epistaxis::

Childhood epistaxis is common from age four…. It is characteristically minor but none the less alarming.

Nosebleeds occur sporadically, with a predilection for nocturnal bleeding. The source of the bleeding is usually on the anterior nasal septum at a rich vascular plexus known as Little's area.

The management of childhood epistaxis includes (a) pinching the nostrils over the soft, lower lateral cartilages, which produces direct pressure over Little's area.

Once bleeding has stopped, (b) some antibiotic ointment can be applied to the anterior nares to reduce any associated vestibulitis. Cutting the child's fingernails can also help. Persistent or recurrent nosebleeds in children should be referred for specialist opinion, which will usually lead to the offending blood vessel being identified and cauterized.


Anterior ethmoid artery
Posterior ethmoid artery
Little area (Kiesselbach plexus)
Sphenopalatine artery
Superior labial artery
Greater palatine artery


Left Little's Area

B- Adult epistaxis::

Adult epistaxis can be a potentially life-threatening condition, which has a peak age of onset of 60 years.

This type of epistaxis is characterized by sudden unilateral severe arterial bleeding. Bleeding in adults often comes from arterial branches of the sphenopalatine artery in the posterior reaches of the nasal cavity.

This has led to the term 'posterior epistaxis' being used. Not surprisingly, this condition does not respond to direct digital pressure. The management of a severe epistaxis relies on resuscitation of the patient followed by attempts to identify the source of the bleeding.

Nasal speculum

The nose is examined using a headlight, nasal speculum and suction. It is often difficult to identify the bleeding point because of its posterior position. If the source cannot be found, otolaryngologists use endoscopes to examine the posterior nasal cavity and identify the bleeding vessel, which can then be cauterized under direct endoscopic vision.

Posterior epistaxis is usually managed by some form of tamponade, using either specially designed balloon catheters or nasal packing.

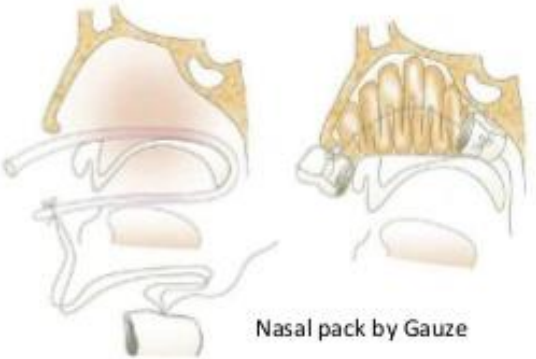
Admission to hospital is required and a search for etiological factors should be undertaken (aspirin use, alcohol excess, thrombocytopenia).

Unlike childhood epistaxis, which is recurrent, adult epistaxis tends to be characterized by a single severe episode of bleeding.

balloon catheters

Posterior Nasal Packing

- For posterior nasal bleed
- Can be carried through different instrument
  - Gauze
  - Foley's Catheterization
  - Nasal balloon



Nasal pack by Gauze

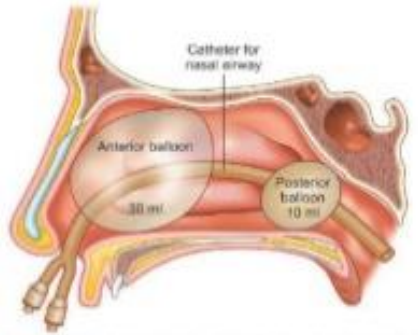
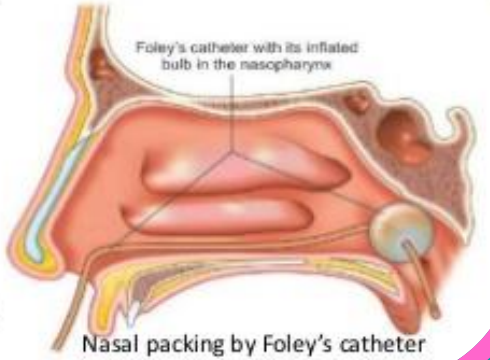


Fig. 11: Epistaxis balloon. Smaller (10 ml) posterior balloon and bigger (30 ml) anterior balloon are inflated. Channel of catheter provides airway for nasal breathing



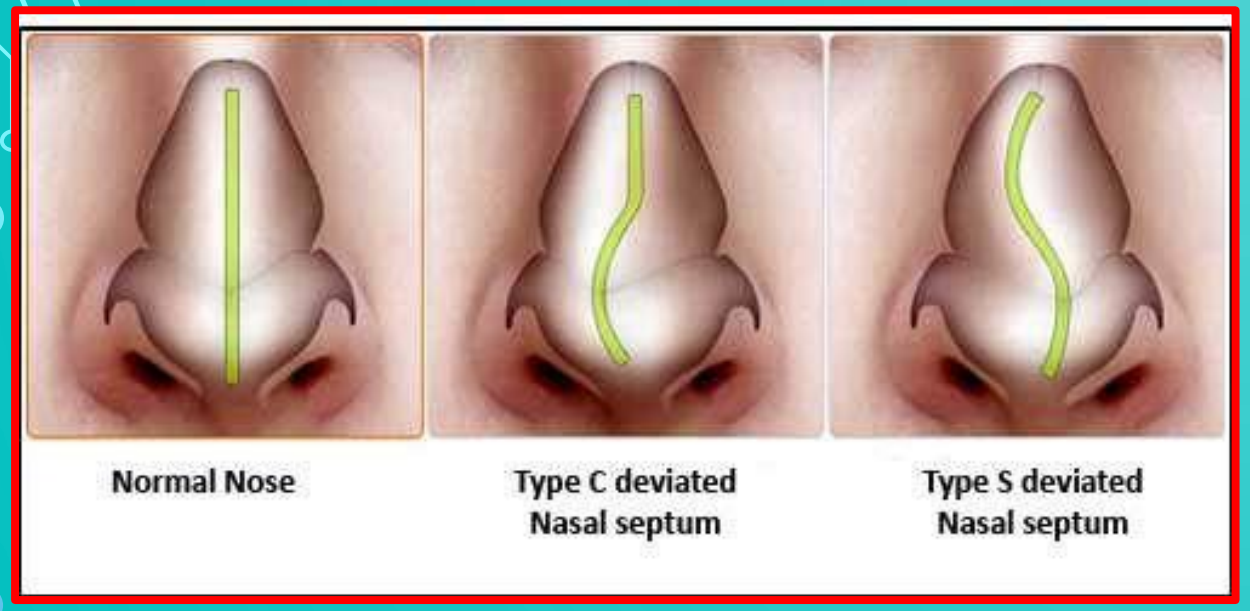
Nasal packing by Foley's catheter

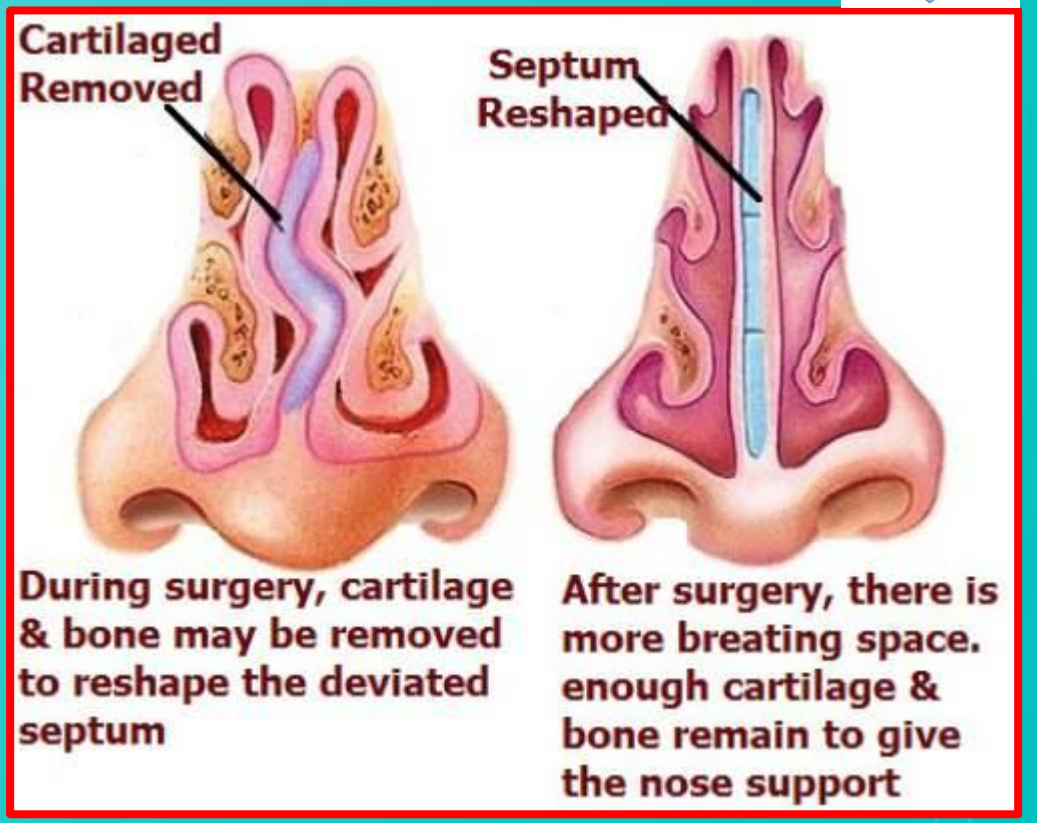
5- Septal deviation following nasal trauma

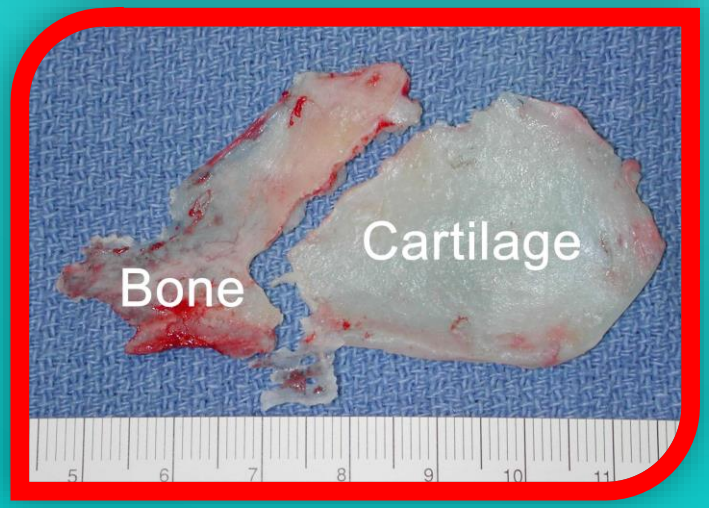
The quadrilateral cartilage of the septum may be fractured, resulting in a septal deviation that can give rise to nasal obstruction. Characteristically, this produces unilateral nasal obstruction and examination reveals a convexity of the septum touching the lateral nasal wall.

The unilateral nature of the symptoms helps distinguish this from rhinitis. Treatment consists of the operation of septoplasty: which resects and straightens the quadrilateral cartilage, perpendicular plate of ethmoid and vomer, and thus recentralizes the septum.

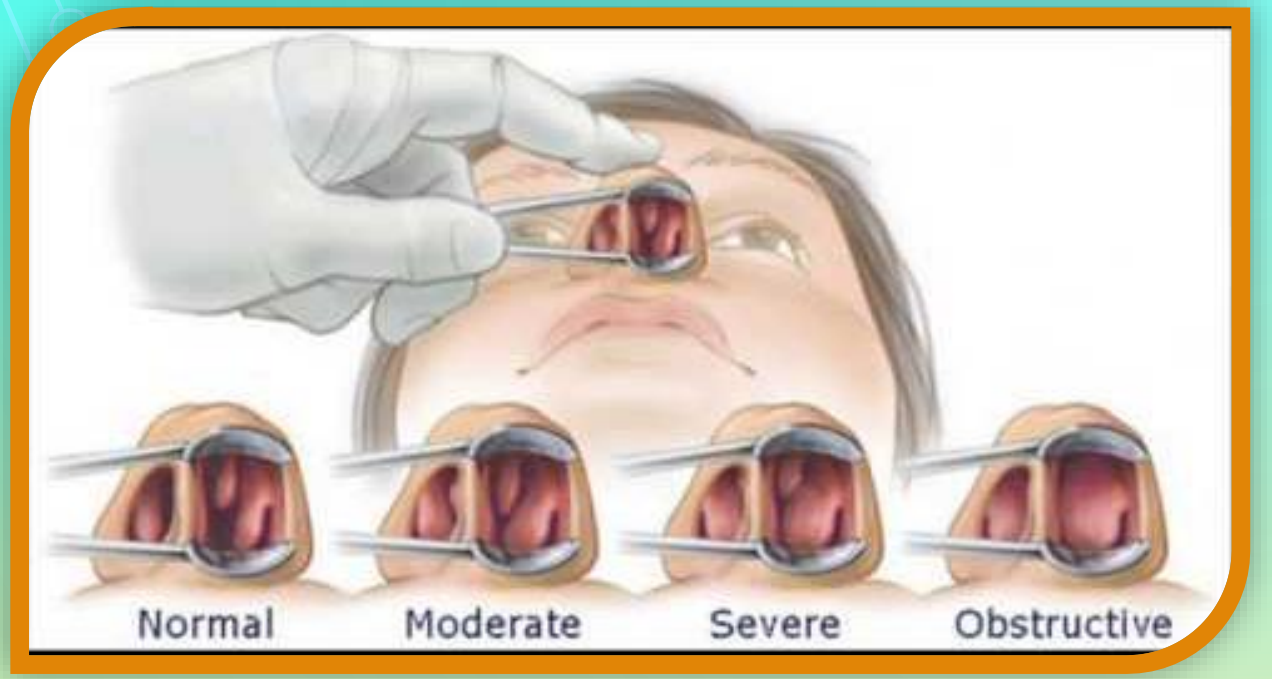
Septoplasty: nasal septal reshaping







Septal deviation following nasal trauma



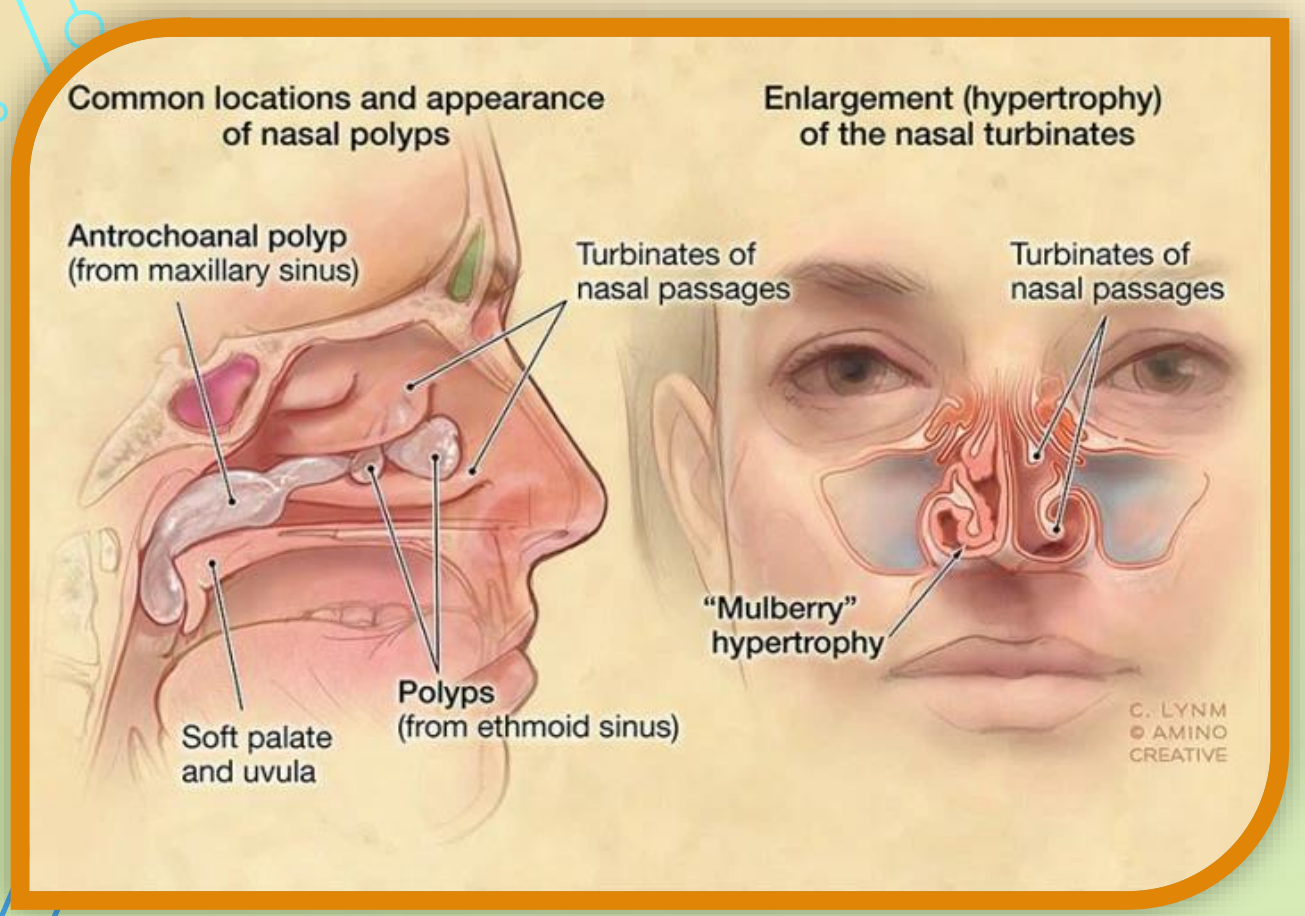
6- Nasal polyps

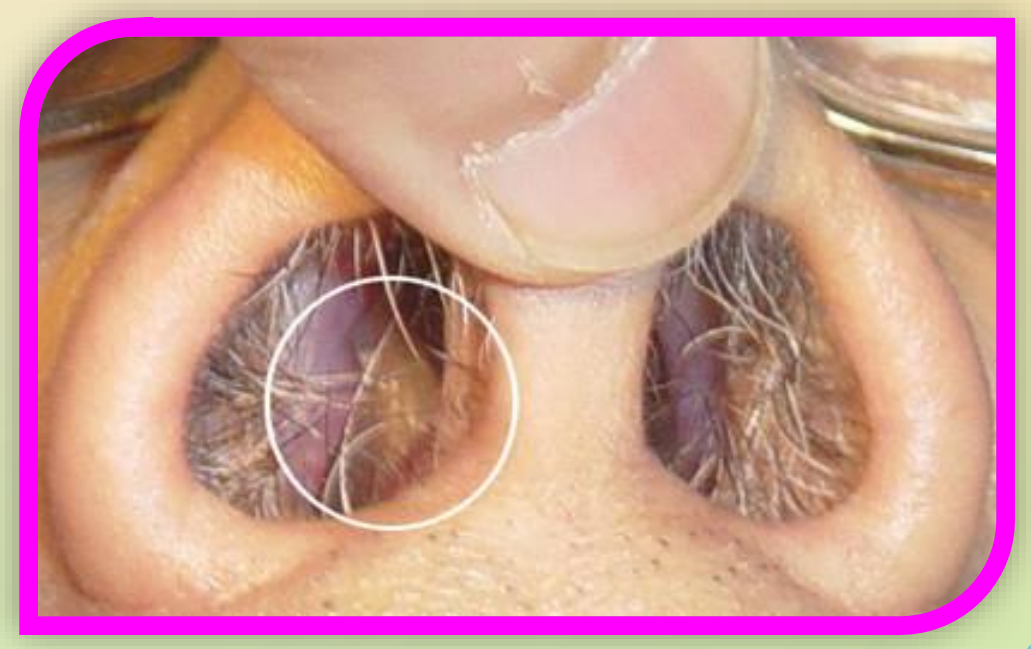
Nasal polyps are inflammatory masses that originate predominantly from the lining of the ethmoid sinuses. Polyps are more common in patients with asthma and, in a proportion of patients, there is an association with aspirin allergy.

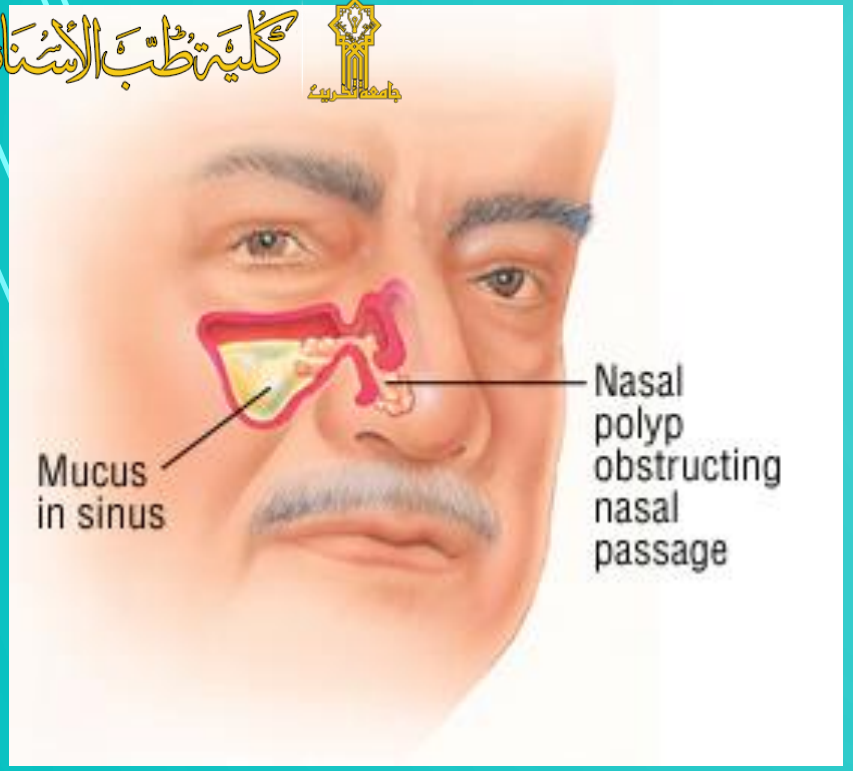
Symptoms are similar to severe rhinitis, with total nasal obstruction, hypo nasal speech, and nasal discharge. Diagnosis is usually easy on nasal examination.

Polyps should be referred for specialist assessment to exclude tumor. Topical or systemic corticosteroid medication can shrink polyps but surgical removal is often required, followed by topical medication to prevent recurrence.

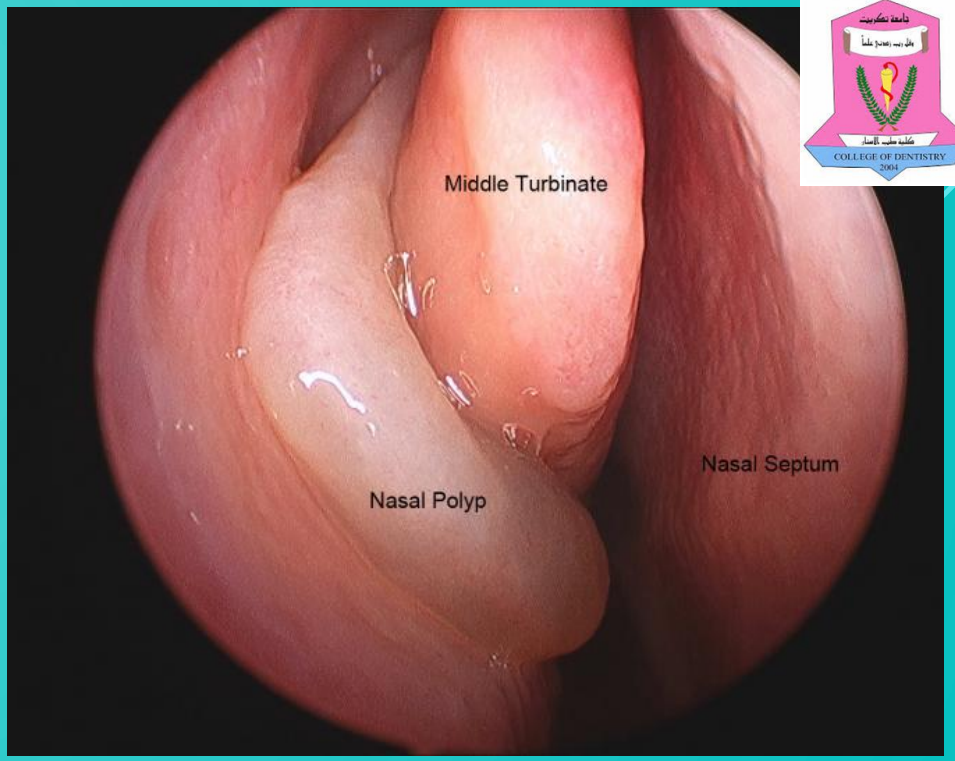
Nasal polyps







Nasal polyps



Nasal polyps after removal

Ear

Acute suppurative otitis media.

Inflammation of the mucous membrane lining the middle ear cleft (consisting the tympanic cavity, Eustachian tube, mastoid antrum, and mastoid cavity). produced by pus forming organism.

Route of infection:

1. The Eustachian tube:

A – from Upper respiratory tract infection, and lower respiratory tract infection.

B- Excessive nasal blowing.

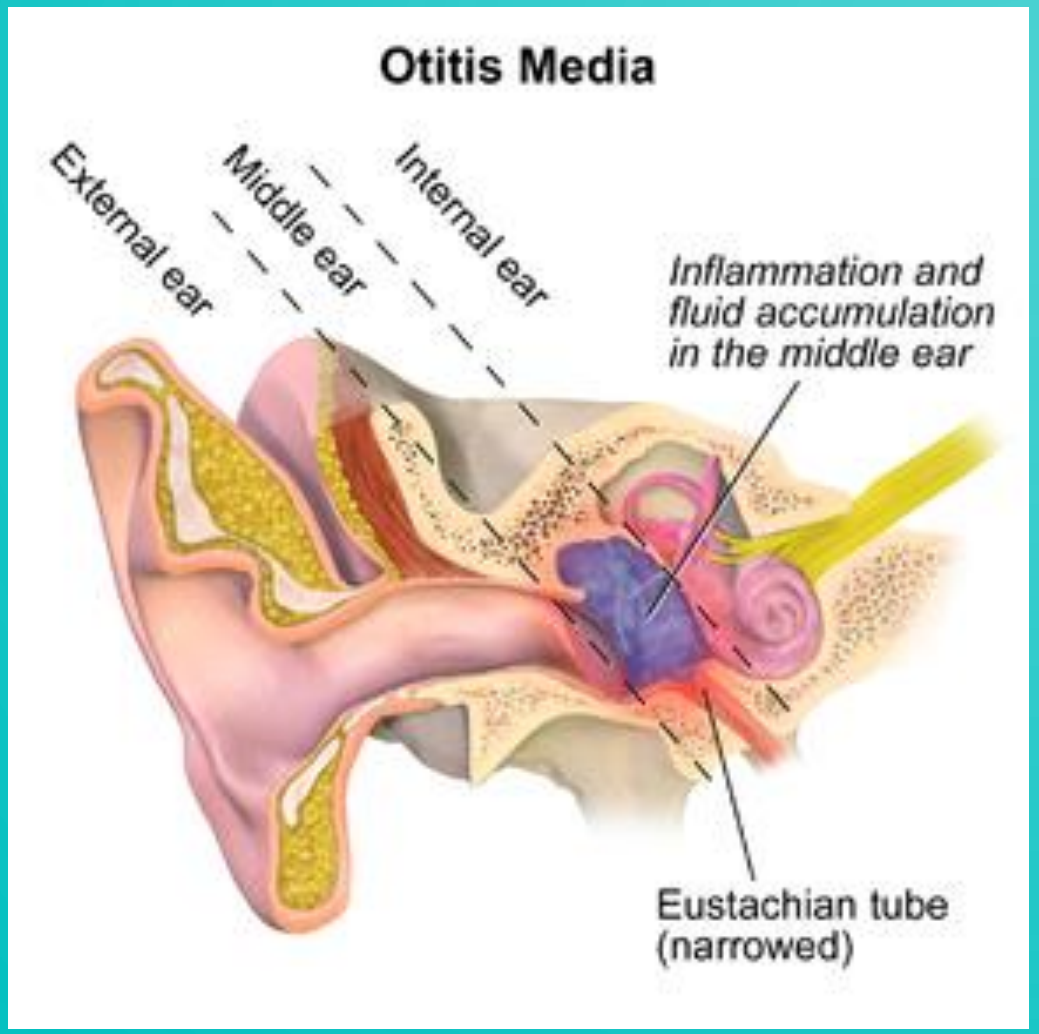
C - Swimming and diving.

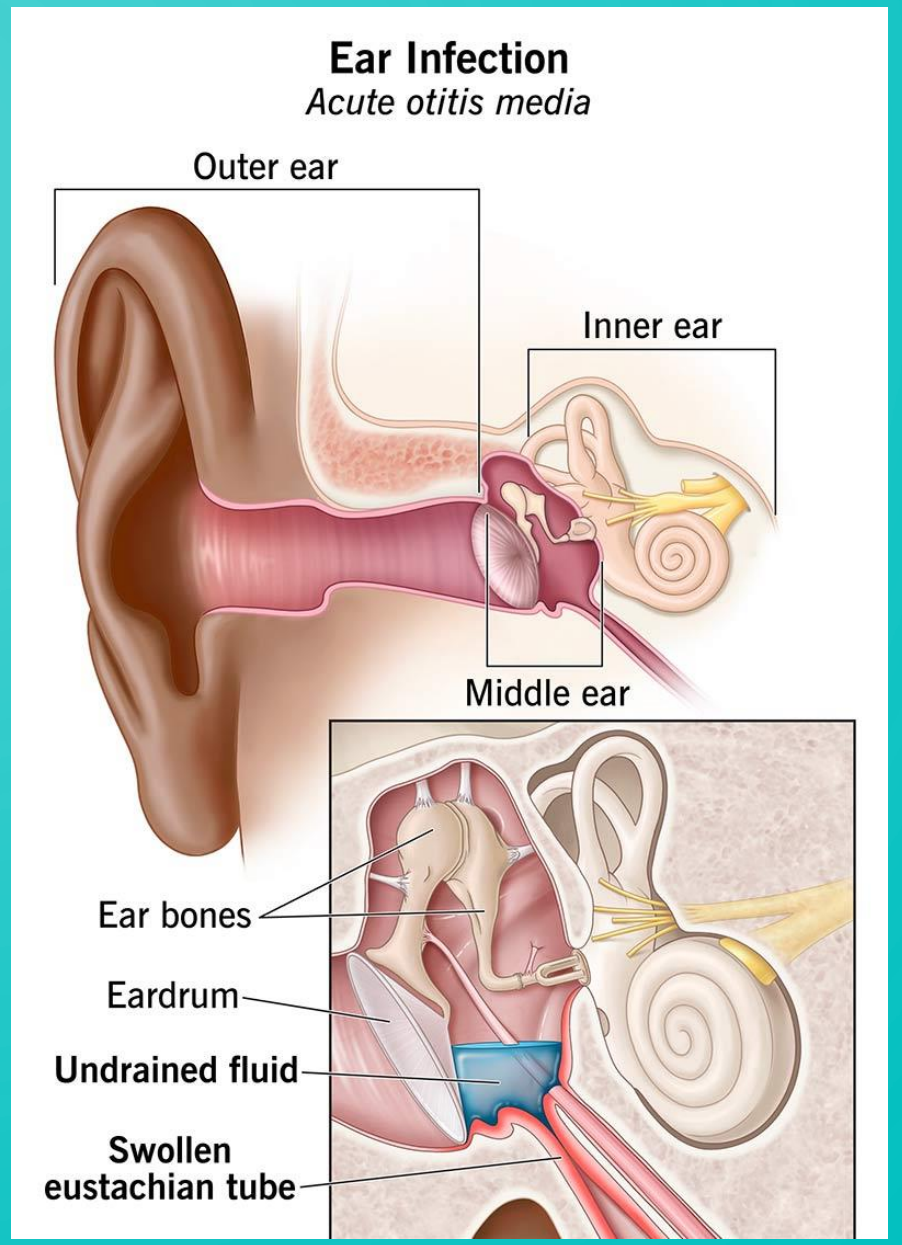
2.External auditory meatus.

* Perforated tympanic membrane.

* Through ventilation tube.

3. Blood borne infection. Rare:: as measles and whooping cough.


Otitis Media
External ear
Middle ear
Internal ear
Inflammation and fluid accumulation in the middle ear
Eustachian tube (narrowed)


Ear Infection
Acute otitis media
Outer ear
Inner ear
Middle ear
Ear bones
Eardrum
Undrained fluid
Swollen eustachian tube

Treatment of acute suppurative otitis media.

1. Bed rest and warmth and analgesia

2. Systemic antibiotics: Broad spectrum antibiotics for 10 days.

Oral Coamox (Amoxicillin + clavulanic acid) is drug of choice (orally).

In allergy >Erythromycin or septrin.

Parental injection given in severe infection.

*Ceftriaxone 50 mg/kg. I.M,or I.V/single dose daily/for three days.

3. Nasal decongestant, to improve patency of Eustachian tube

-Local .Xylometazoline (drops or spray)/4 times daily.

-Systemic decongestant.pseudoephedrin.

-Antihistamines is controversy.