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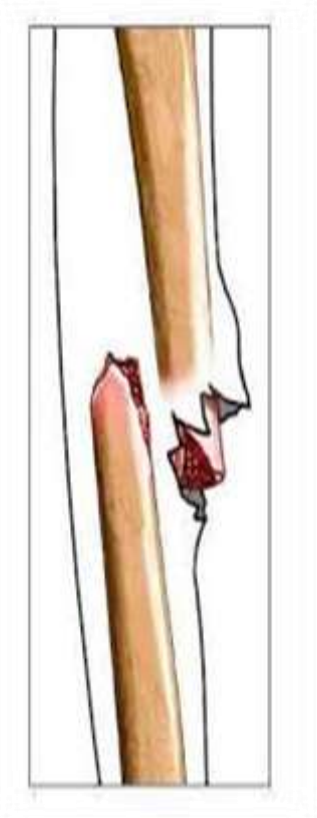
# Fracture

A fracture is a break or disruption in the continuity of bone or it is a disruption of the normal architecture of the bone.



# Etiology

- Traumatic injuries

- Fractures occur when the bone is subjected to stress greater than it can absorb.

- Fractures are caused by direct blows, crushing forces, sudden twisting motions, and even extreme muscle contractions.

- Metabolic bone diseases like osteoporosis.

Predisposing factors include:

- Neoplasm
- Post menopausal estrogen loss
- Protein malnutrition

- High risk recreation and employment related activities.
  (rock- climbing)

- Victims of domestic violence.

# Classification of fracture

Fractures are classified according to

- Type
- Communication or non communication with the external environment
- Anatomic location of the fracture on the involved bone.

# Types Of Fractures

## Avulsion

Avulsion is a fracture of bone resulting from the strong pulling effect of tendons or ligaments at the bone attachment.

## Comminuted fracture

It is a fracture with more than two fragments. The smaller fragments appear to be floating.


## Displaced (overriding)fracture

It involves a displaced fracture segment that is overriding the other bone fragment.


The periosteum is disrupted on both sides.

## Greenstick fracture

It is an incomplete fracture with one side splintered and the other side bent.

## Impacted fracture

It is a comminuted fracture in which more than one fragments are driven into each other.


# Interarticular fracture

It is a fracture extending to the articular surface of the bone.

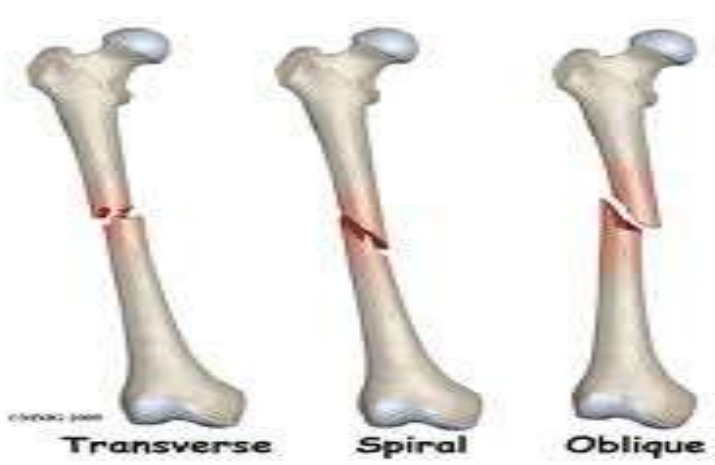
## Longitudinal fracture

- It is an incomplete fracture in which the fracture line run along the longitudinal axis of the bone.

- The periosteum is not torn away from the bone.

# Oblique fracture

It is a fracture in which the line of the fracture extends in an oblique direction.



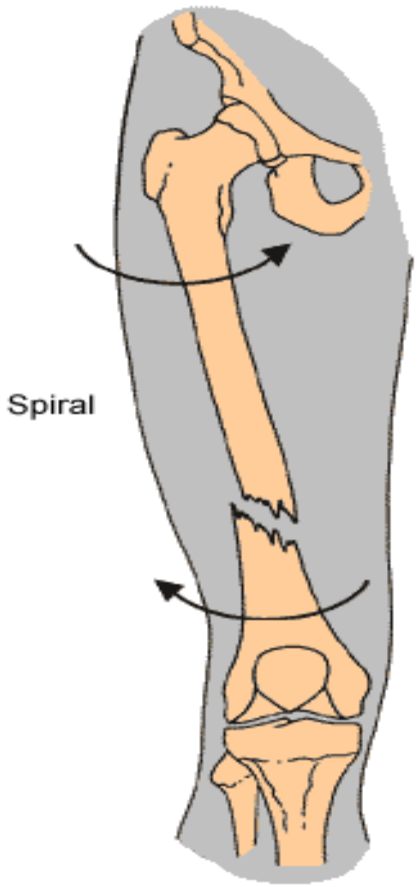
- Spiral fracture

It is a fracture in which the line of the fracture extends in a spiral direction along the shaft of the bone.

# Spiral Fracture

- Bone is broken by twisting

Spiral fracture of femur




- Transverse fracture

It is a fracture in which the line of the fracture extends across the bone shaft at a right angle to the longitudinal axis.

# Pathologic Fracture

- It is a spontaneous fracture at the site of bone disease.

**Causes**

Bone tumors, metastatic lesions, infection, metabolic disease and an injury to old fracture site.

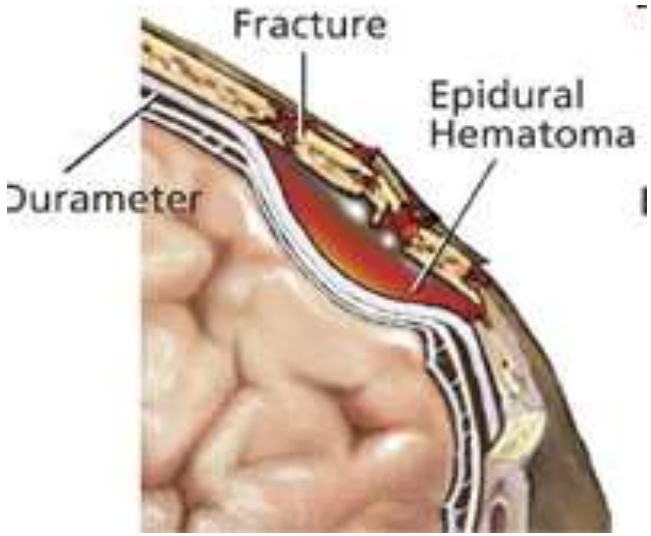
- Stress fracture

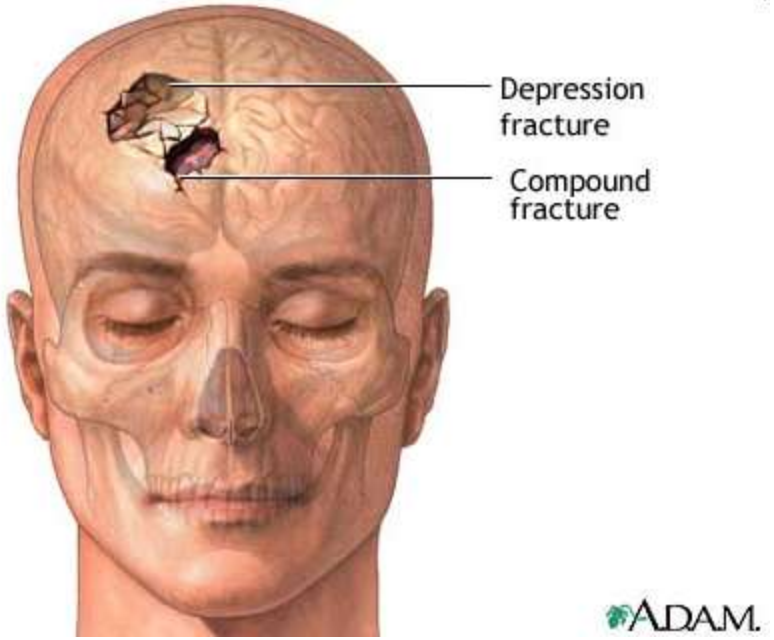
  It is a fracture that occurs in normal or abnormal bone that is subject to repeat stress, such as from jogging or running.

  They are considered as overuse injuries.

# Depression Fracture

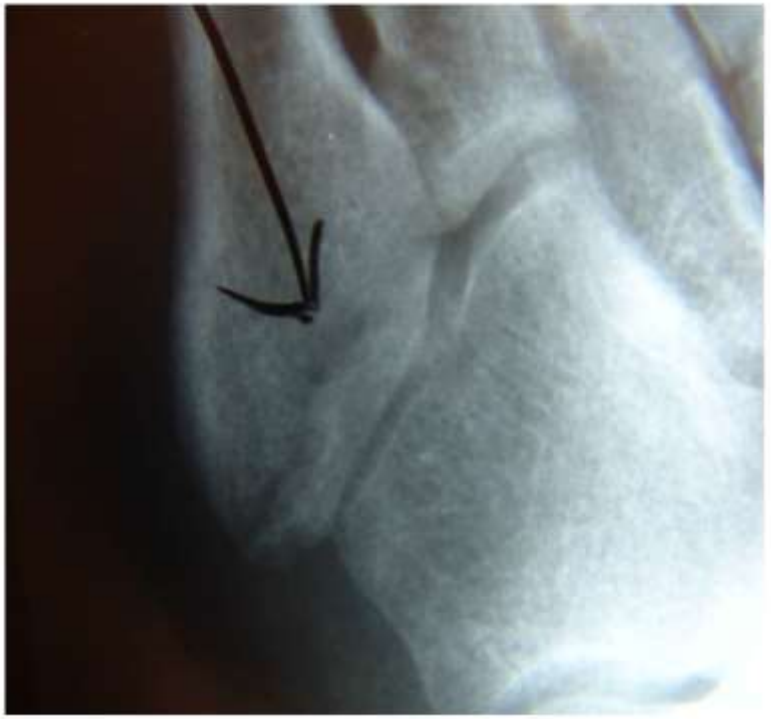
- When the skull is fractured inward



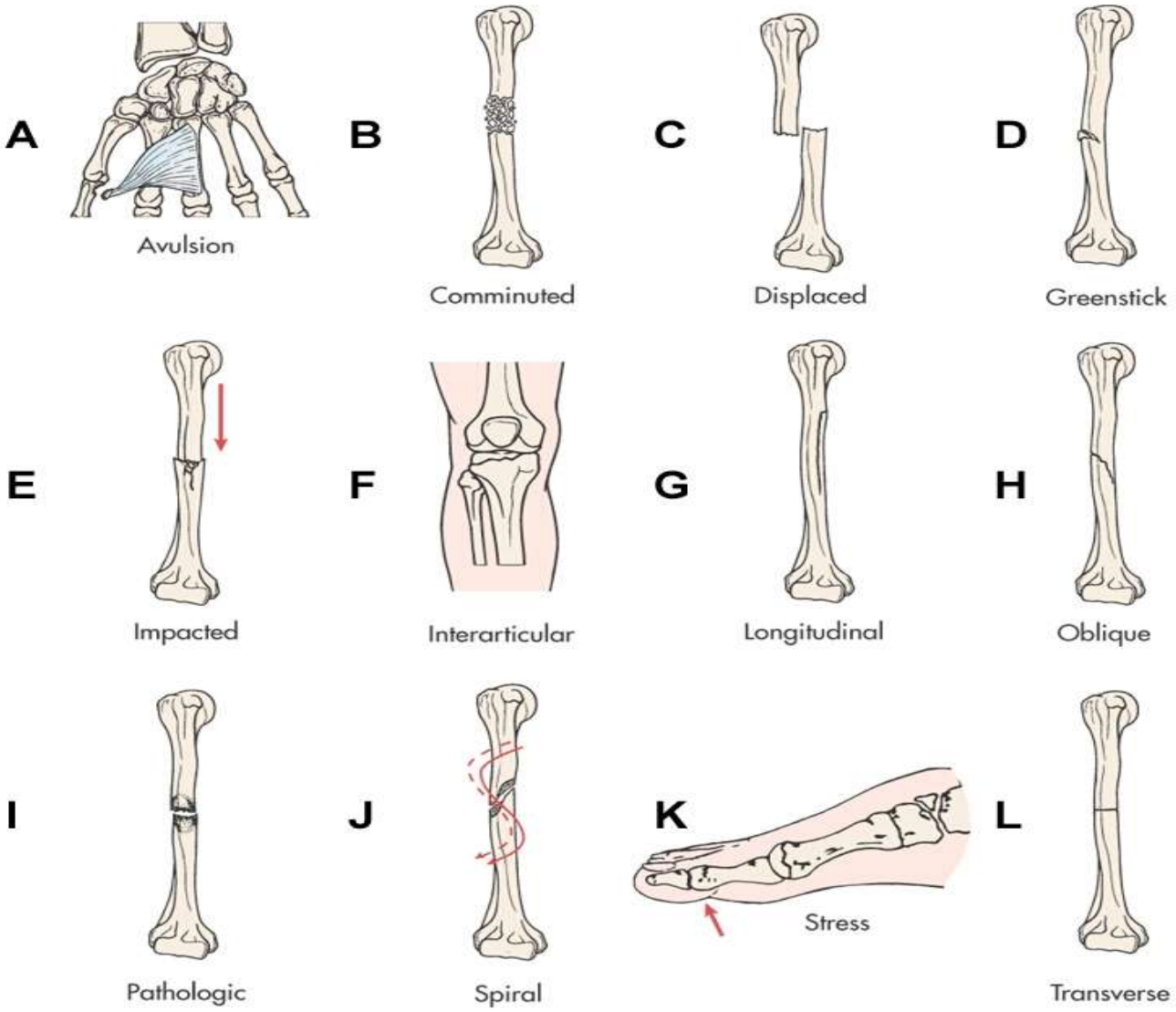
# Hairline Fracture

- A very thin crack or break in the bone

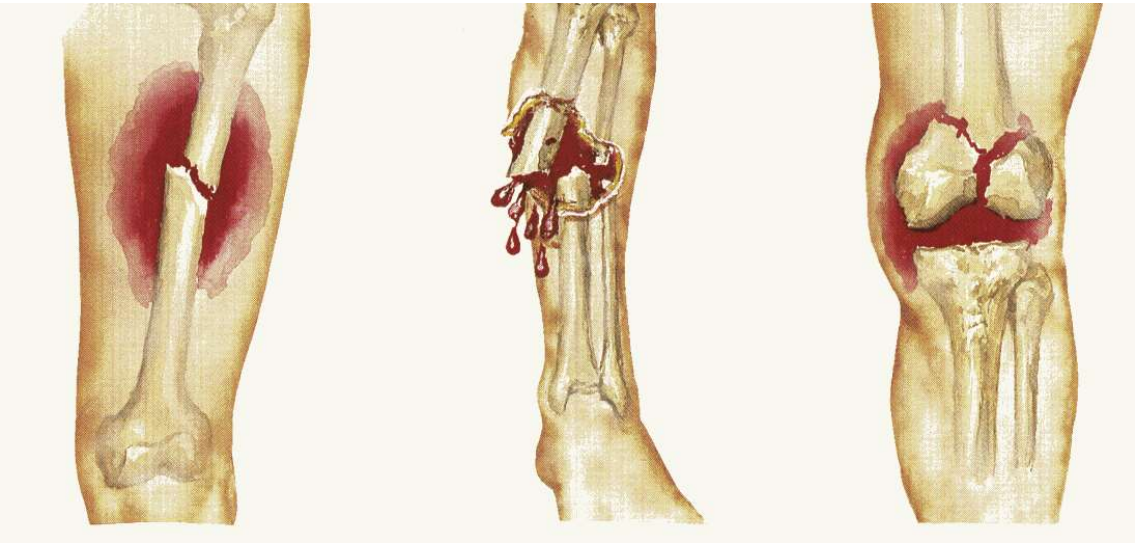
Hairline fracture of the foot

# Types of Fractures



# Communication or non communication with the external environment

- Open fracture
- Closed fracture



# PATHOPHYSIOLOGY

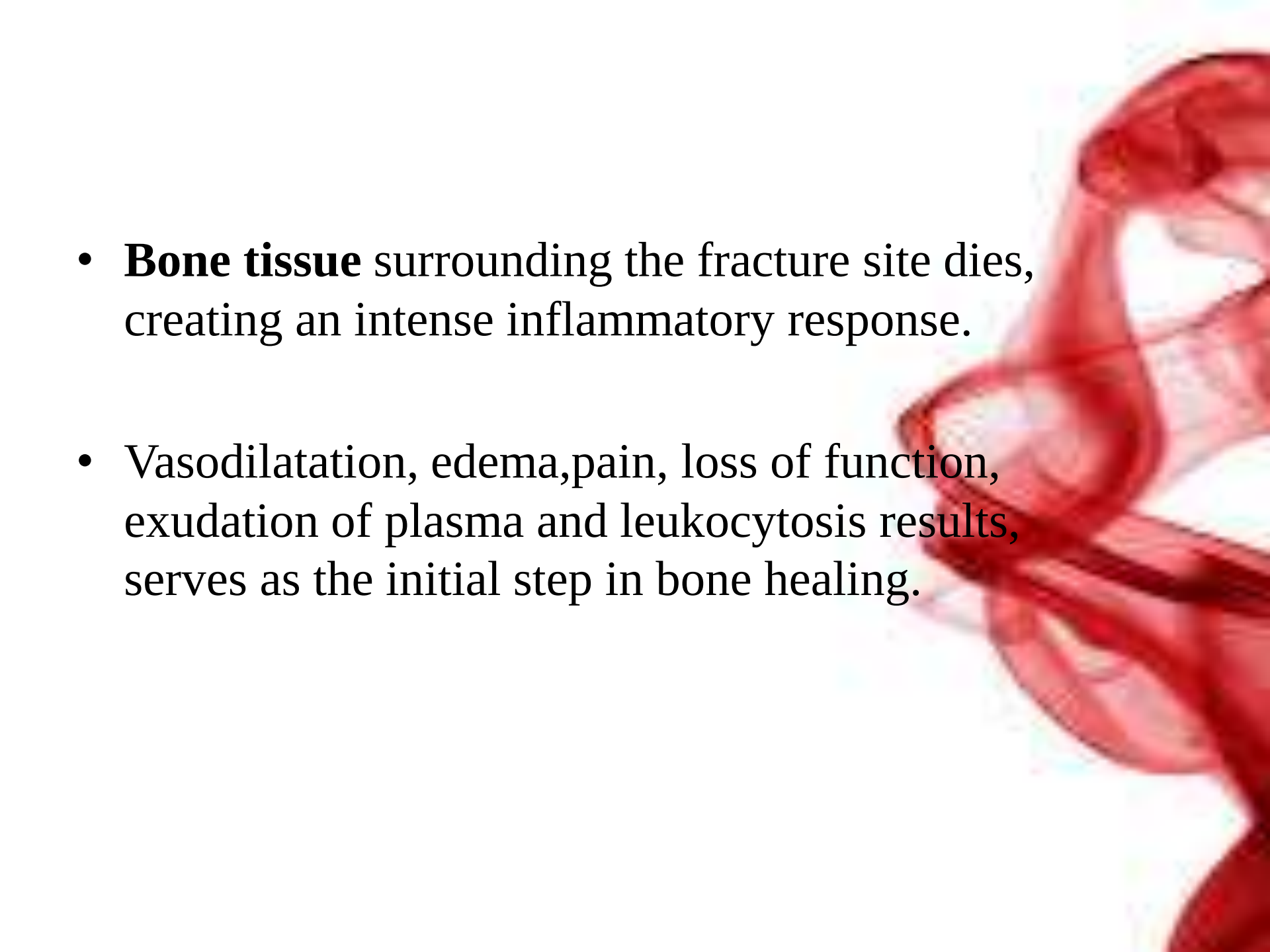
- Fracture → Disruption of **Muscles** attached to the bone.
- Muscles undergo spasm and pull the fracture fragments out of position.
- Fracture fragments may be displaced sideways and may also be rotated.
- **Periosteum and blood vessels** in the cortex and marrow of the fractured bone are disrupted.

- Bleeding occurs from both the soft tissue and from the damaged end of bone.

- Hematoma form in the medullary canal.

- **Bone tissue** surrounding the fracture site dies, creating an intense inflammatory response.

- Vasodilatation, edema,pain, loss of function, exudation of plasma and leukocytosis results, serves as the initial step in bone healing.

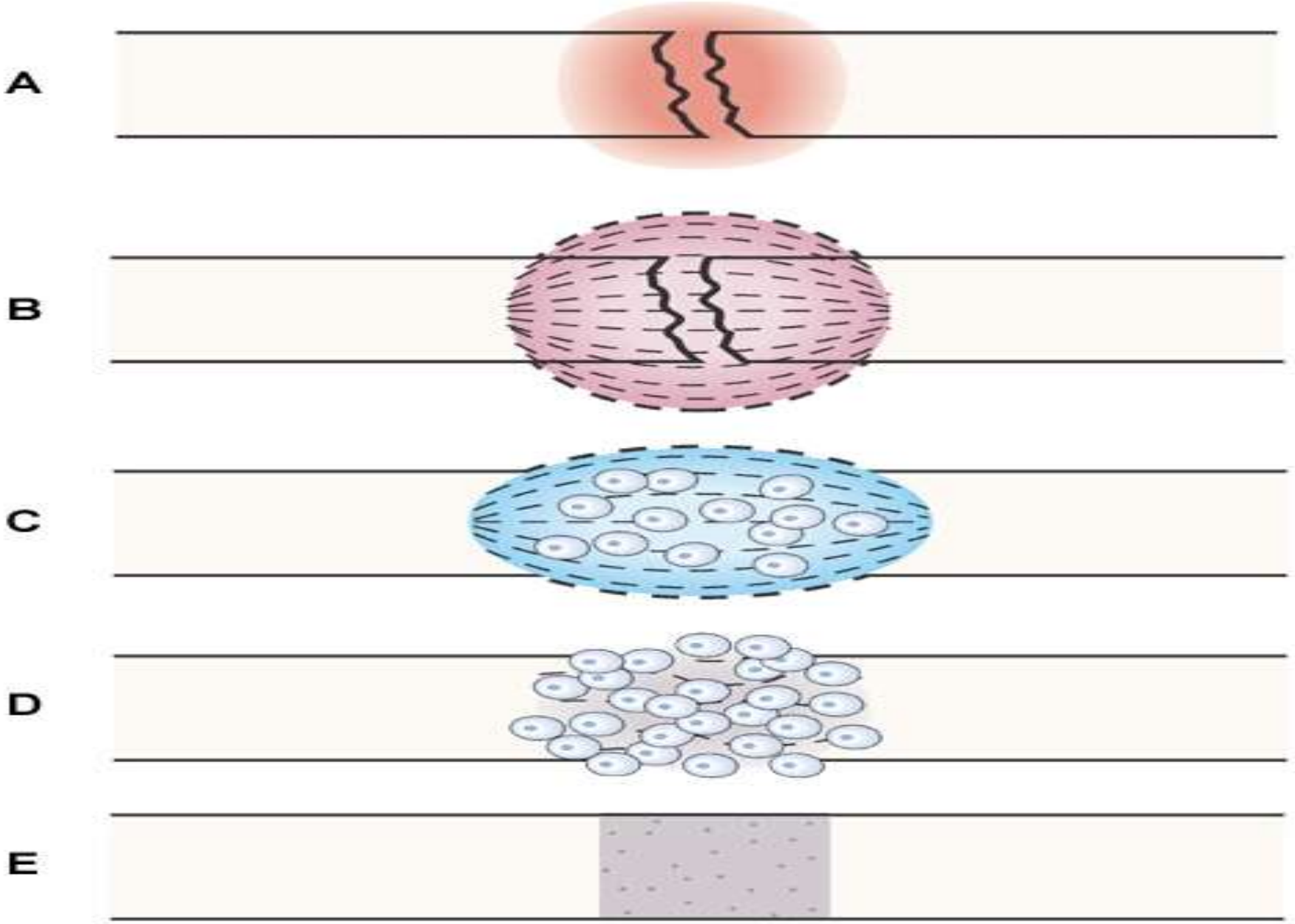


# Fracture healing

- ***Fracture hematoma:*** when a fracture occurs, bleeding creates a hematoma, which surrounds the ends of the fragments. (within 72 hours)
- ***Granulation tissue*** : active phagocytosis absorbs the products of local necrosis. The hematoma converts to granulation tissue. Granulation tissue produces the basis for new bone substance called osteoid ( days 3 to 14 )
- ***Callus formation*** :As minerals and new bone matrix are deposited in the osteoid, an unorganized network of bone is formed. It usually appears by the end of the second week after injury. Evidence of callus formation can be verified by x-ray.

- ***Ossification*** : Ossification of the callus occurs from 3 weeks to 6 months after the fracture and continues until the fracture has healed. During this stage of clinical union the patient may be allowed limited mobility or the cast may be removed.
- ***Consolidation*** : As callus continues to develop, the distance between bone fragments diminishes and eventually closes. This stage is called consolidation, and ossification continues. It can be equated with radiologic union.

- ***Remodeling*** : Excess bone tissue is reabsorbed in the final stage of bone healing, and union is completed. Gradual return of the injured bone to its pre injury structural strength and shape occurs. Radiologic union occurs when there is x-ray evidence of complete bony union. This phase can occur up to a year following injury.




Redrawn from Long B, Phipps W, Cassmeyer V: *Medical-surgical nursing: a nursing process approach*, St. Louis, 1993, Mosby.

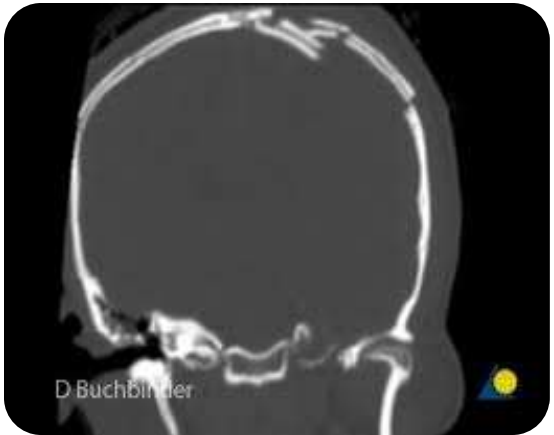
# CLINICAL MANIFESTATIONS

- **Pain**
- **Loss of function**
- **Deformity**
- **Shortening**
- **Crepitus**
- **Swelling and discoloration**
- **Muscle spasm**
- **Tenderness**

# Diagnostic Studies for Fracture

- **X-ray examinations:** Determines location and extent of fracture.

- **Bone scans, tomograms, computed tomography (CT)/magnetic resonance imaging (MRI) scans:** Visualizes fractures, bleeding, and soft-tissue damage; differentiates between stress/trauma fractures and bone neoplasms.

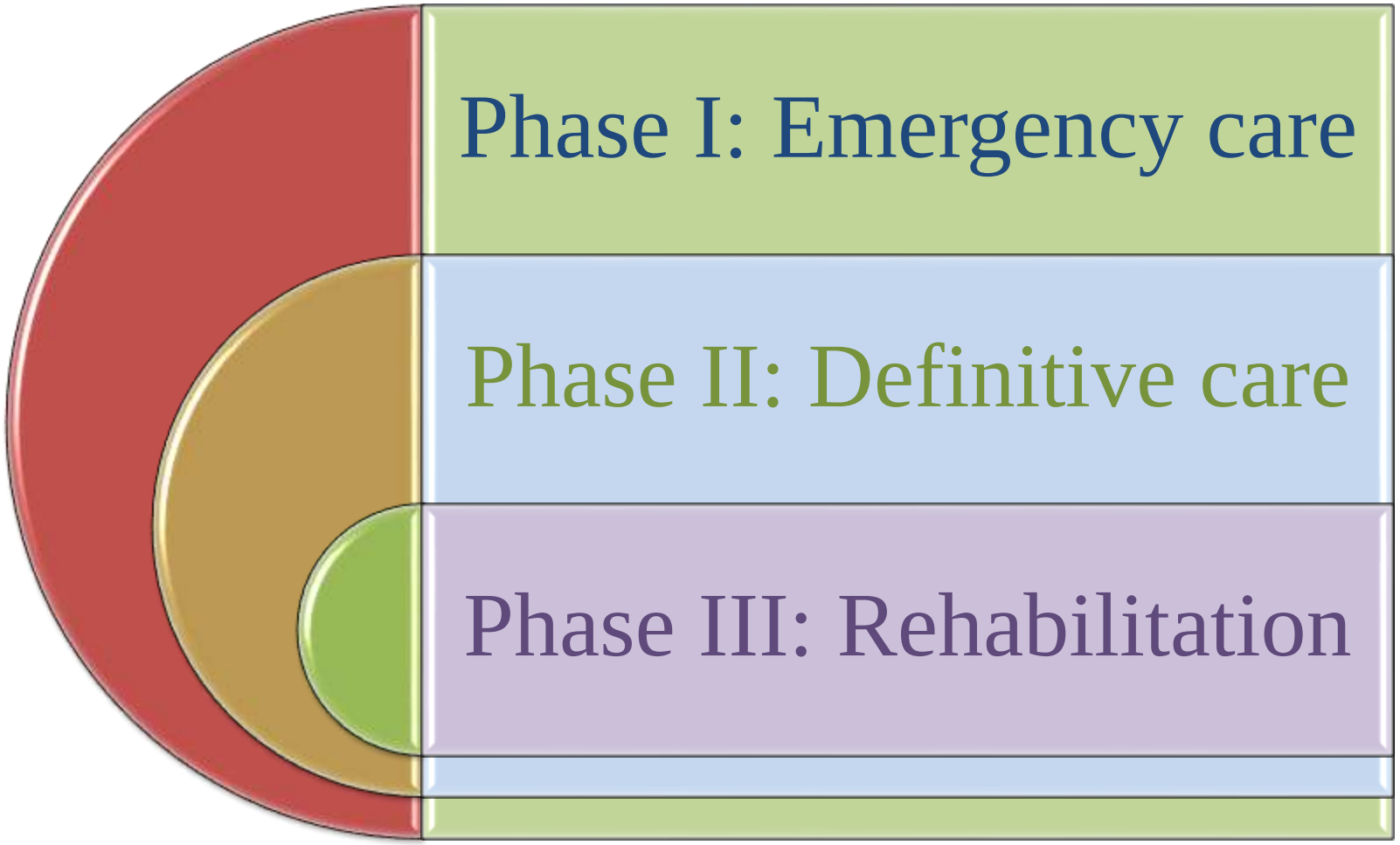


- **Complete blood count (CBC):** Hematocrit (Hct) may be increased (hemoconcentration) or decreased (hemorrhage).
- Increased white blood cell (WBC) count is a normal stress response after trauma.
- **Urine creatinine (Cr) clearance:** Muscle trauma increases load of Cr for renal clearance.

- **Coagulation profile:** Alterations may occur because of blood loss, multiple transfusions, or liver injury.

- **Arteriograms:** May be done when occult vascular damage is suspected.

# Treatment Of Fracture



# Phase I: Emergency care

- Begins at the site of the accident.
- It consists of ‘splint them where they lie’.


# Closed fracture

- Before splinting remove any ring or bangles worn by the patient.

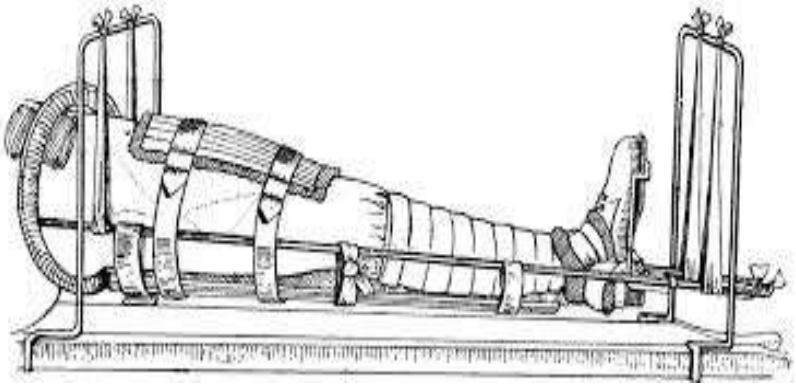
- Almost any available object( for eg: folded news paper, magazine, rigid cardboard, stick, umbrella, pillow etc.) can be used for splinting at the site of the accident.

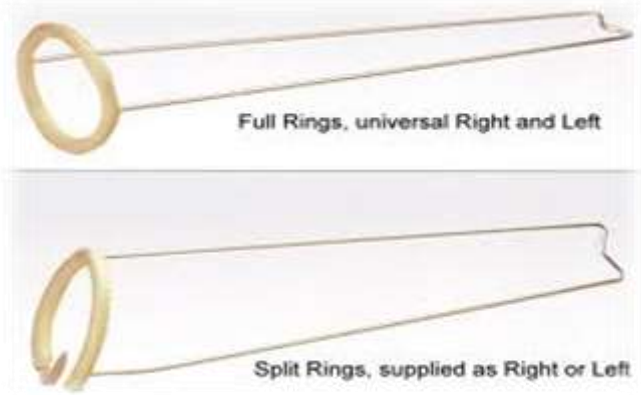
# Open fracture

- The bleeding from the wound is stopped by applying firm pressure using a clean piece of cloth.
- Circular bandage can apply proximal to the wound in order to stop bleeding.
- If the wound is very dirty, it is washed with clean tap water and covered with a clean cloth.
- The fracture is splinted.

# In the emergency department

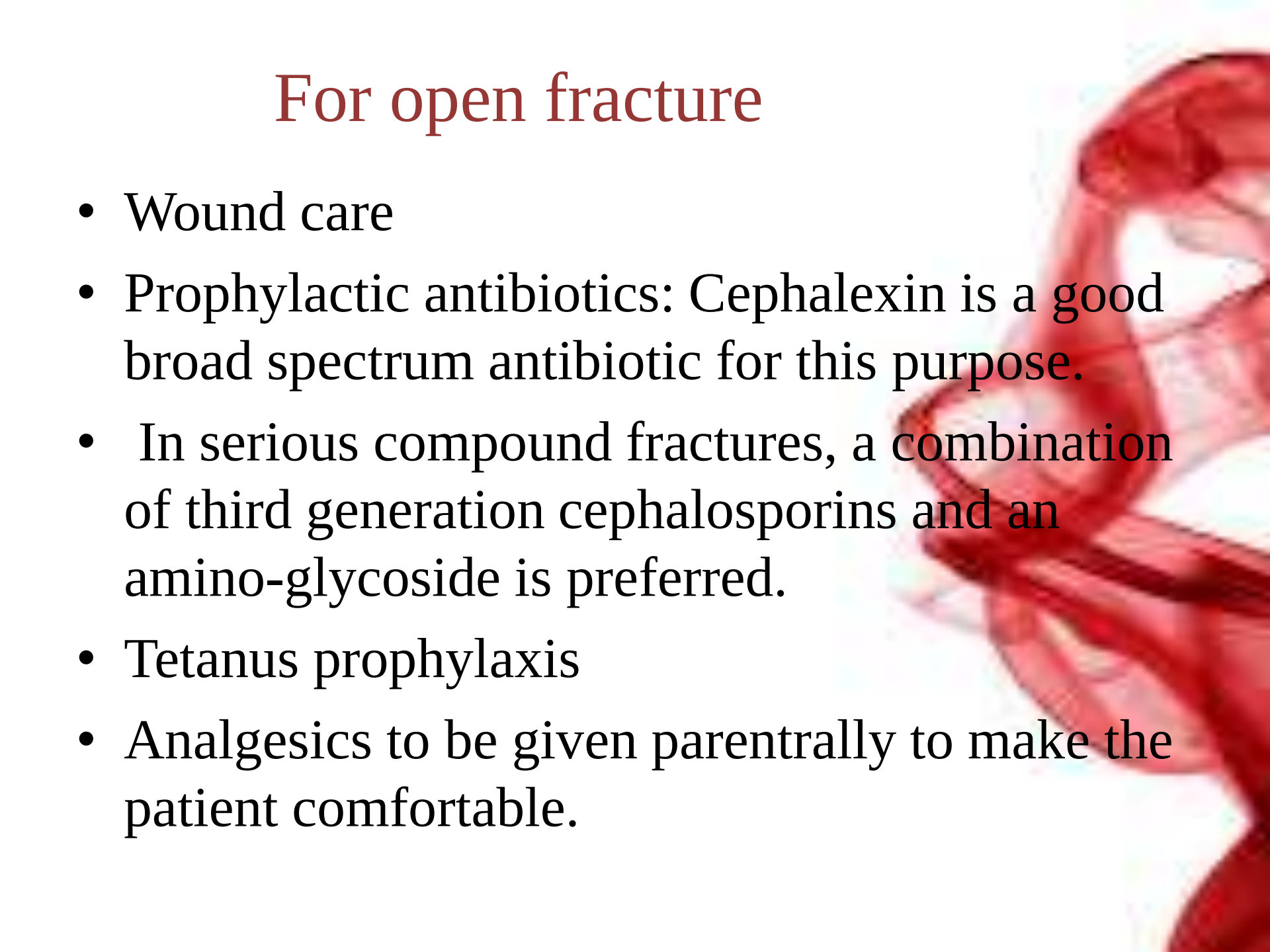
- Basic life support
- Bleeding is recognized and stopped by local pressure.
- Wooden plank, Cramer-wire splint, Thomas' splint, inflatable splint are some of the splints used in emergency department.
- After emergency care is provided , suitable radiological and other investigations are carried out.




Full Rings, universal Right and Left
Split Rings, supplied as Right or Left

# For open fracture

- Wound care
- Prophylactic antibiotics: Cephalexin is a good broad spectrum antibiotic for this purpose.
- In serious compound fractures, a combination of third generation cephalosporins and an amino-glycoside is preferred.
- Tetanus prophylaxis
- Analgesics to be given parentrally to make the patient comfortable.



# Phase II- Definitive care

The aim of treatment is rehabilitation of the limb to pre-injury status.

- Anatomic realignment of bone fragments(reduction)
- Immobilization to maintain realignment
- Restoration of normal or near normal function of the injured part

# Methods of treatment

Not all fractures need all three of these treatment.

- **Treatment by functional use of the limb**: Some fractures (eg: fractured ribs, scapula) need no reduction or immobilization. These fractures unite despite functional use of the body part. Analgesics are needed for the initial few days.

- **Treatment by immobilization** : Fractures without significant displacement or fractures where the displacement is of no concern are treated this way.

- **Treatment by reduction followed by immobilization**: It is required for most displaced fractures. These otherwise result in deformity, shortening etc.

- **Open reduction and internal fixation**: Some fractures , such as intra- articular fractures, are best treated by open reduction and internal fixation.

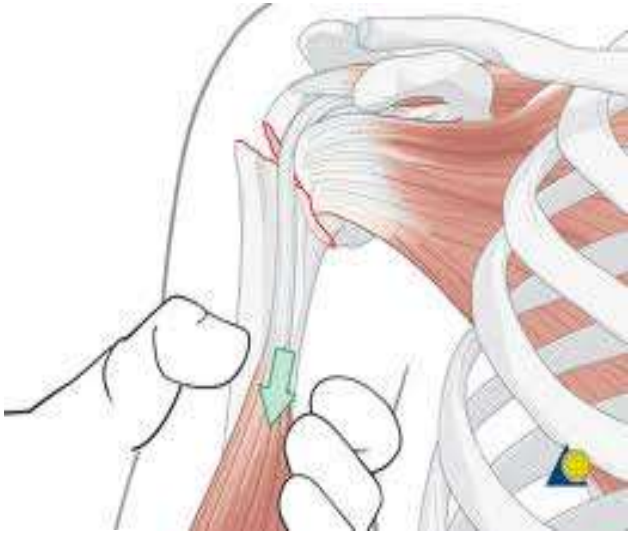
# Fracture reduction

Reduction of a fracture can be carried out by following methods

- Closed reduction
- Open reduction
- Continuous traction

# Closed reduction





# Closed reduction

- Nonsurgical, manual realignment of bone fragments to their previous anatomic position.
- Traction and counter traction are manually applied to the bone fragments.
- Usually performed under local or general anesthesia.
- After reduction, traction, casting, external fixation, splints or orthoses immobilize the injured part to maintain alignment until healing occurs.

# Open reduction

- Open reduction is the correction of bone alignment through a surgical incision.

- It usually includes internal fixation of the fracture with the use of wires, screws, pins, plates, intra medullary rods or nails.

- This techniques allows anatomic reduction and the creation of highly stable constructs.

# Indication

1. Fracture that **cannot be reduced** except by operation

2. Fracture that are **inherently unstable** and prone to displacement after reduction

3.Fracture that **unite poorly and slowly**

- Principally fracture of the femoral neck

**4.Pathological fracture**

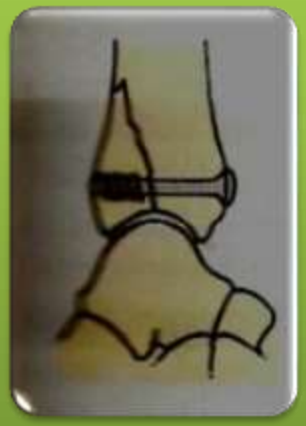
- Bone disease may prevent healing

**5.Multiple fracture**

- Where early fixation reduced the risk of general complication

6.Fracture in patient who present **severe nursing difficulty**

# Type of internal fixation



## Screw

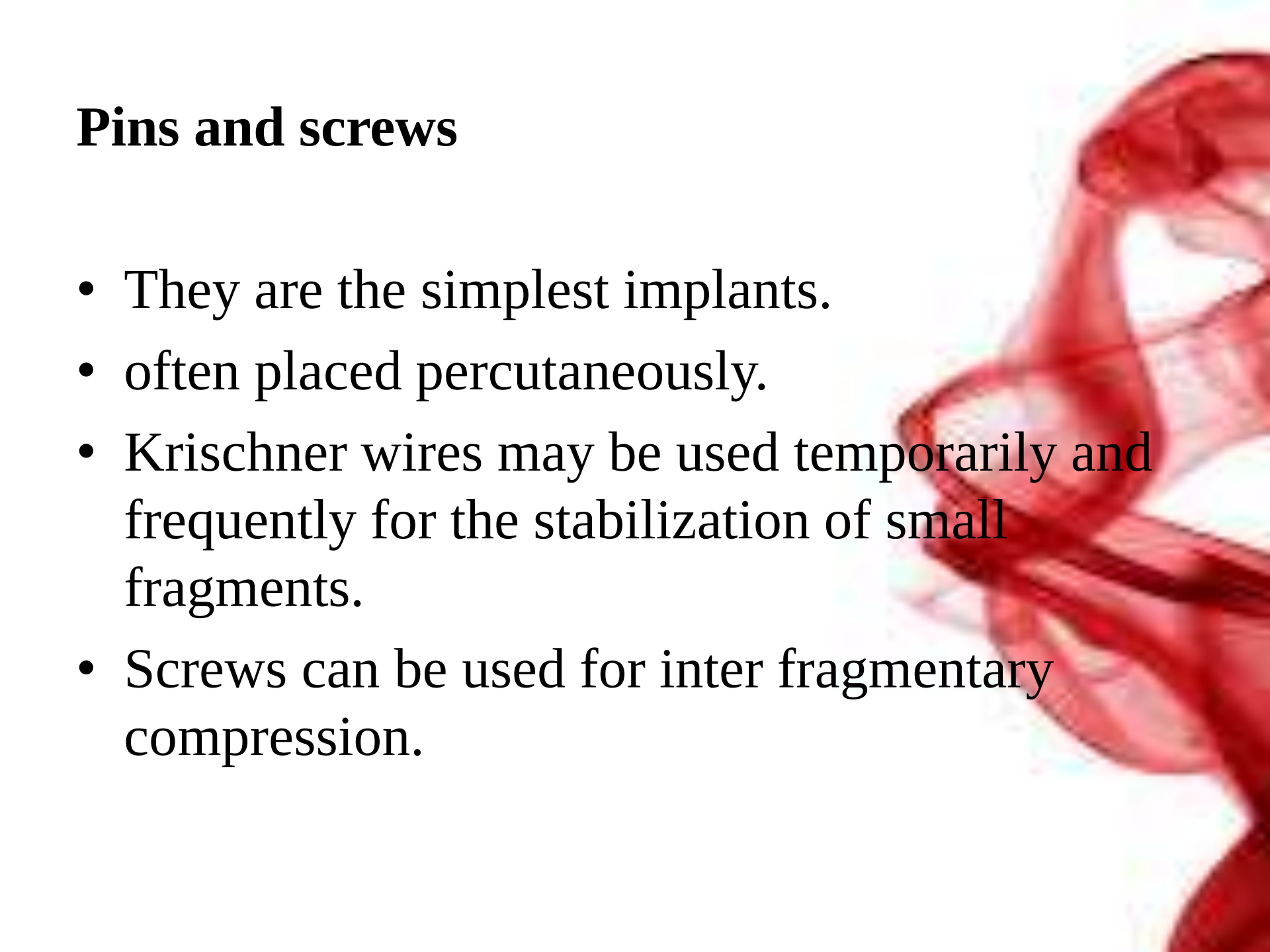
- Interfragmentary screw (lag screw) are used for fixing small fragment onto the main bone

## Wires

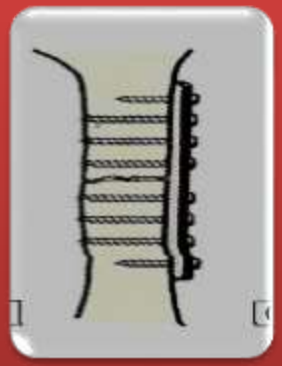
- **Kirschner wire often inserted percutaneously without exposing the fracture**
- **Used in situation where fracture healing is predictably quick**

## Pins and screws

- They are the simplest implants.
- often placed percutaneously.
- Krischner wires may be used temporarily and frequently for the stabilization of small fragments.
- Screws can be used for inter fragmentary compression.



## Plates and screw



- Useful for treating metaphyseal fracture of long bones and diaphyseal fracture of radius and ulna

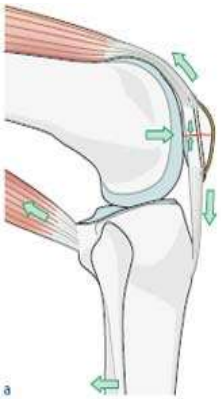
## Intramedullary nail

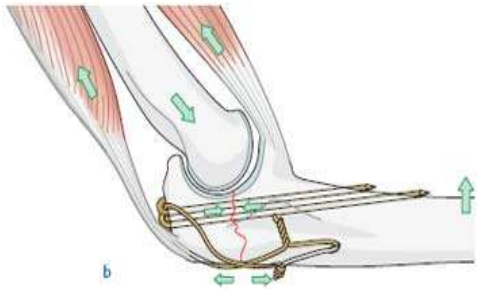

- Suitable for long bones
- Nail is inserted onto medullary canal to splint the fracture
- Rotational  fracture are resisted by introducing locking screw which tranfix the bone cortices and the nail proximal and distal to the fracture.

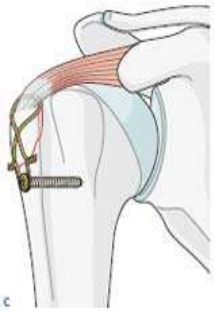
## Tension bands

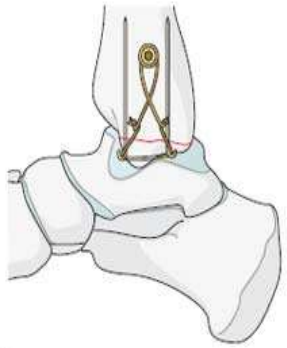
- convert the displacing tensile forces on one side of a fracture into a compressive force across the entire contact area.
- Traditionally wires or cables are used to create tension bands.

# Tension bands

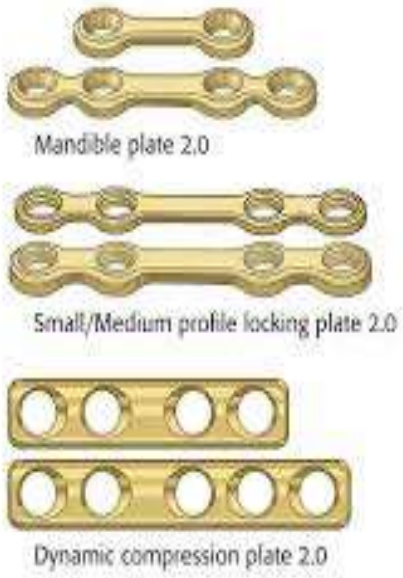


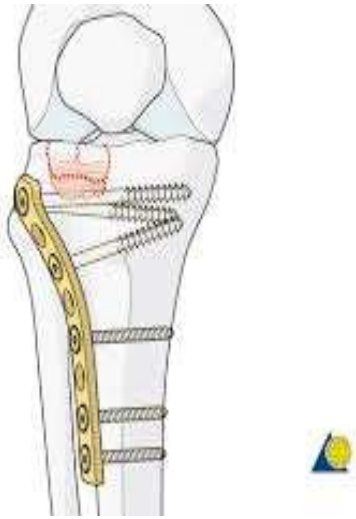



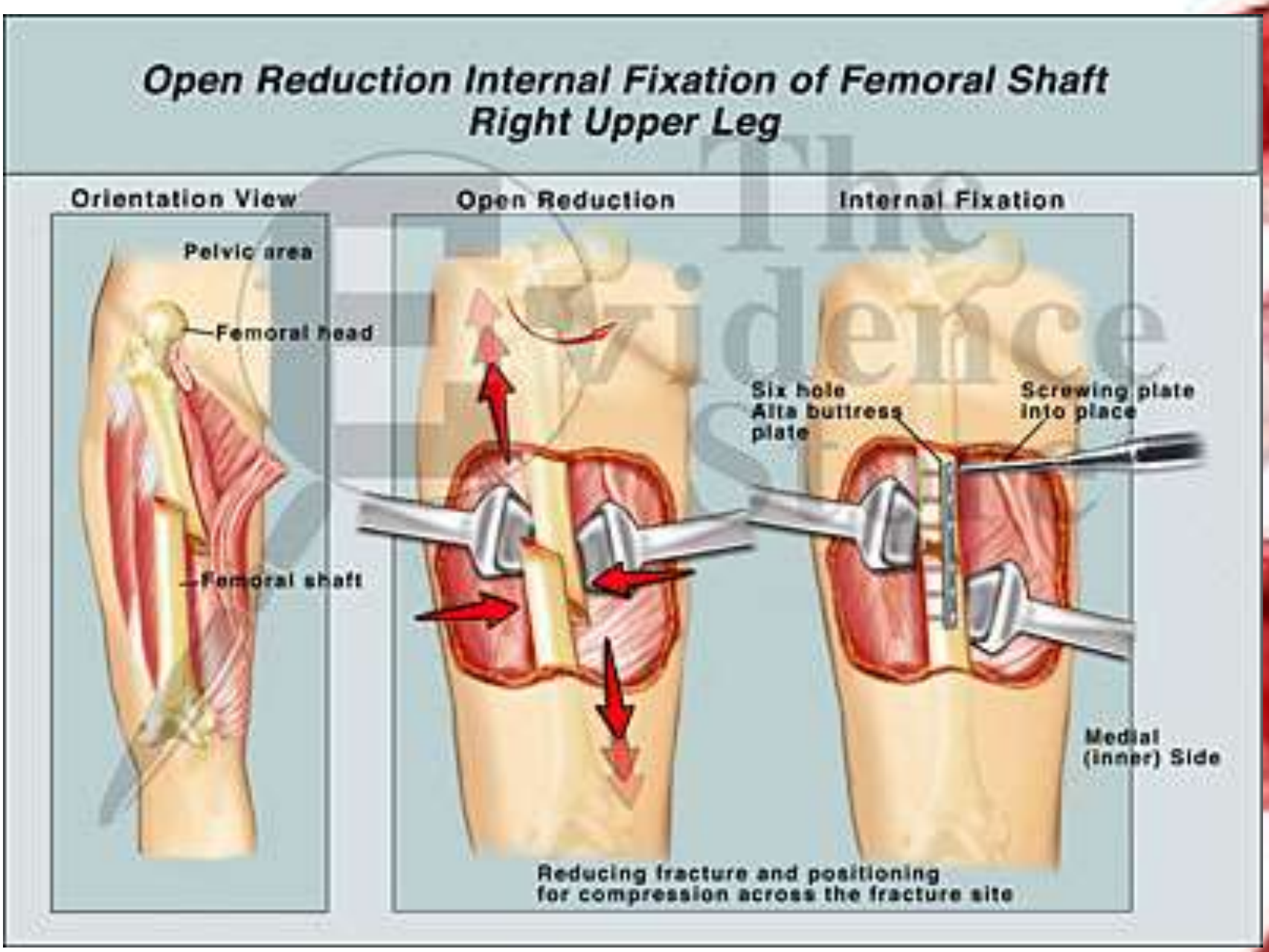



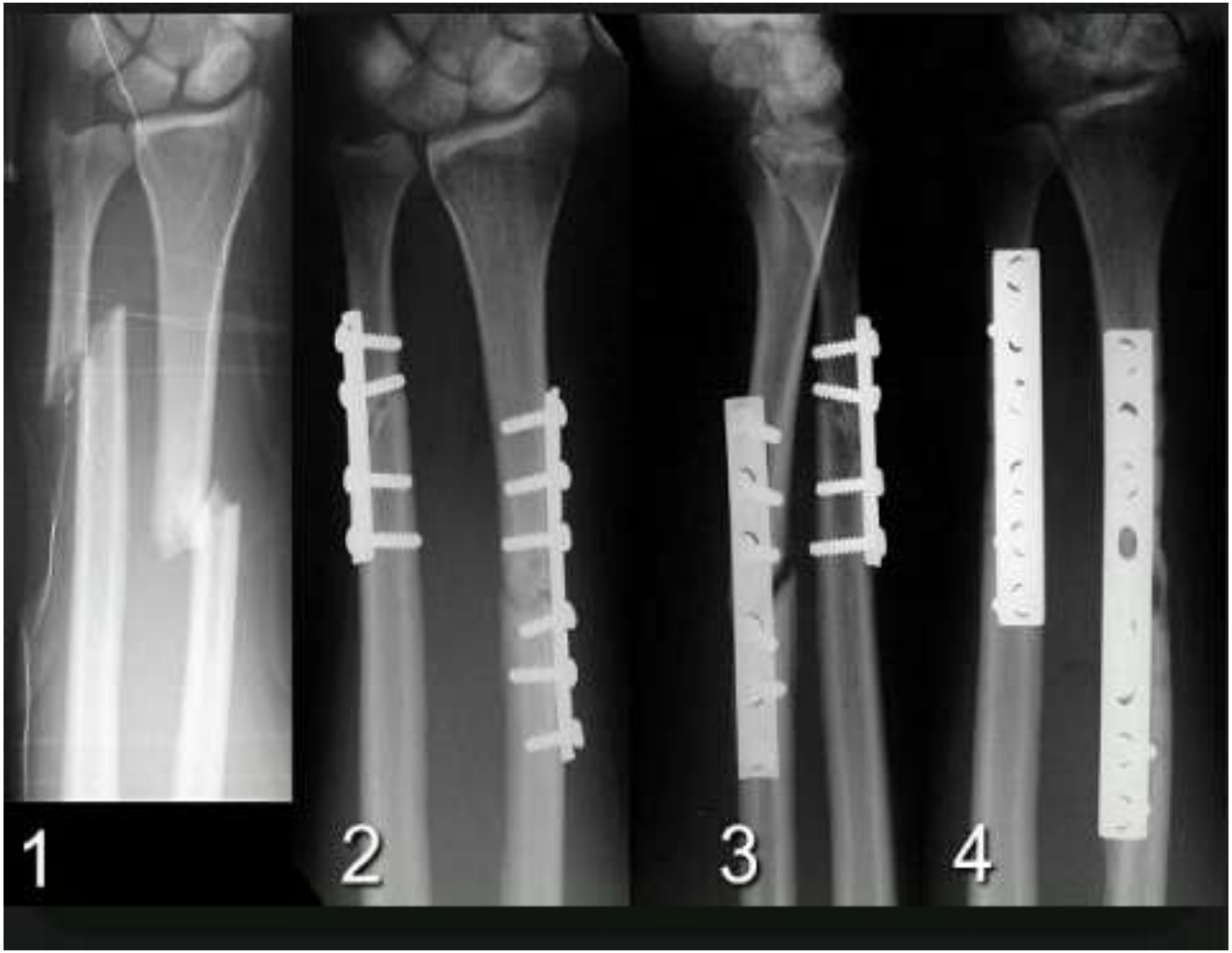




# Plates



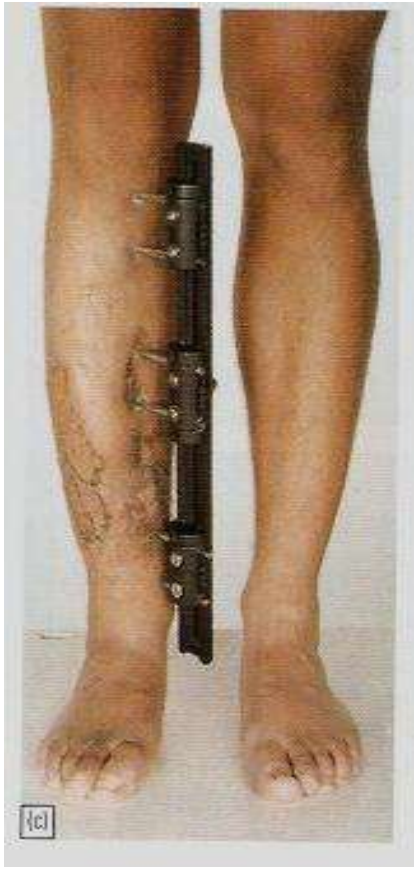




Open Reduction Internal Fixation of Femoral Shaft
Right Upper Leg
Orientation View
Open Reduction
Internal Fixation
Pelvic area
Femoral head
Femoral shaft
Six hole
Alta buttress
plate
Screwing plate
into place
Medial
(inner) Side
Reducing fracture and positioning
for compression across the fracture site

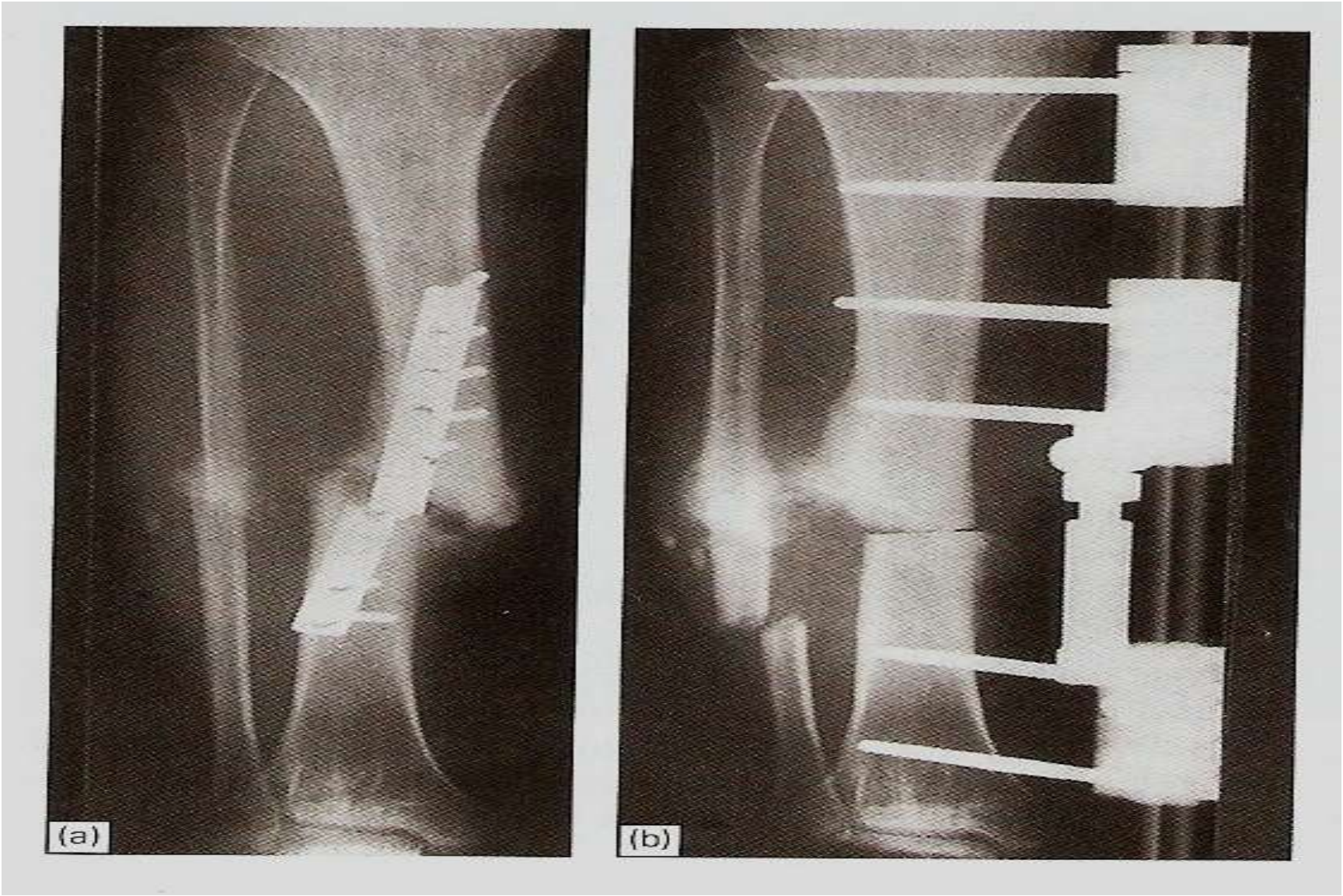

1
2
3
4

# EXTERNAL FIXATION

# Principle



The bone **is transfixed above** and **below** the fracture with screw or pins or tension wire and these are then clamped to a frame or **connected** to each other by rigid bars outside the skin




(a)The patient was fixed with a plate and screw but did not unite (b) external fixation was applied

## Continuous Traction

- It is the application of a pulling force to an injured or diseased part of the body or an extremity while counter traction pulls in the opposite direction.

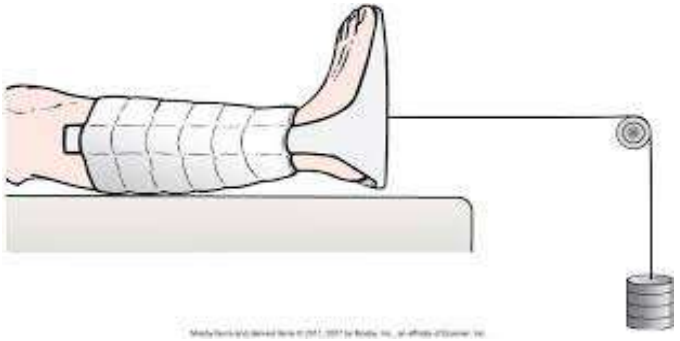
# Traction-Purposes

- Prevent or reduce muscle spasm
- Immobilize a joint or part of the body
- Reduce a fracture or dislocation
- Treat a pathologic condition.

The two most common types of traction are

- **Skin traction**
- **Skeletal traction**

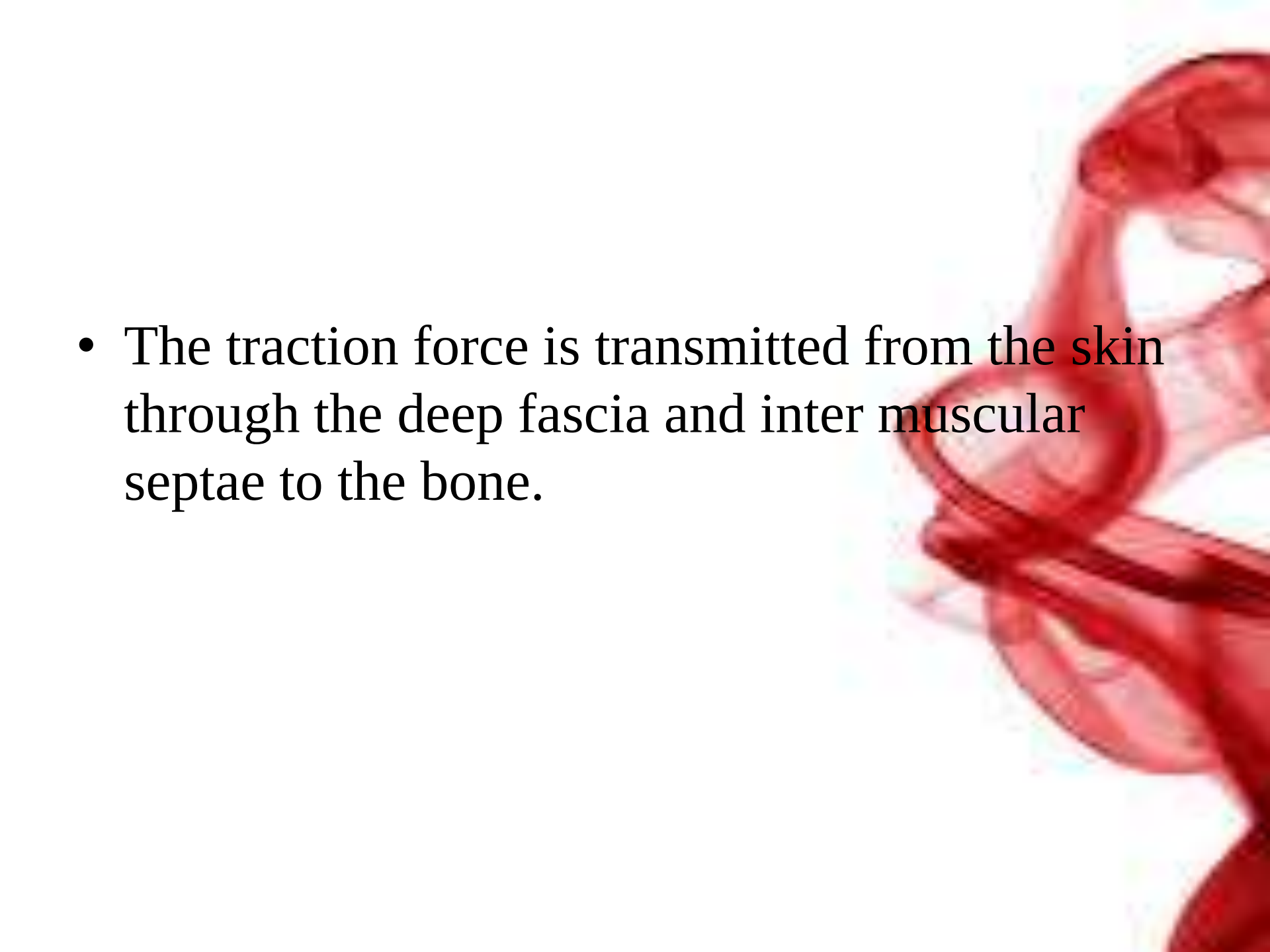
# Skin Traction



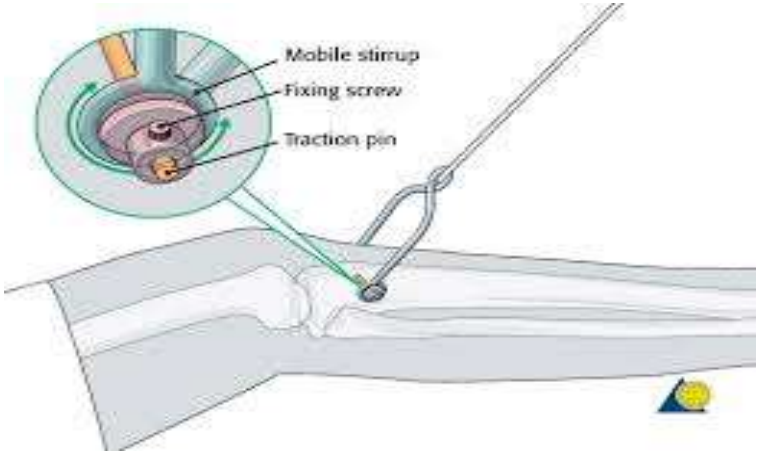
# Skin traction

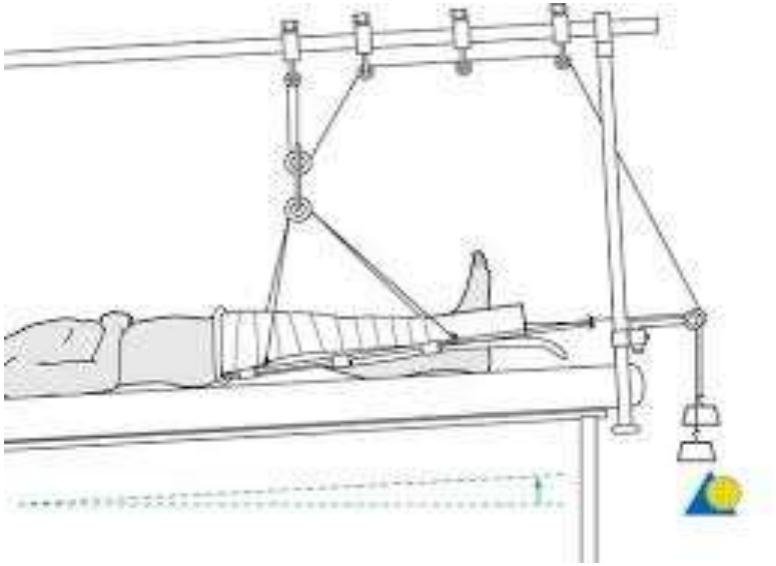
- It is generally used for short term treatment (48 to 72 hours) until skeletal traction or surgery is possible.
- An adhesive strap is applied on the skin and traction applied.
- The traction weights are usually limited to 2.3 to 4.5 kg.
- Pelvic or cervical skin traction may require heavier weights applied intermittently.

- The traction force is transmitted from the skin through the deep fascia and inter muscular septae to the bone.



# Skeletal Traction



# Skeletal Traction

- Provides long term pull that keeps the injured bones and joints aligned.
- Applied directly on the bone by inserting K-wire or Steinmann pin through the bone to align and immobilize the injured body part.
- Used to align injured bones and joints or to treat joint contractures and congenital hip dysplasia
- Weight for skeletal traction ranges from 2.3 to 20.4 kg. The use of too much weight can result in delayed union or nonunion.

# 2)**Fracture immobilization**

- To prevent displacement or angulation of the fracture.
- To prevent movement that might interfere with the union.
- To relieve pain

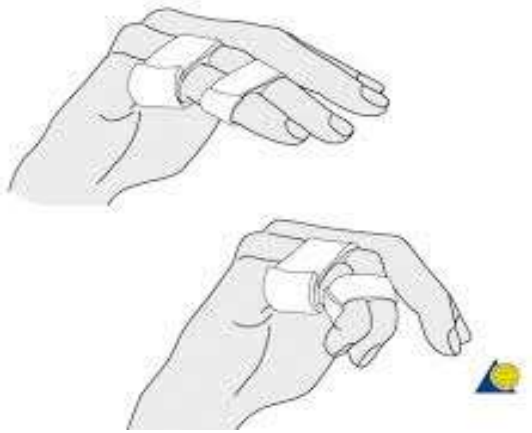
- After the fracture has been reduced, the bone fragments must be immobilized, or held in correct position and alignment, until union occurs.
- Immobilization may be accomplished by **external or internal fixation**.

- Methods of external fixation include bandages, casts, splints, continuous traction, and external fixators.

- Metal implants used for internal fixation serve as internal splints to immobilize the fracture.

- Strapping : The fractured part is strapped to an adjacent part of the body.

  Eg: phalanx fracture, where one finger is strapped to the adjacent normal finger.



- Sling : A fracture of the upper extremity is immobilized with the help of a sling, mostly to relieve pain in cases where strict immobilization is not necessary.

  Eg : Triangular sling used for a fracture of the clavicle

- Casts immobilization
- A cast is a temporary circumferential immobilization device.
- It allows the patient to perform many normal activities of daily living while providing sufficient immobilization to ensure stability.
- Cast materials are natural(plaster of paris), synthetic acrylic, latex free polymer or a hybrid of materials

- Plaster of Paris (gypsum salt) is $CaSO_4.1/2\ H_2O$ in dry form, which becomes $CaSO_4.2H_2O$ on wetting.
- This conversion is an exothermic reaction and is irreversible. The plaster sets in the given shape on drying.

Plaster casts commonly used are

- Minerva cast – cervical spine disease
- Colles' cast -colles' fracture
- Hip spica - fracture of the femur.
- Hanging cast – fracture of the humerus.

## Splints

- Splints are used for immobilizing fractures; either temporary during transportation or for definitive treatment.

# Common splints and their uses

- Thomas splint: fracture femur
- Crammer –wire splint: emergency immobilization
- Volkmann’s splint: volkmann’s ischemic contracture.
- Aluminium splint: immobilization of fingers.
- Boston brace: Scoliosis
- Lumbar corset: Back ache

# Operative Methods

- External Fixation
- Internal Fixation

**Drug therapy**

Pain management

Central and peripheral muscle relaxants, such as carisoprodol, cyclobenzaprine or methocarbamol may be prescribed for relief of pain.

# Phase III- Rehabilitation of a fractured limb

- Rehabilitation begins at the time of injury, and goes on till maximum possible functions have been regained.

**Exercises**

- During immobilization: Parts of the limb out of paster should be mobilized to prevent stiffness and weakness of these parts. The muscles within the plaster should be exercised in order to prevent wasting.

- After removal of immobilization:

- The skin is cleaned, scales removed and some oil applied to take care of the dryness.
- The joints are moved, to regain the range of motion. It needs hot fomentation, active and active- assisted joint mobilizing exercises.

# Complications of fractures

- **Systemic**
- **Local**

**Systemic**

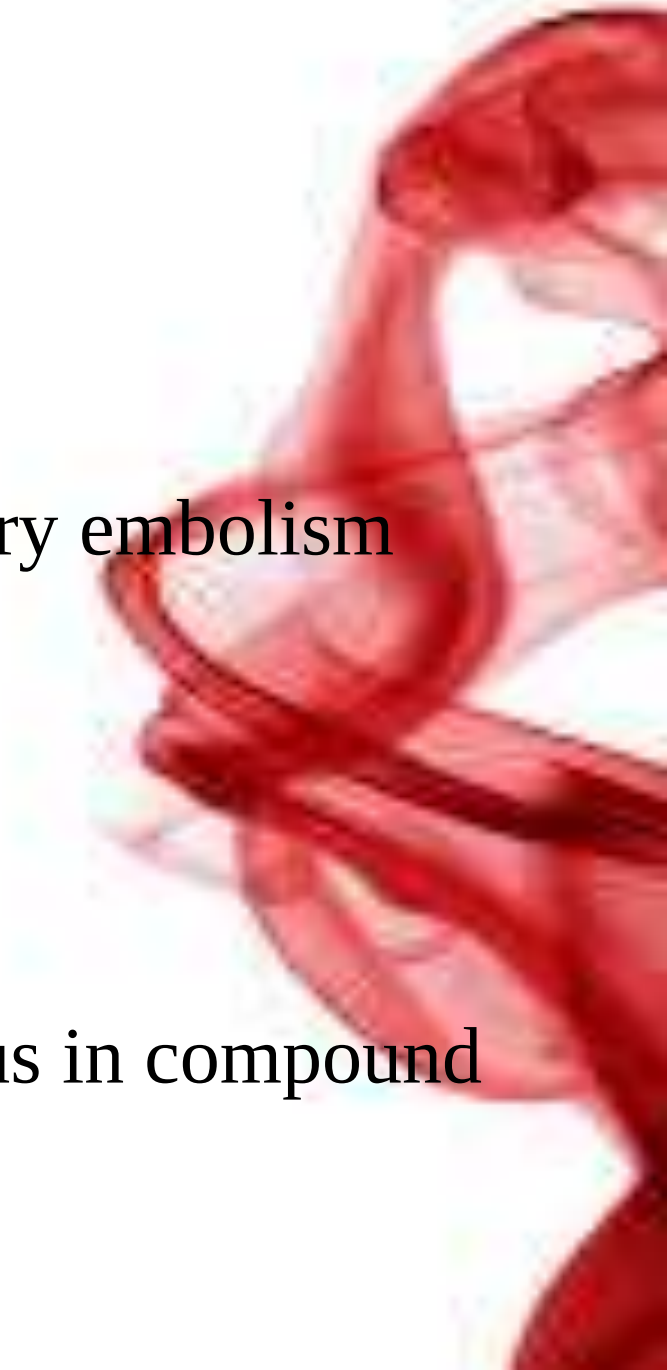
- Hypovolaemic shock

**Local**

- Injury to major vessels
- Injury to muscles and tendons
- Injury to joints
- Injury to viscera

Systemic

- Hypovolaemic shock
- venous thrombosis and pulmonary embolism
- Fat embolism
- Fracture fever
- Crush syndrome
- ARDS
- hypostatic pneumonia and tetanus in compound fracture.



# SHOCK (EARLY)

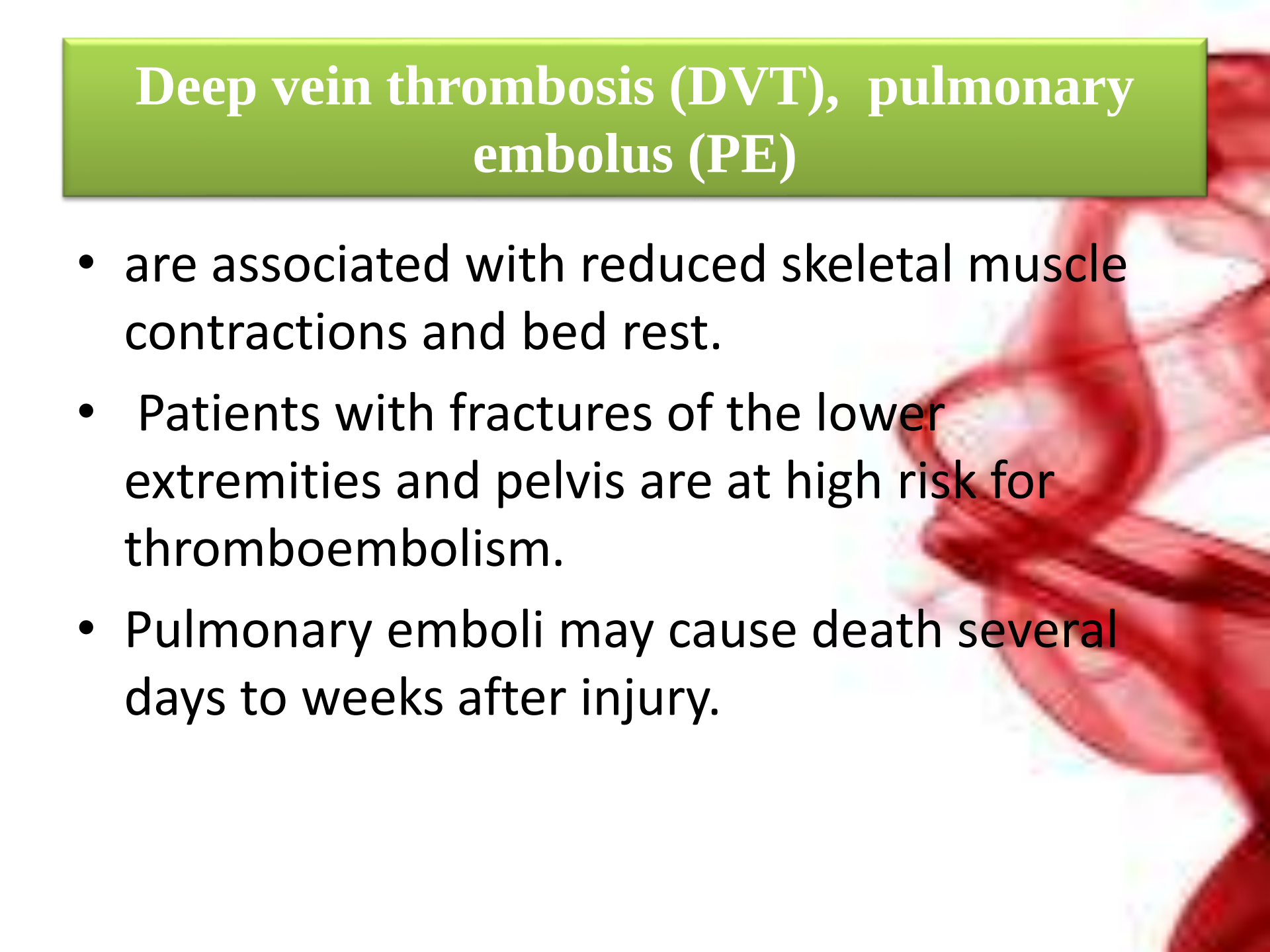
- Hypovolemic or traumatic shock resulting from hemorrhage (both visible and nonvisible blood loss) and from loss of extracellular fluid into damaged tissues
- may occur in fractures of the extremities, thorax, pelvis, or spine. Because the bone is very vascular, large quantities of blood may be lost as a result of trauma, especially in fractures of the femur and pelvis.
- Treatment of shock consists of restoring blood volume and circulation, relieving the patient's pain, providing adequate splinting, and protecting the patient from further injury and other complications.

# VOLKMANN'S CONTRACTURE

- Results from unrelieved compartment syndrome.
- Due to ischemia muscle is gradually replaced by fibrous tissue.
- Leads to a permanently stiff , claw- like deformity of the hand and arm.
- Prevention by prompt recognition followed by limb splinting and compartment decompression.

# Deep vein thrombosis (DVT), pulmonary embolus (PE)

- are associated with reduced skeletal muscle contractions and bed rest.
- Patients with fractures of the lower extremities and pelvis are at high risk for thromboembolism.
- Pulmonary emboli may cause death several days to weeks after injury.



# Disseminated intravascular coagulopathy (DIC)

- includes a group of bleeding disorders with diverse causes, including massive tissue trauma.
- Manifestations of DIC include ecchymoses, unexpected bleeding after surgery, and bleeding from the mucous membranes, veni puncture sites, and gastrointestinal and urinary tracts.

Local

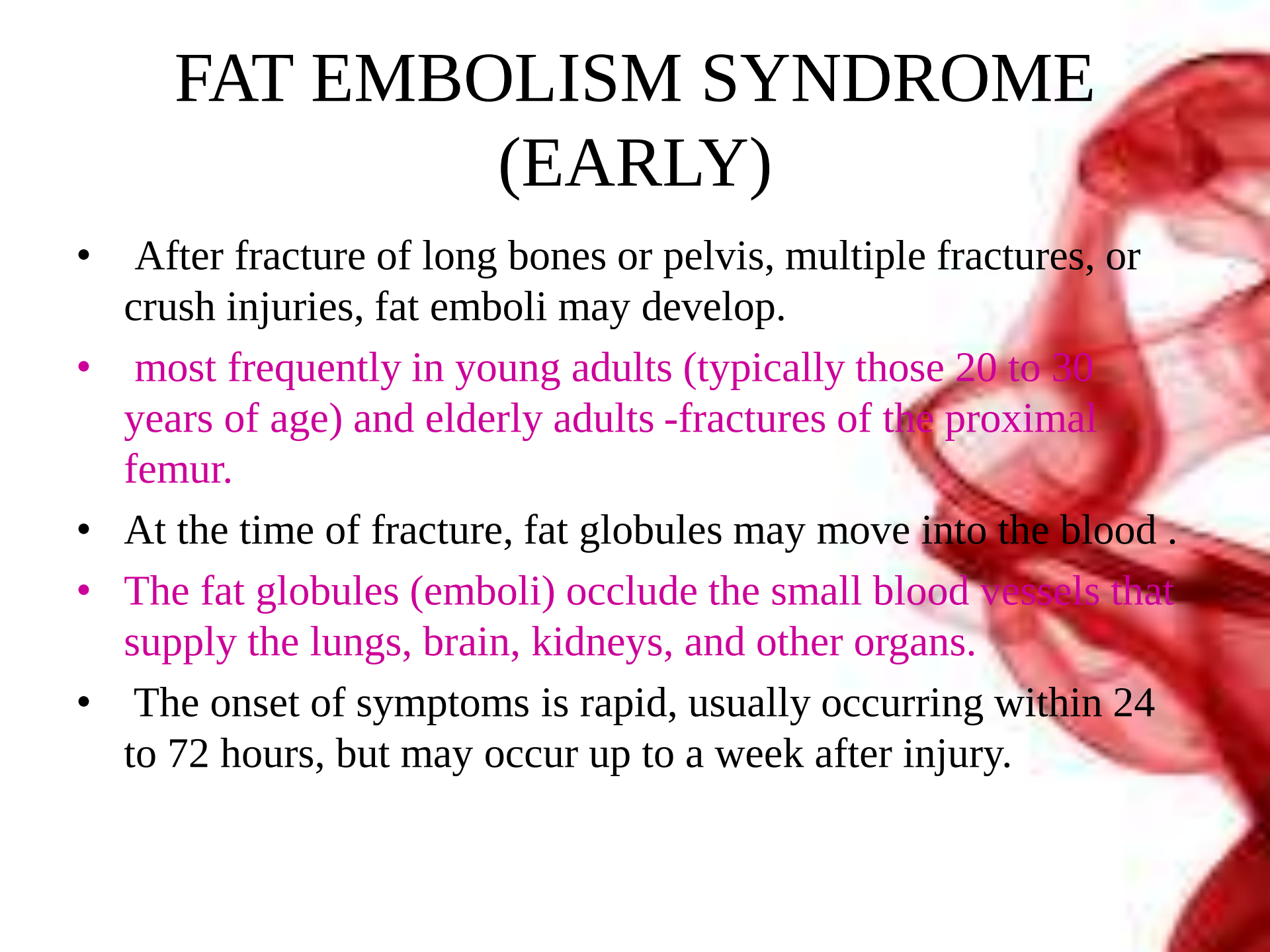
- Infection
- Compartment syndrome
- Fat embolism syndrome (early)

# INFECTION

- All open fractures are considered contaminated.
- Surgical internal fixation of fractures carries **a risk for infection**.
- The nurse must monitor for and teach the patient to monitor for signs of infection, including tenderness, pain, redness, swelling, local warmth, elevated temperature, and purulent drainage.
- Infections must be treated promptly.
- Antibiotic therapy must be appropriate and adequate for prevention and treatment of infection

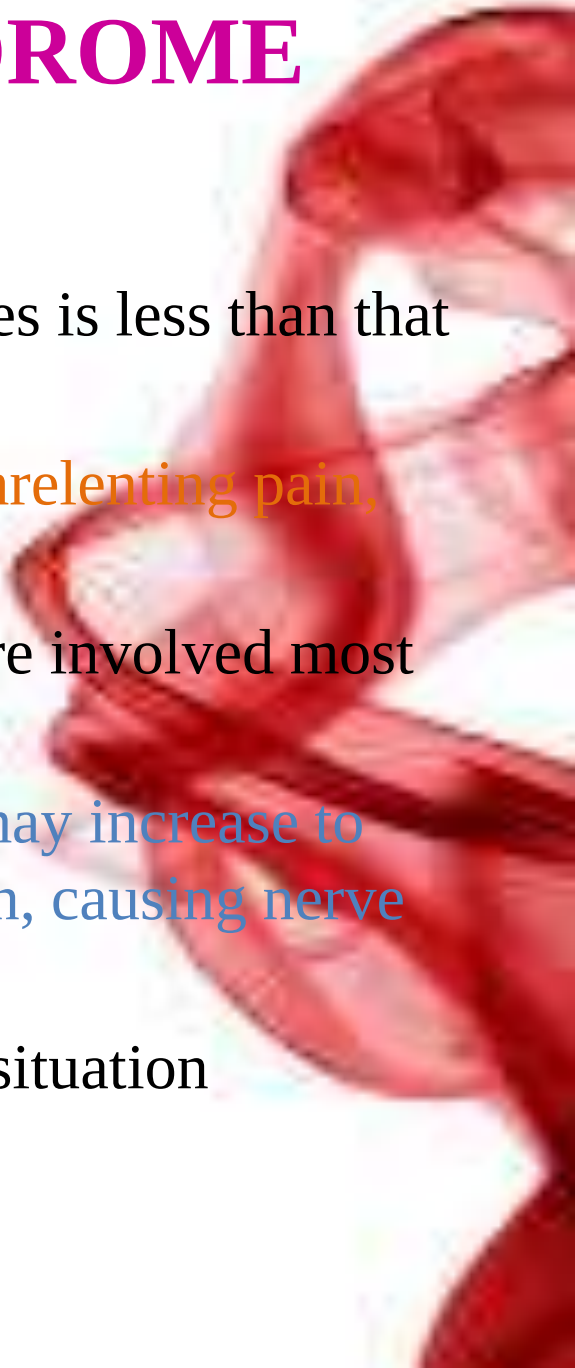
# FAT EMBOLISM SYNDROME (EARLY)

- After fracture of long bones or pelvis, multiple fractures, or crush injuries, fat emboli may develop.
- most frequently in young adults (typically those 20 to 30 years of age) and elderly adults -fractures of the proximal femur.
- At the time of fracture, fat globules may move into the blood .
- The fat globules (emboli) occlude the small blood vessels that supply the lungs, brain, kidneys, and other organs.
- The onset of symptoms is rapid, usually occurring within 24 to 72 hours, but may occur up to a week after injury.



# COMPARTMENT SYNDROME (EARLY)

- develops when tissue perfusion in the muscles is less than that required for tissue viability.
- The patient complains of deep, throbbing, unrelenting pain, which is not controlled by opioids.
- The forearm and leg muscle compartments are involved most frequently.
- The pressure within a muscle compartment may increase to such an extent as to decrease microcirculation, causing nerve and muscle anoxia and necrosis.
- Permanent function can be lost if the anoxic situation continues for longer than 6 hours.



Late complications

- delayed union
- mal-union
- Non union
- Cross union

Others

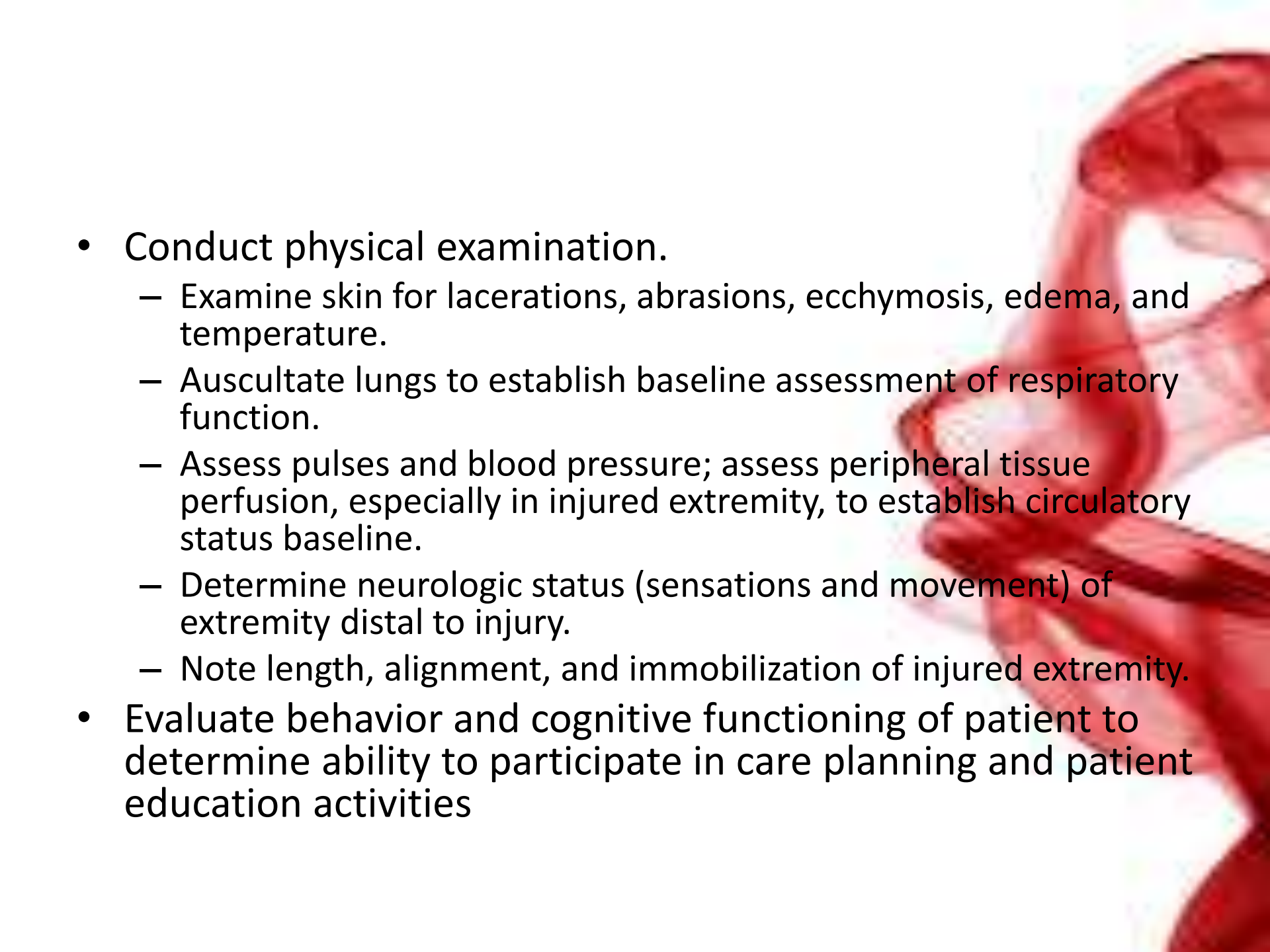
- Avascular necrosis
- shortening
- Volkmann’s ischemic contracture,
- myositis ossificans
- Joint instability and stiffness.

# NURSING MANAGEMENT

# Nursing Assessment

- Ask patient how the fracture occurred, mechanism of injury
- Ask patient to describe location, character, and intensity of pain
- To aid in evaluation of neurovascular status ask patient to describe sensations in injured extremity.
- To assess functional mobility observe patient's ability to change position.
- Note patient's emotional status and behavioral indicators of ability to cope with stress of injury.
- Assess patient's support system; identify current and potential sources of support, assistance, and care giving.

- Conduct physical examination.
  - Examine skin for lacerations, abrasions, ecchymosis, edema, and temperature.
  - Auscultate lungs to establish baseline assessment of respiratory function.
  - Assess pulses and blood pressure; assess peripheral tissue perfusion, especially in injured extremity, to establish circulatory status baseline.
  - Determine neurologic status (sensations and movement) of extremity distal to injury.
  - Note length, alignment, and immobilization of injured extremity.
- Evaluate behavior and cognitive functioning of patient to determine ability to participate in care planning and patient education activities



# Nursing Diagnoses

- Risk for Deficient Fluid Volume related to hemorrhage and shock
- Impaired Gas Exchange related to immobility and potential pulmonary emboli or fat emboli
- Risk for Peripheral Neurovascular Dysfunction
- Risk for Injury related to thromboembolism
- Acute or Chronic Pain related to injury
- Risk for Infection related to open fracture or surgical intervention
- Bathing or Hygiene Self-Care Deficit related to immobility
- Impaired Physical Mobility related to injury/treatment modality
- Risk for Disuse Syndrome related to injury and immobilization
- Risk for Post trauma Syndrome related to cause of injury

# References


- Black.M.J, Haawks.J.H. Medical Surgical Nursing. VoII. 7th Edition.New delhi Saunders publication.
- Bracinwald.E.Fauci.S A, Hanser L.S, Jaeson. J.L,Kasper.P .L, Long.Harrison's Principles of Internal Medicine. 16th edition.
- Burke. K, Lemon. P. Medeical Surgical Nursing. 7th edition.New Delhi. Saunder's Publication
- Lewis. S. Heitkemper M. Medical surgical Nursing. 6th edition. Missouri: Elseveir's publications
- Smelter S C, Bare B G. Textbook of Medical Surgical Nursing. 12th edition. Philadelphia: Lippincott Williams and Wilikins Publishers

Tag By Aalena

# ThankYou