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CLOSED INJURIES

- **CLOSED SOFT TISSUES INJURIES**
- **CRUSH-SYNDROME**
- **DISLOCATIONS AND FRACTURES**

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CLOSED SOFT TISSUES INJURIES

are mechanical injury to the soft tissues without defects in skin covering

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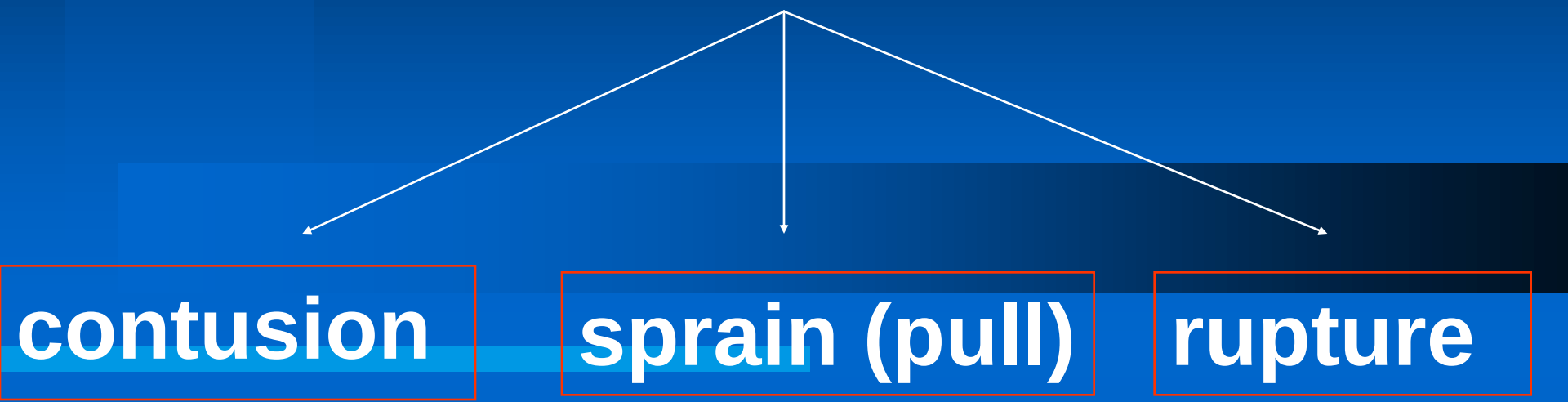
Classification



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CONTUSION

- **it is a damage of soft tissues and organs without visible disturbance of their anatomical integrity**
- **occurs as a result of a fall or a blow from a blunt object**
- **can also accompany injuries of internal organs**

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GRAVITY OF A CONTUSION

is determined by factors:

- **character of the traumatizing agent**
- **a type of tissues and their physical condition.**

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CONTUSION
Clinical signs

- **pain**
- **swelling**
- **functional disorder**
- **haemorrhage**

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CONTUSION
Treatment

- **rest**
- **pressure bandage**
- **raised position of an extremity**
- **ice pack**
- **immobilization**
- **gemostatic therapy.**

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SPRAIN

- **is a damage of joint in which some of fibres of a supporting ligament are ruptured, but anatomical continuity remaining intact**

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SPRAIN
Clinical signs

- **local tenderness**
- **tissue oedema**
- **painful joint movement**

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RUPTURE

- **is damage at the similar mechanism with a sprain , but the force exceeds resistance of tissues**
- **Rupture of**

muscle

- severe pain
- abrupt muscular paresis
- local haematoma formation

tendon

- local tenderness
- tissue oedema

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RUPTURE

- **Rupture of**

muscle

tendon

partial

complete

TREATMENT

immobilization with plaster

suture ruptured muscle or tendon

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CRUSH-SYNDROME

the same:

- **traumatic toxicosis**
- **syndrome of prolonged compression**
- **myorenal syndrome**

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CRUSH-SYNDROME

- **is a result of ischaemic necrosis of muscles, intoxication by the products of necrosis and increasing hepatic and renal failures**
- **occurs after the extremity has been freed from compression, when the blood circulation and lymph flow in an extremity is recovered.**

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Clinic periods of crush-syndrome :

1. **Oedema and vascular failure (1-3 day)**
2. **Acute renal failure (3-14 day)**
3. **Recovery**

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Gravity of syndrome

depends on three factors:

1. **Duration of a compression**
2. **volume of ischaemic tissues**
3. **degree of mechanical injuries.**

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First aid:

- **injection of promedol or morphine**
- **pressure bandage**
- **transportation splint**
- **antishock infusion**
- **application of ice packs**

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Treatment
1 period (vascular failure):

1. **novocainic circular block of the limb higher than a place of compression**
2. **anesthesia**
3. **application of ice packs**
4. **infusion therapy**
5. **antibacterial therapy**
6. **primary surgical debridement**
7. **early amputation of an extremity (in life-threatening cases)**

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Treatment
2 period (acute renal failure)

- **diuretics, haemodialysis**
- **longitudinal fasciotomy (wide incisions of the damaged area)**

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Treatment
3 period (recovery)

- **treatment of purulent wound, necrosis and gagrene**

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Dislocations and fractures

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Dislocations

is a complete displacement of the joint ends of bones in relation to each other

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Classification of dislocations

- congenital
- acquired
  - traumatic and pathologic;
  - complicated and non-complicated;
  - open and closed

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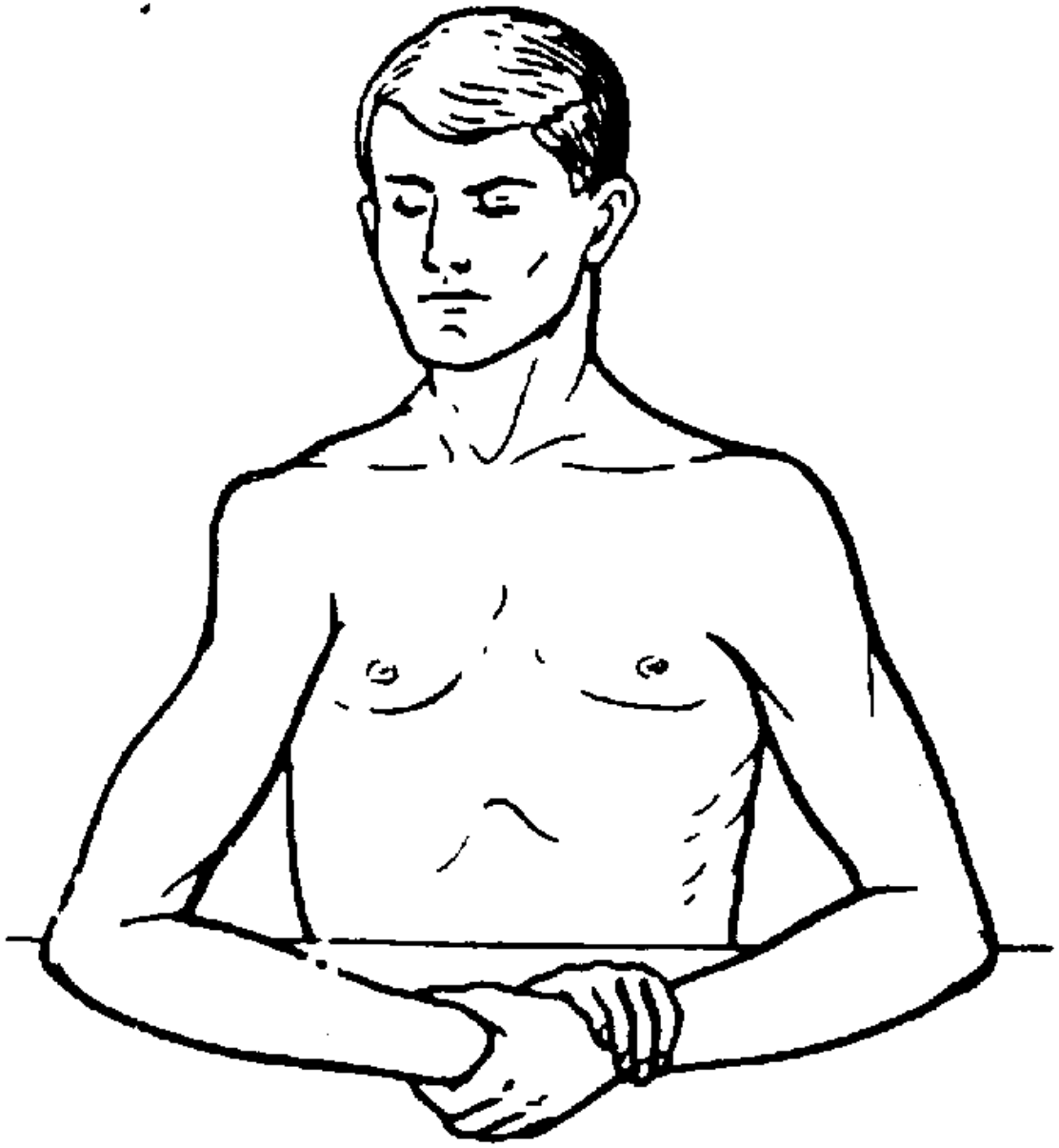
Signs of dislocation

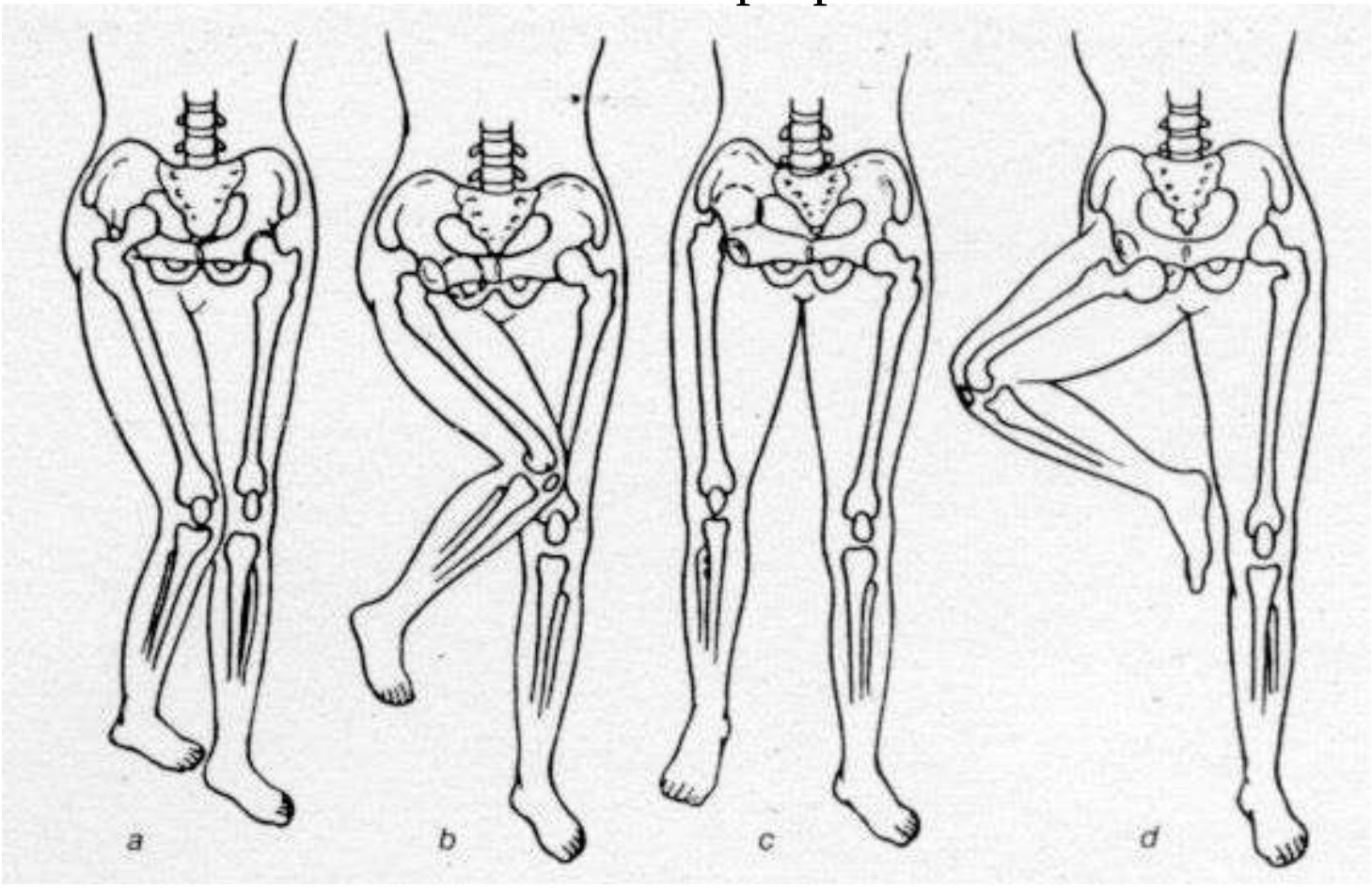
- severe pain in the affected joint
- unable to make any active or passive movements
- deformation at the joint region
- atypical, forced position of the joint
- after changing atypical position extremity returns to its original position if not held (*the springy resistance sign*)

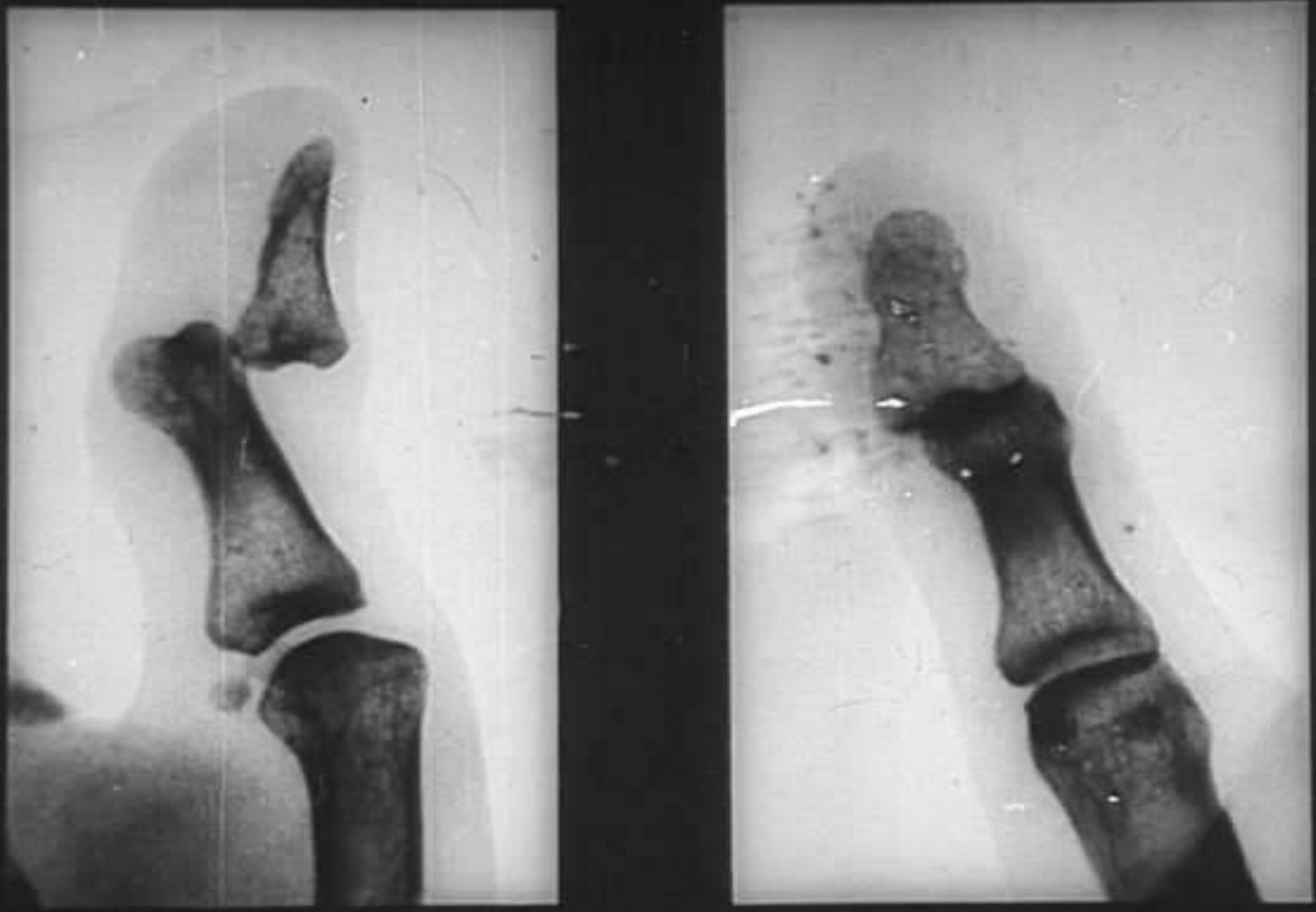


Humeral dislocation.

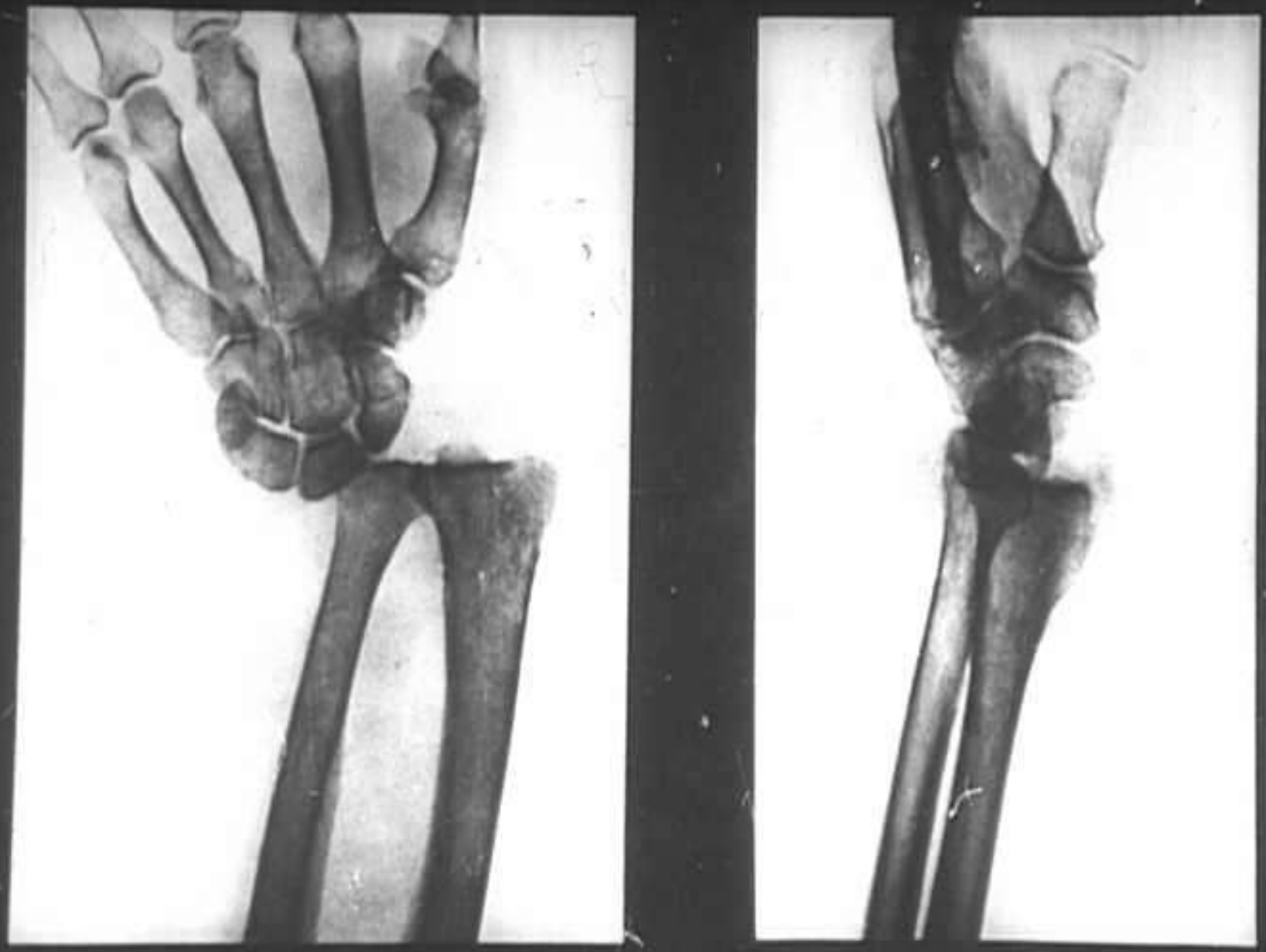
Femoral dislocation

iliac ishiac suprapubic obturator





Dislocation of finger



Dislocation of hand

Dislocation of forearm

Dislocation of humerus

Dislocation of hip

Dislocation of neck vertebra

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The treatment of traumatic dislocations

- **Reduction**
- **Immobilisation of the limb**
- **Restoration of functions.**

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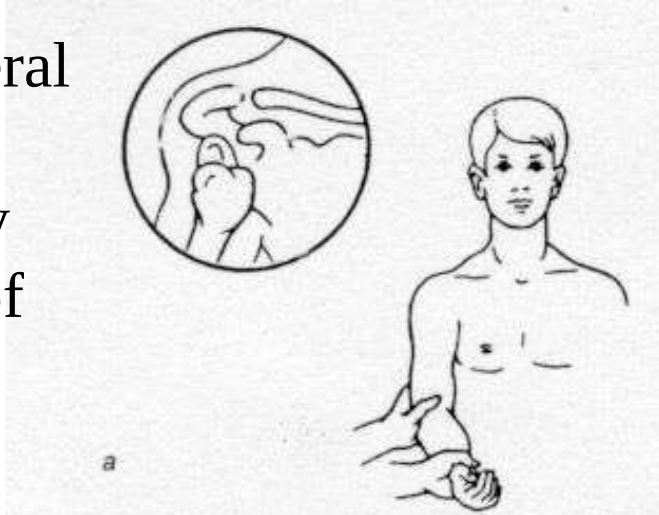
Reducing humeral dislocation (Koher's method)

Axial humeral traction followed by adduction of the arm



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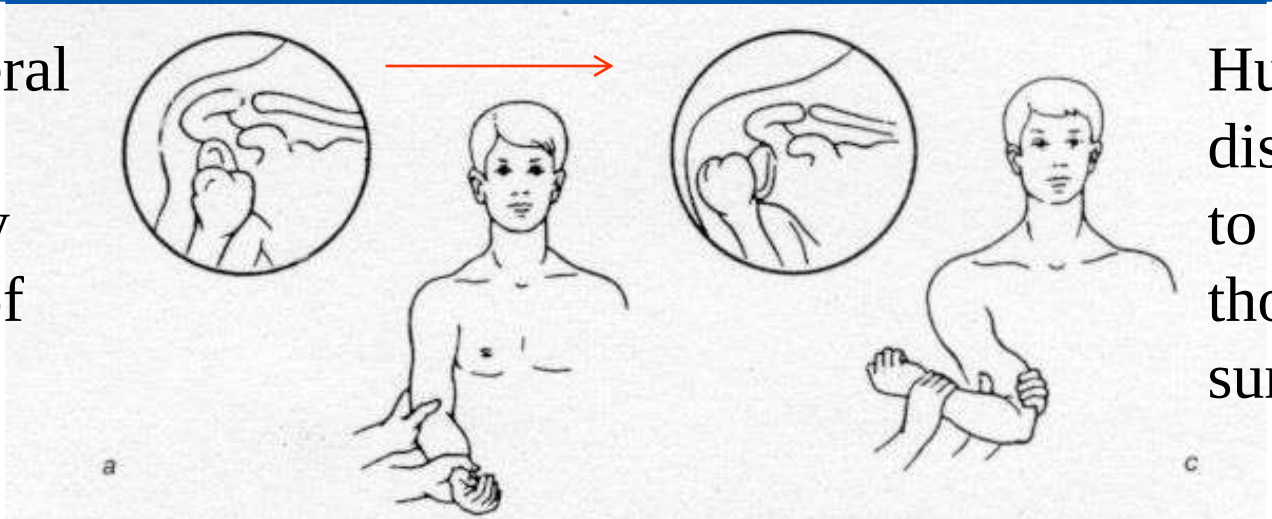

Humeral displacement to the anterior thoracic surface

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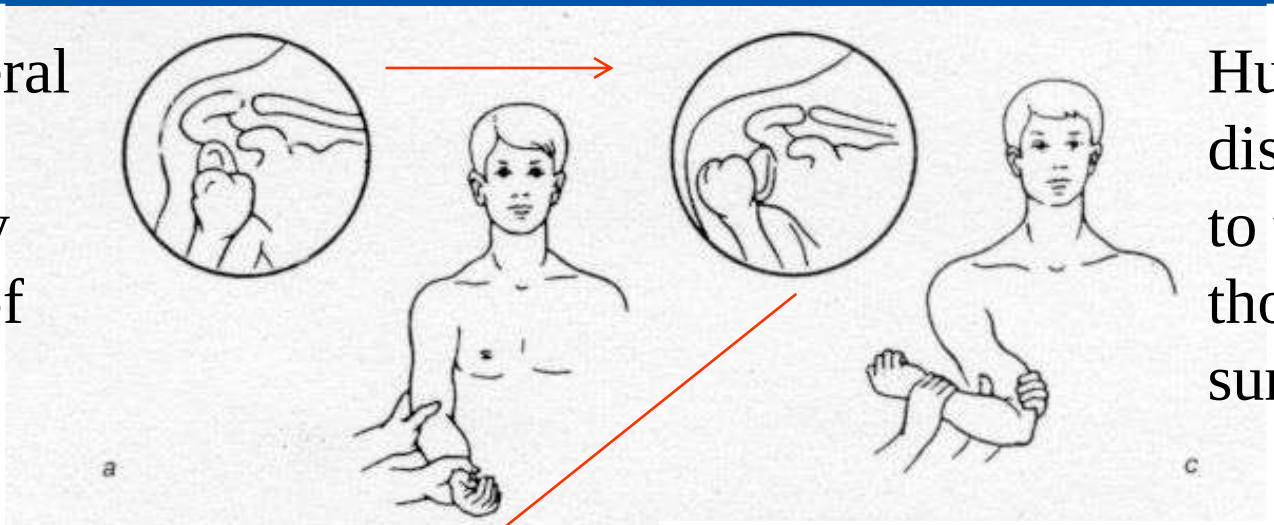
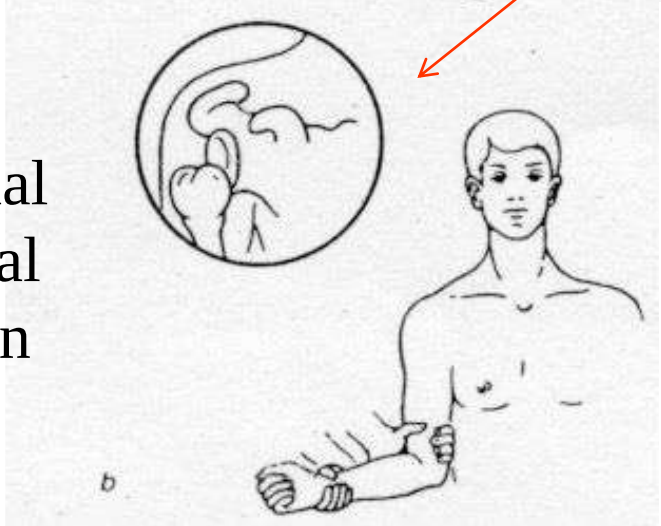
Axial humeral traction followed by adduction of the arm



Humeral displacement to the anterior thoracic surface

External humeral rotation



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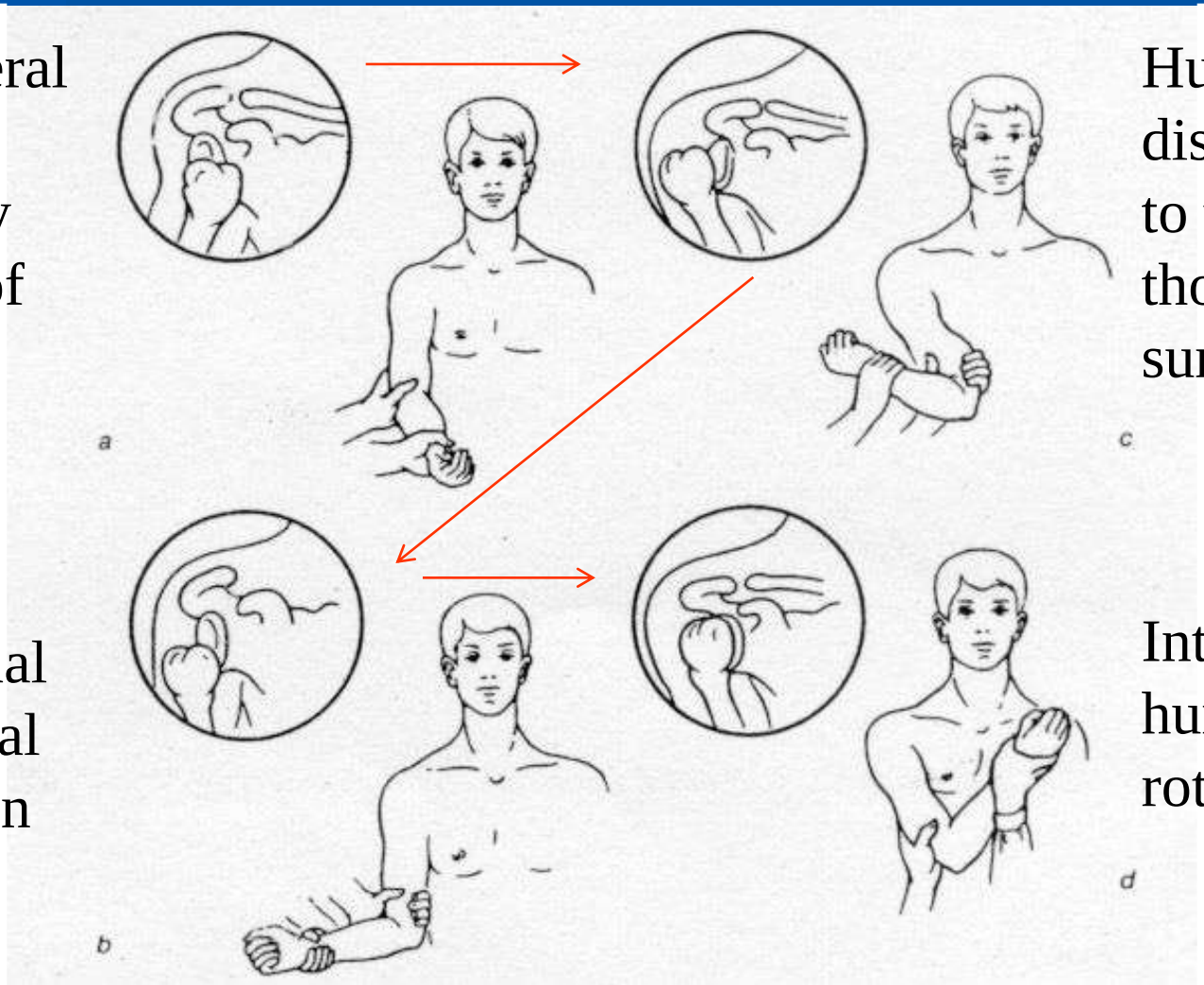
Reducing humeral dislocation (Koher's method)

Axial humeral traction followed by adduction of the arm



Humeral displacement to the anterior thoracic surface

External humeral rotation

Internal humeral rotation

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FRACTURE

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Fracture

is a break or interruption in the continuity of a bone, which is caused by mechanical exposure (trauma) or pathology (tumour or inflammation)

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Classification of fractures

I. Based on the origin of fractures:

- **congenital;**

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Classification of fractures

I. Based on the origin of fractures:

- **congenital;**
- **acquired**
  - ***traumatic***
  - ***pathological***

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Classification of fractures

II. Based on the extent of organ or tissue damage:

- complicated;
- non-complicated

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Classification of fractures

III. Based on the location of fractures, i.e. the position of the fracture line:

- **diaphyseal;**
- **epiphyseal;**
- **metaphyseal.**

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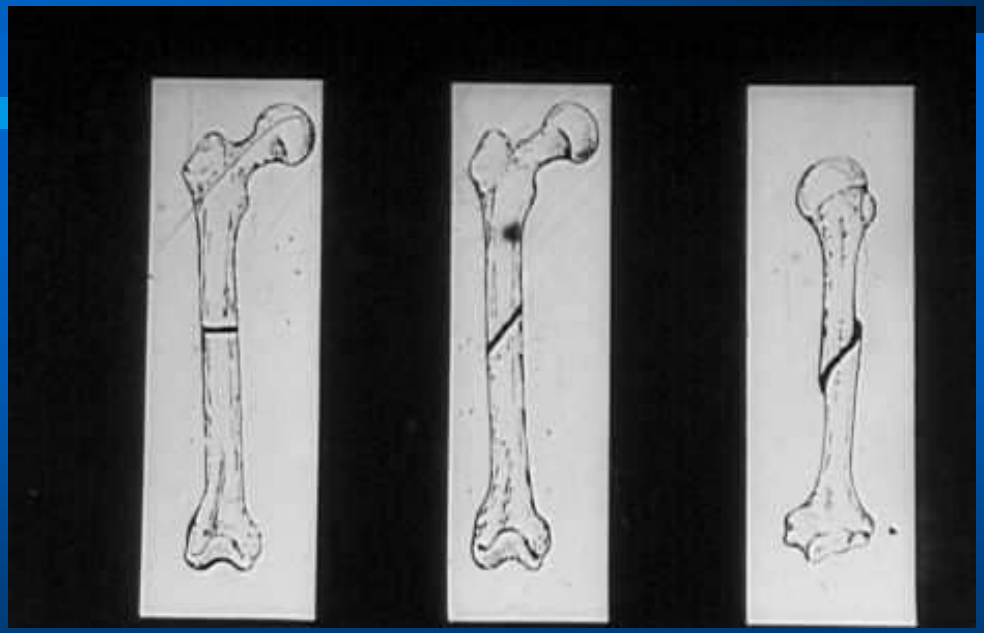
Classification of fractures

IV. Based on the relation of the fracture line to the longitudinal axis of the bone:



transverse oblique spiral

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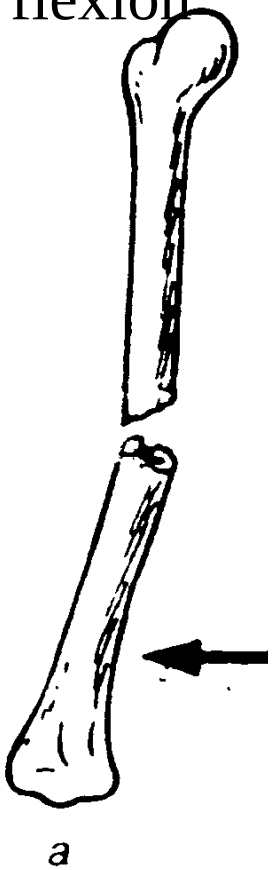
Bone fractures depending on mechanisms

Due to flexion



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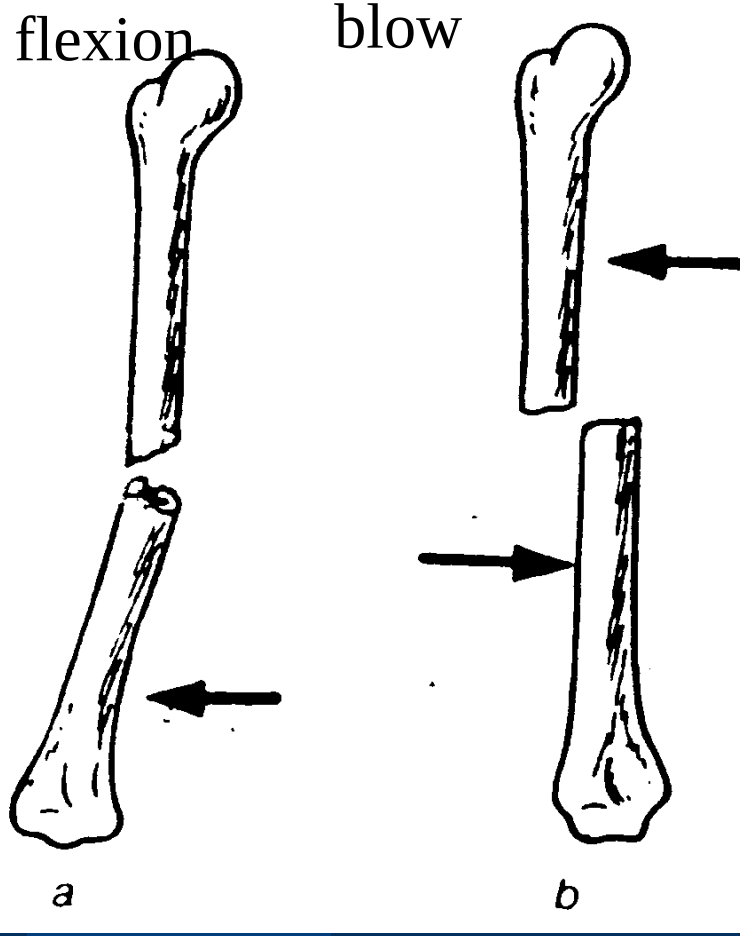
Bone fractures depending on mechanisms

Due to flexion

Due to a direct blow



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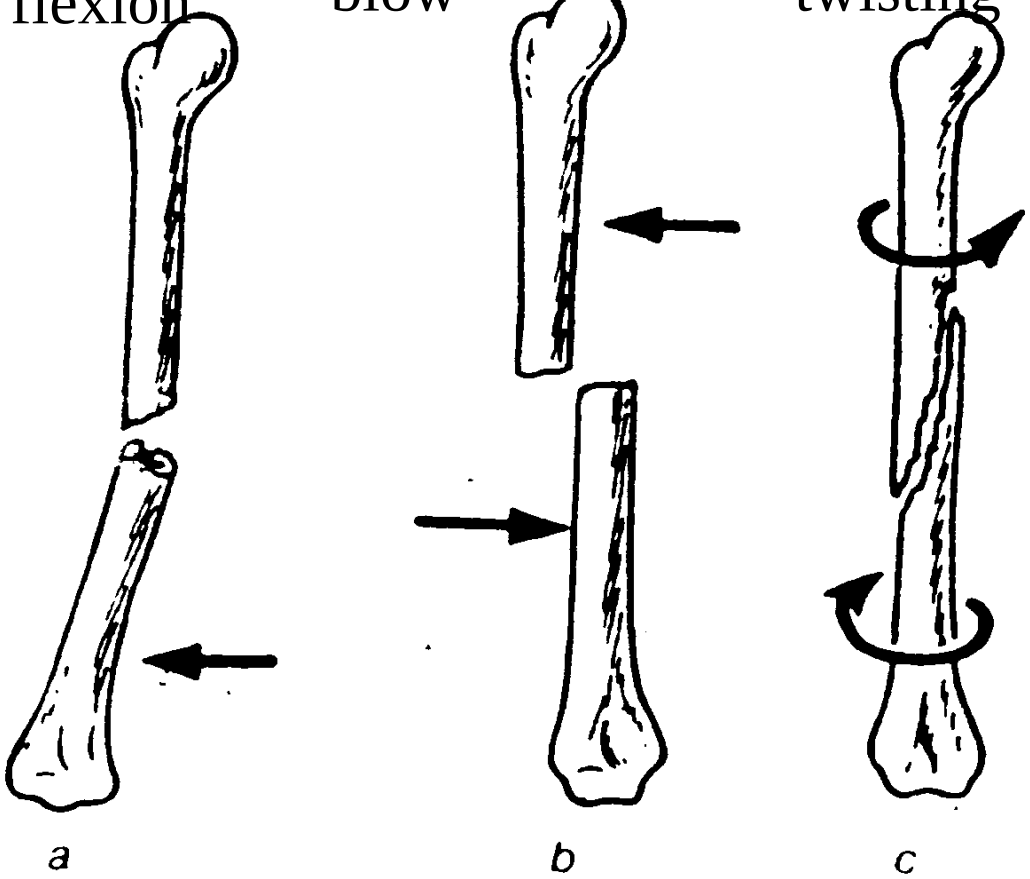
Bone fractures depending on mechanisms

Due to flexion

Due to a direct blow

Due to twisting



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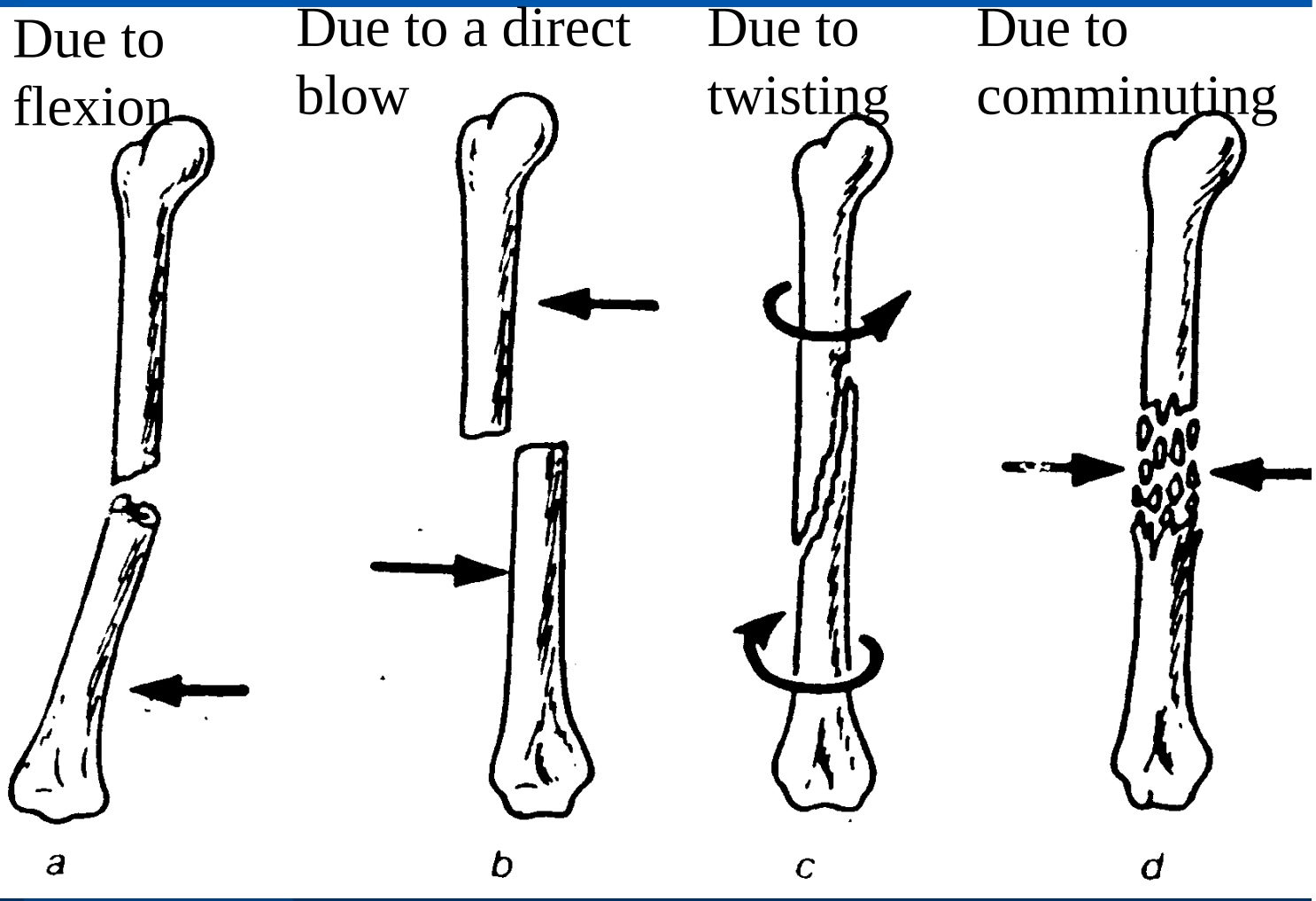
Bone fractures depending on mechanisms



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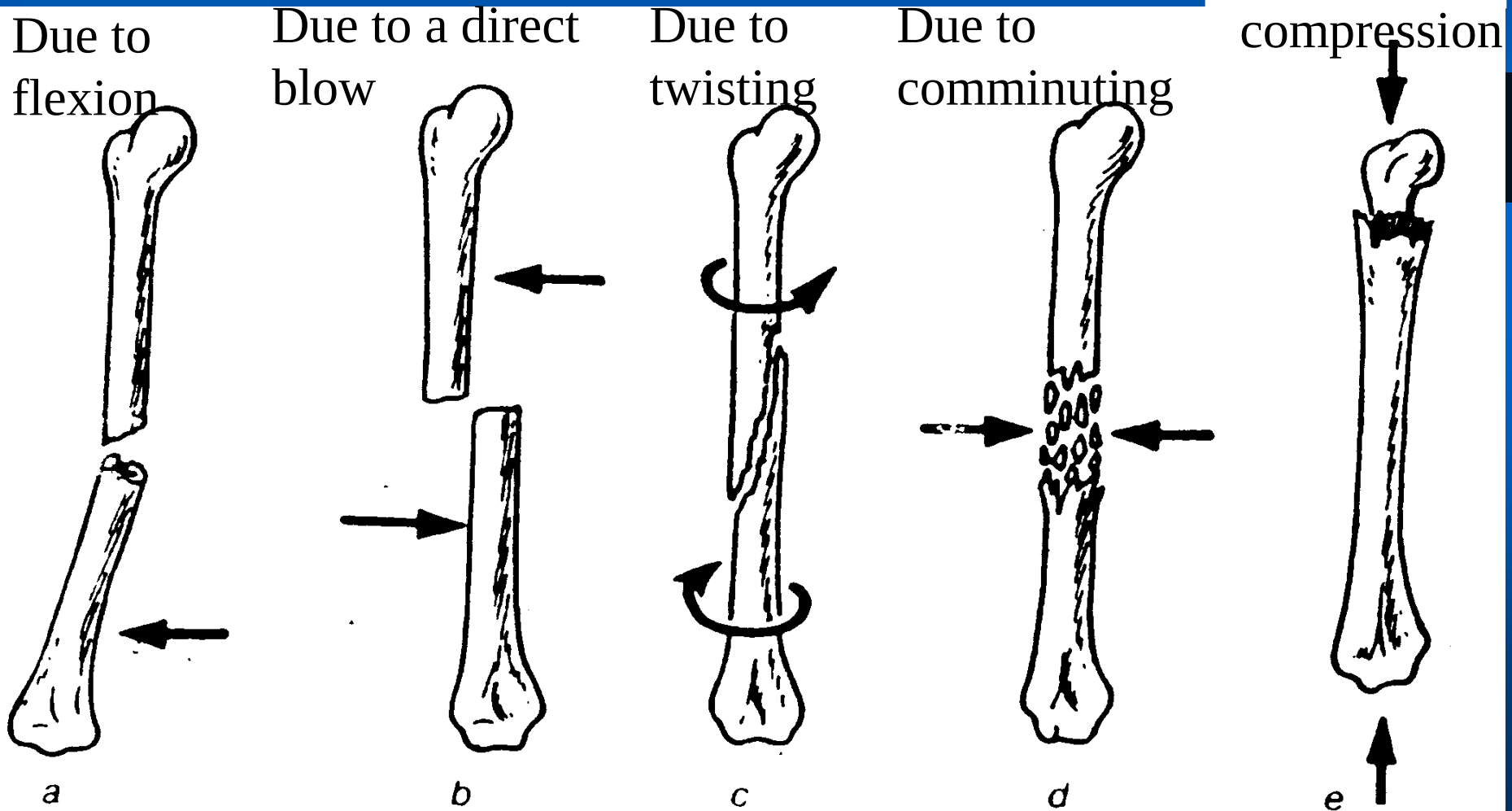

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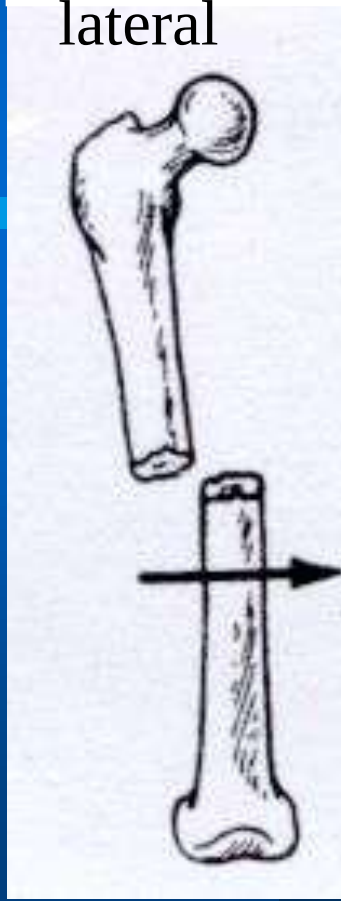
Bone fragment displacements due to fractures

lateral



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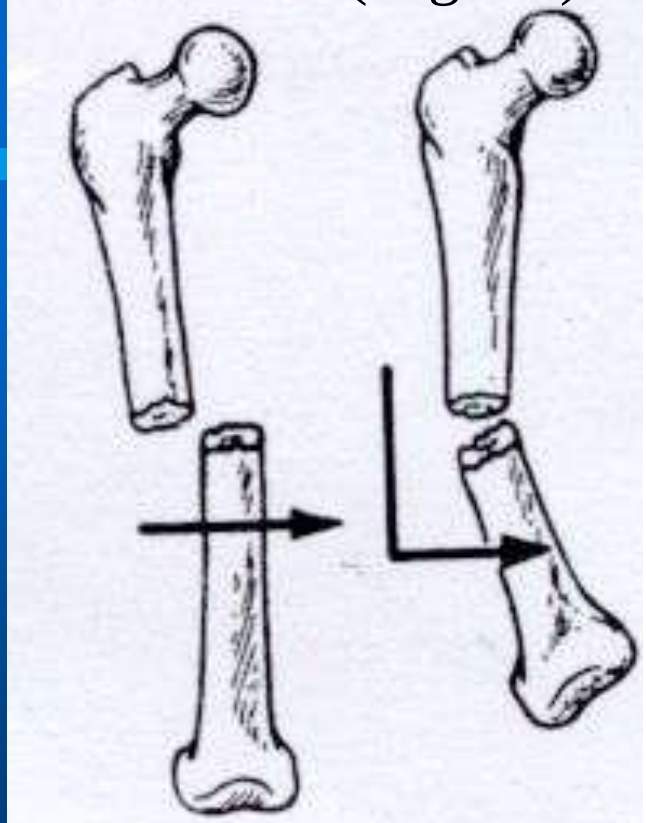
Bone fragment displacements due to fractures

lateral

Axial (angular)



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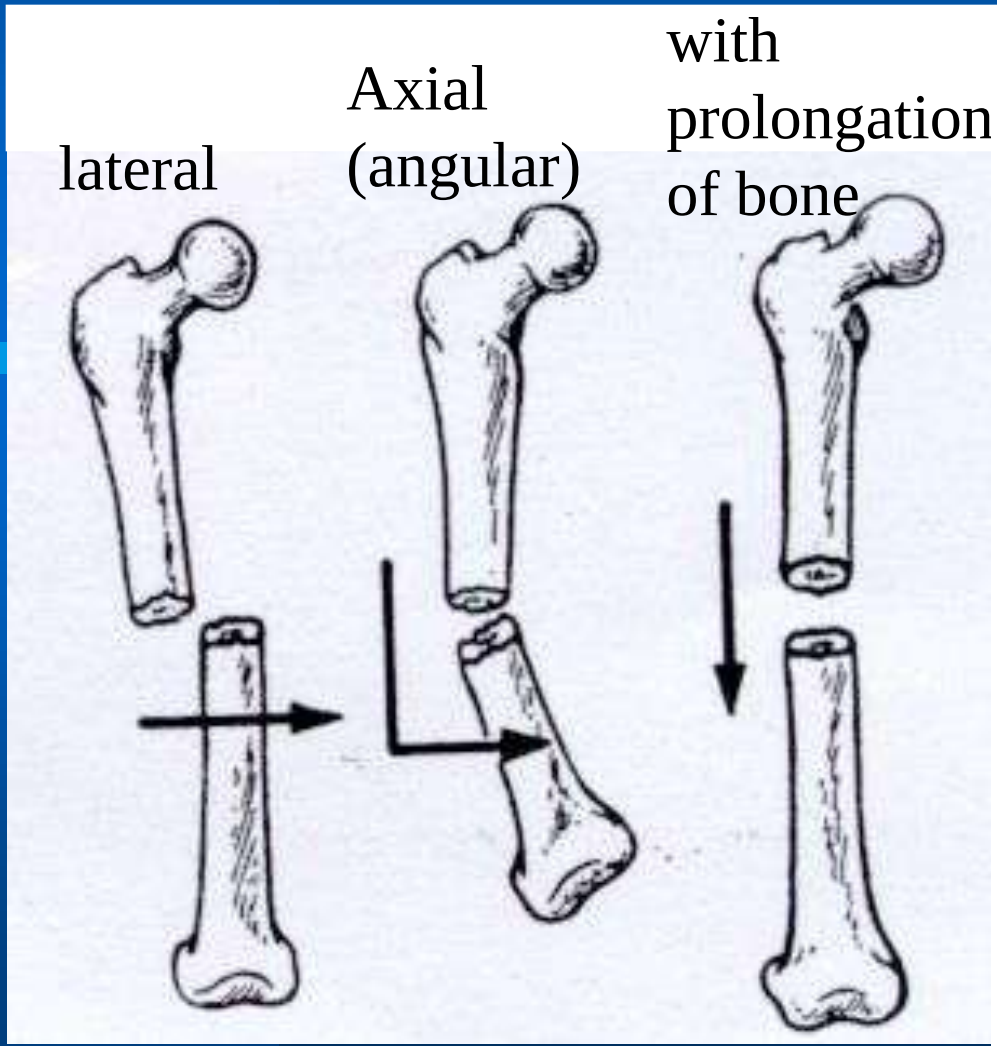
Bone fragment displacements due to fractures



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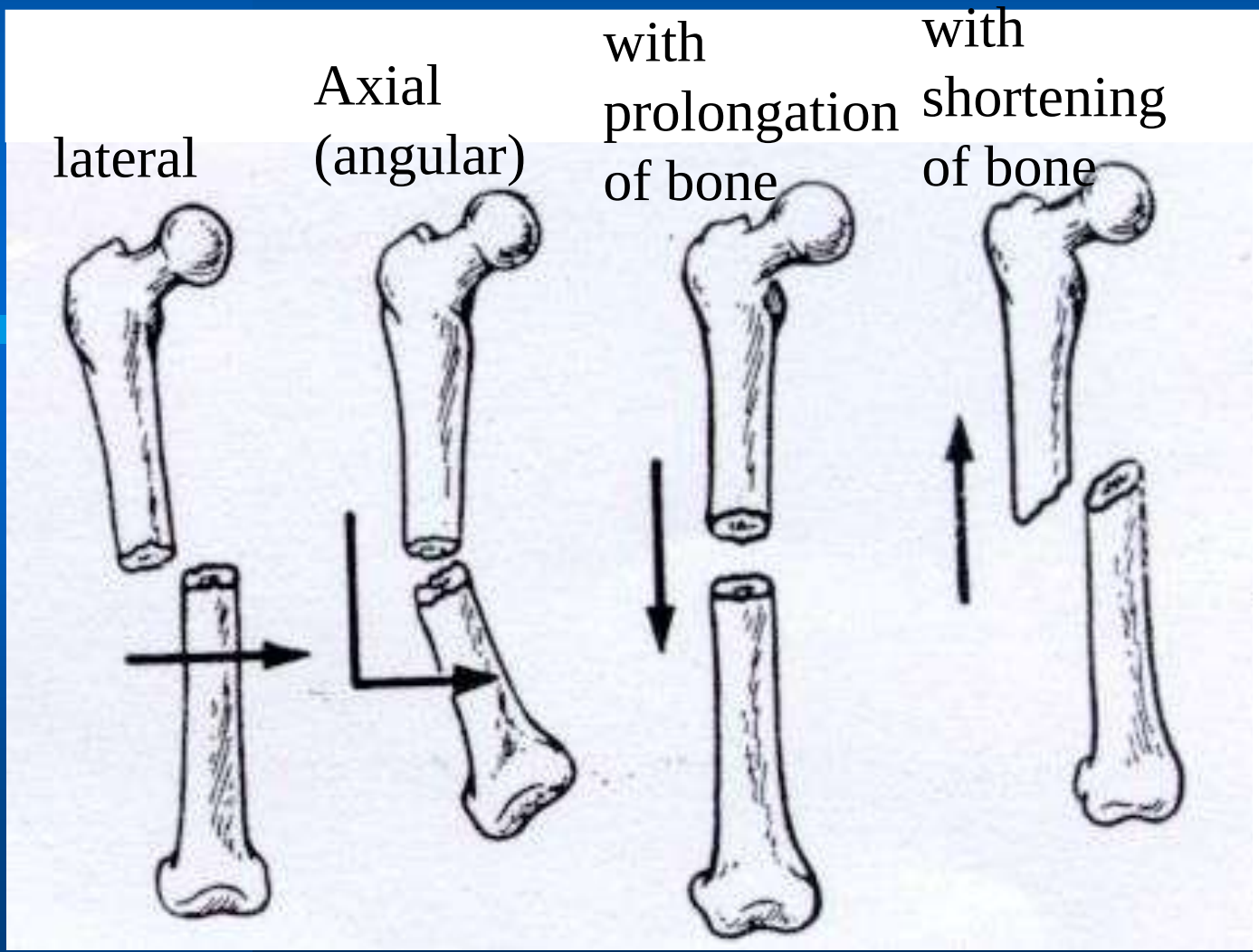
Bone fragment displacements due to fractures



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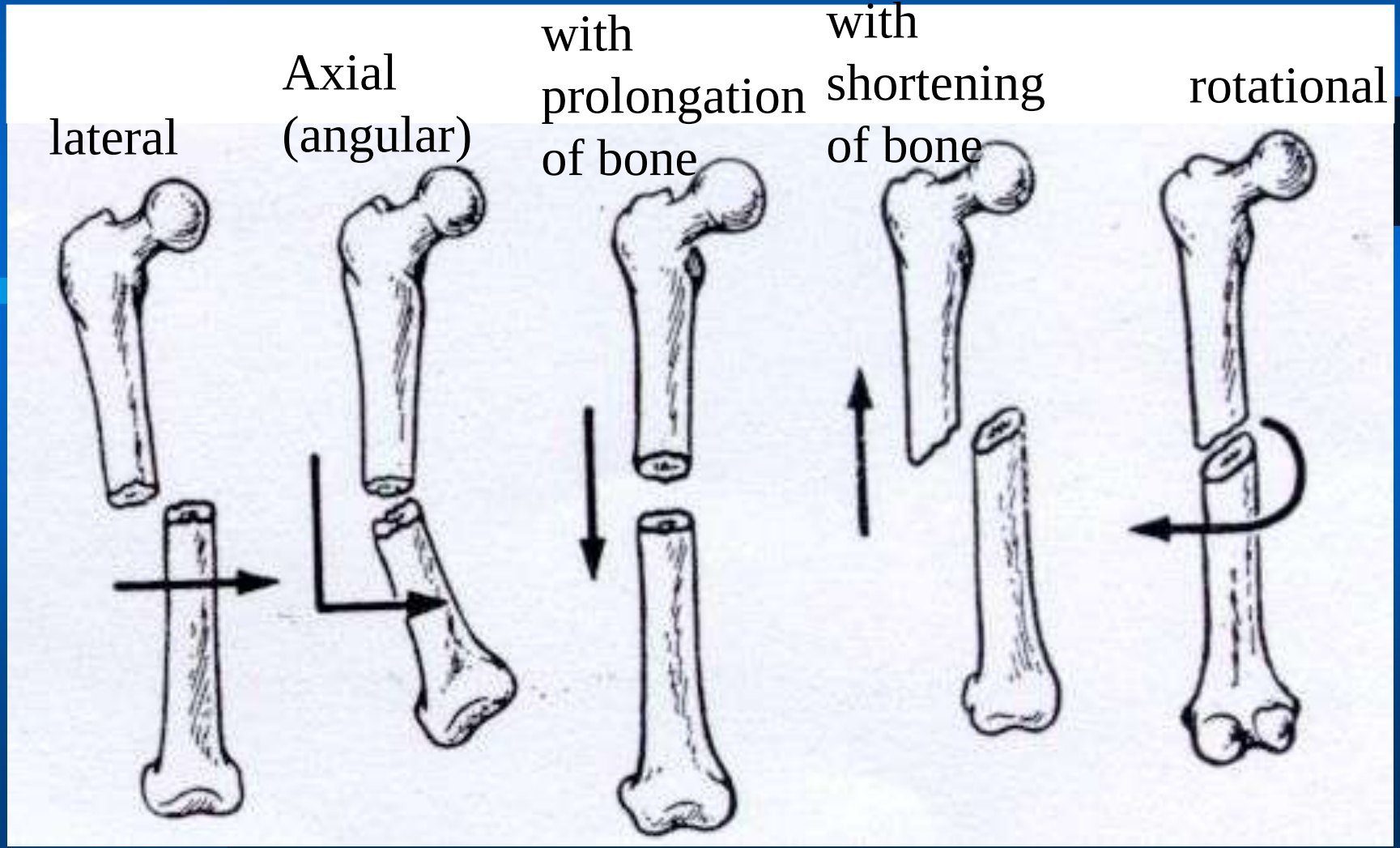
Bone fragment displacements due to fractures



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signs of fractures

- **Probable**:
  - pain

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signs of fractures

- **Probable**:
  - pain
  - swelling

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signs of fractures

- **Probable**:
  - pain
  - swelling
  - deformity

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signs of fractures

- **Probable**:
  - pain
  - swelling
  - deformity
  - dysfunction

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signs of fractures

- **Probable**
- **absolute:**
  - pathological mobility of the limb

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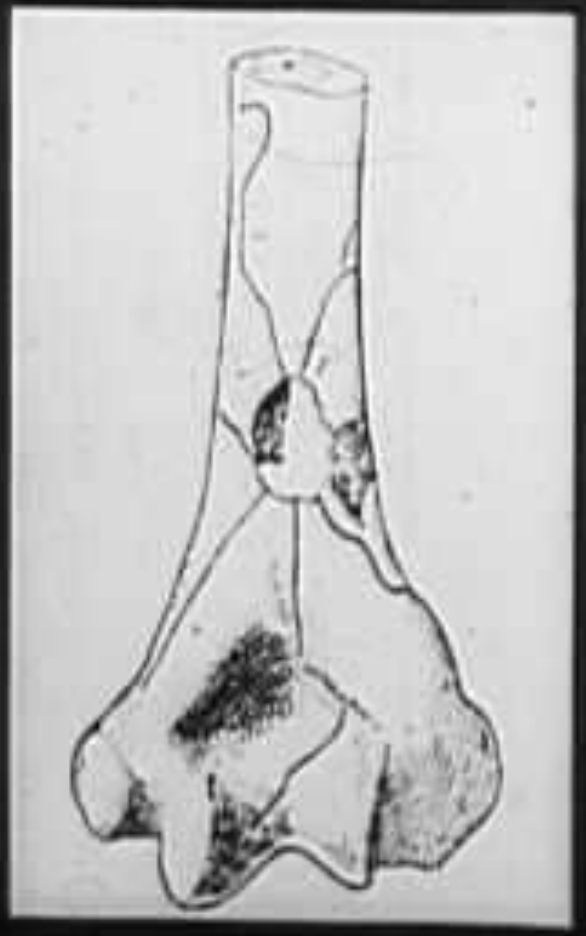
signs of fractures

- **Probable**
- **absolute:**
  - pathological mobility of the limb
  - crepitation of bone fragments



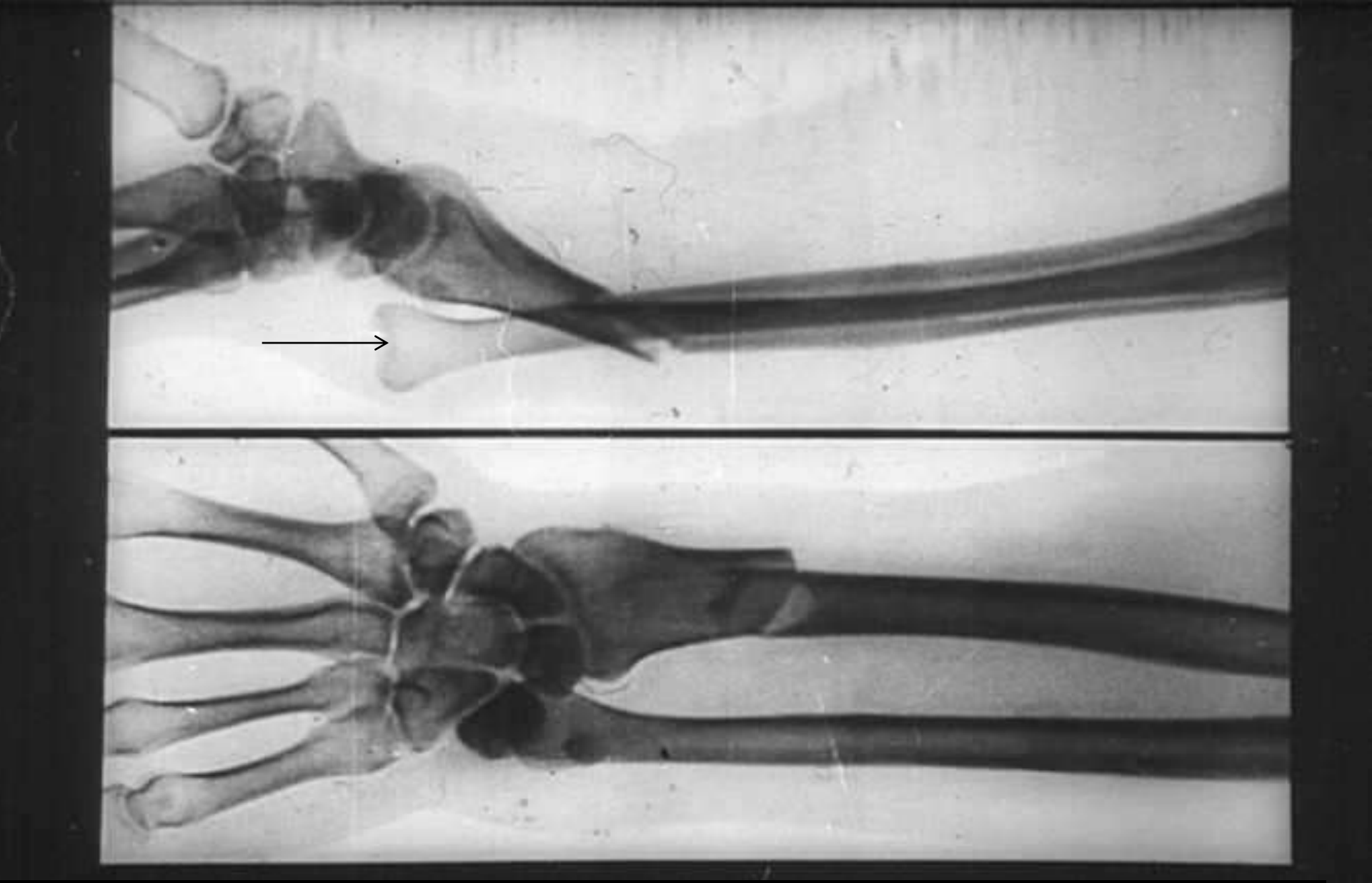
Comminuted, gunshot fracture

gunshot fracture

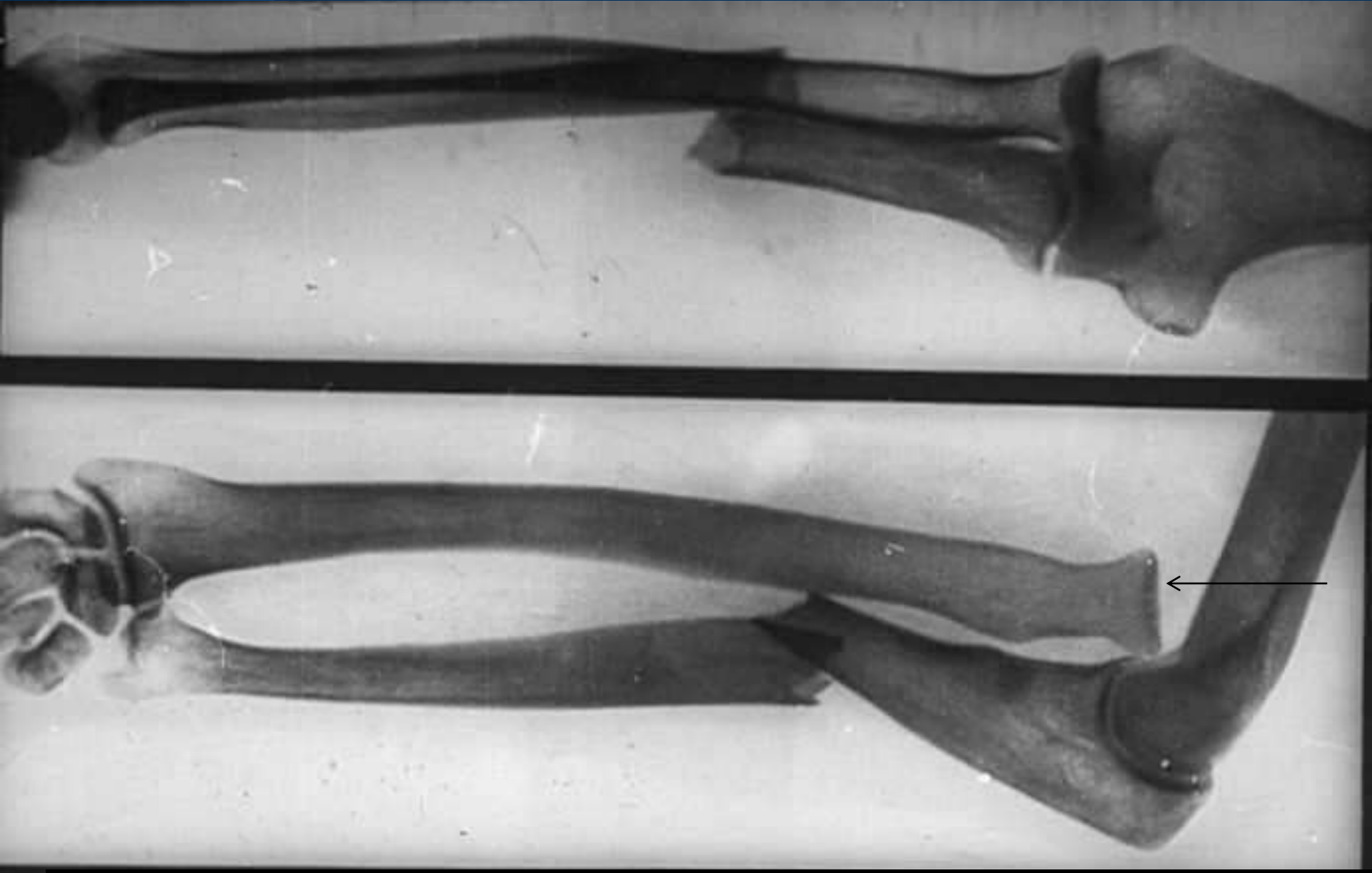
Comminuted fracture

Intraarticular fracture of epyphisis of radius bone and styloid process of the elbow

Comminuted fracture of epyphisis of radius bone



fracture of diaphisis of radius bone and dislocation of elbow



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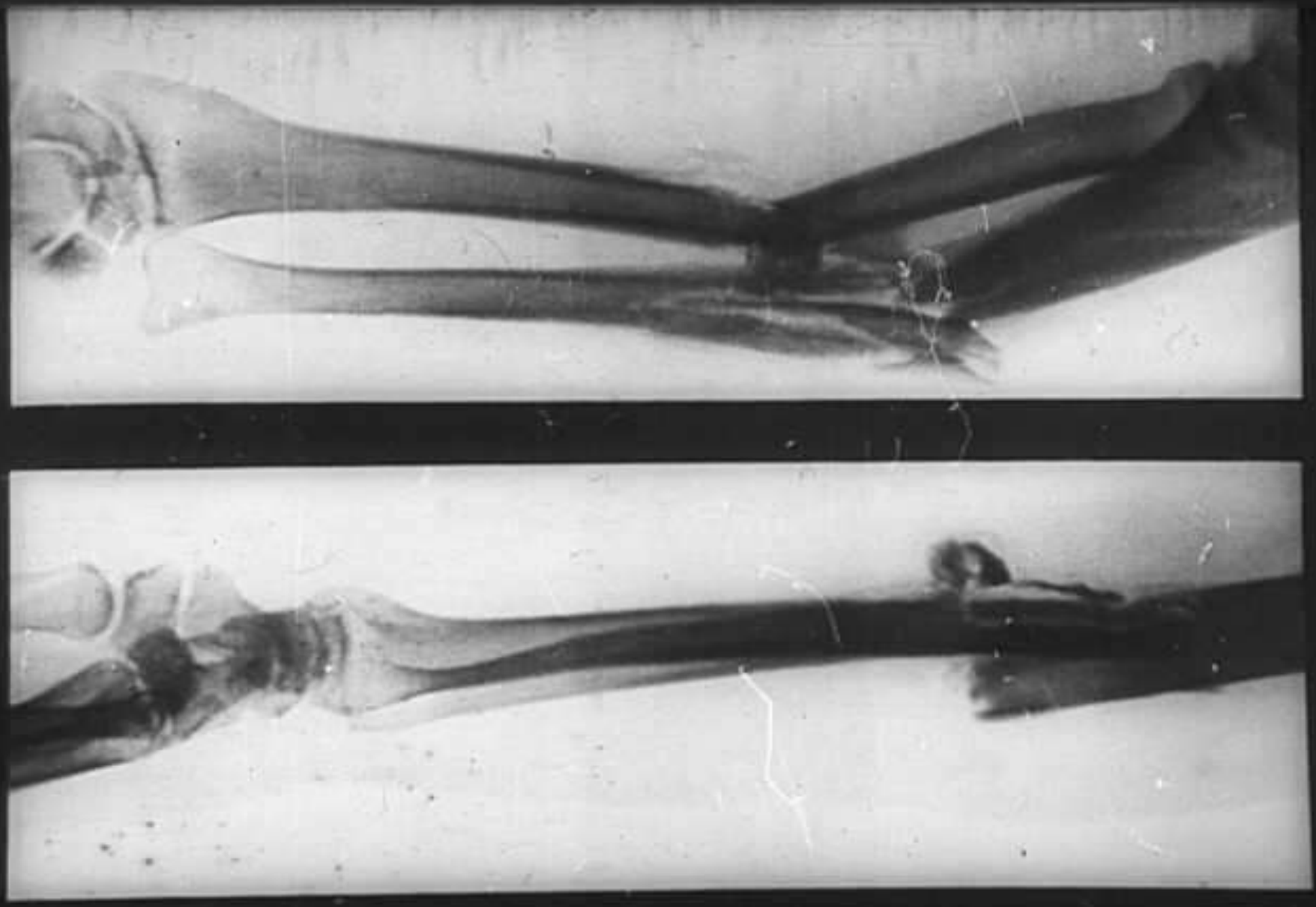
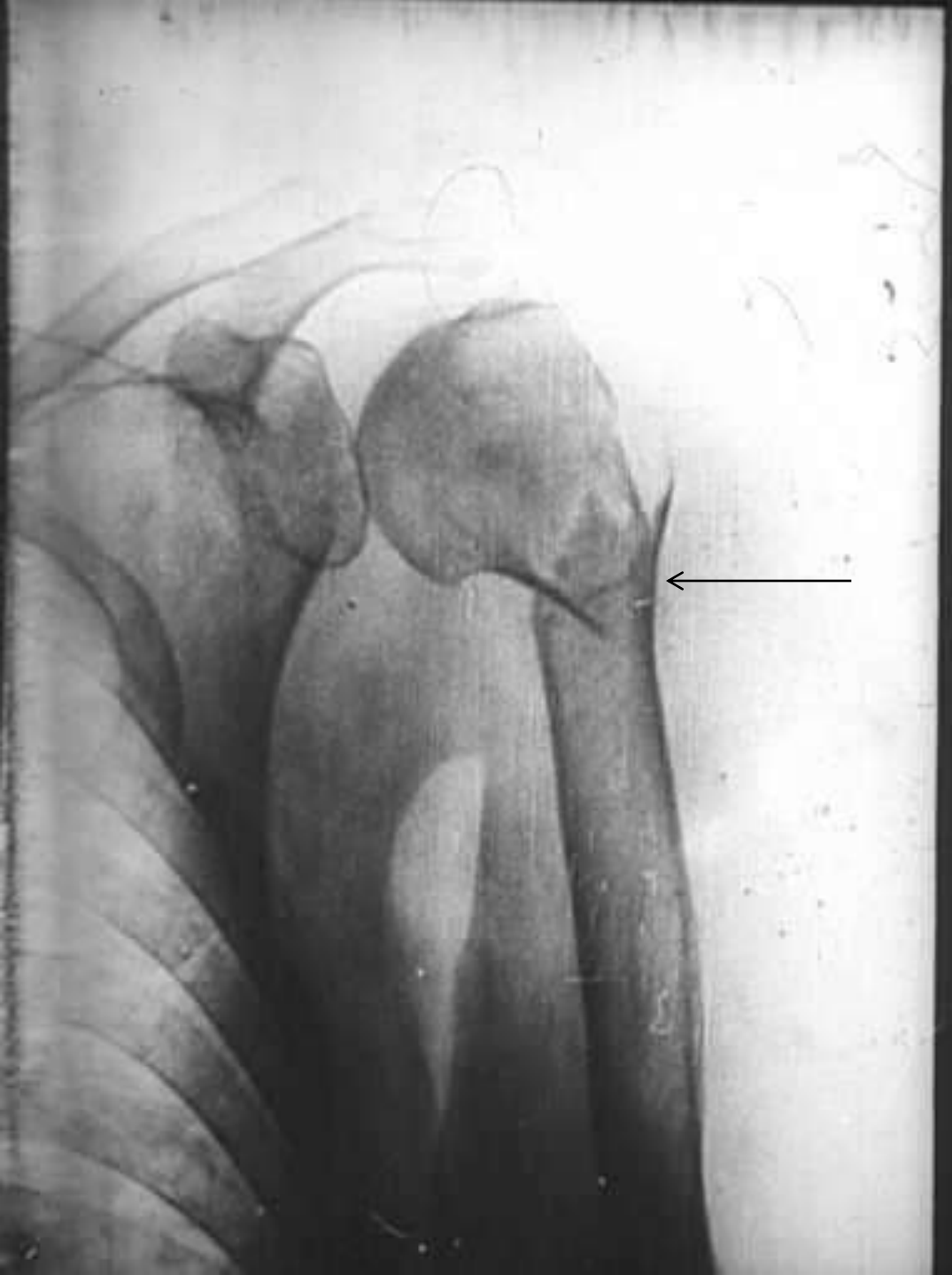


Comminuted fracture elbow and radius bone



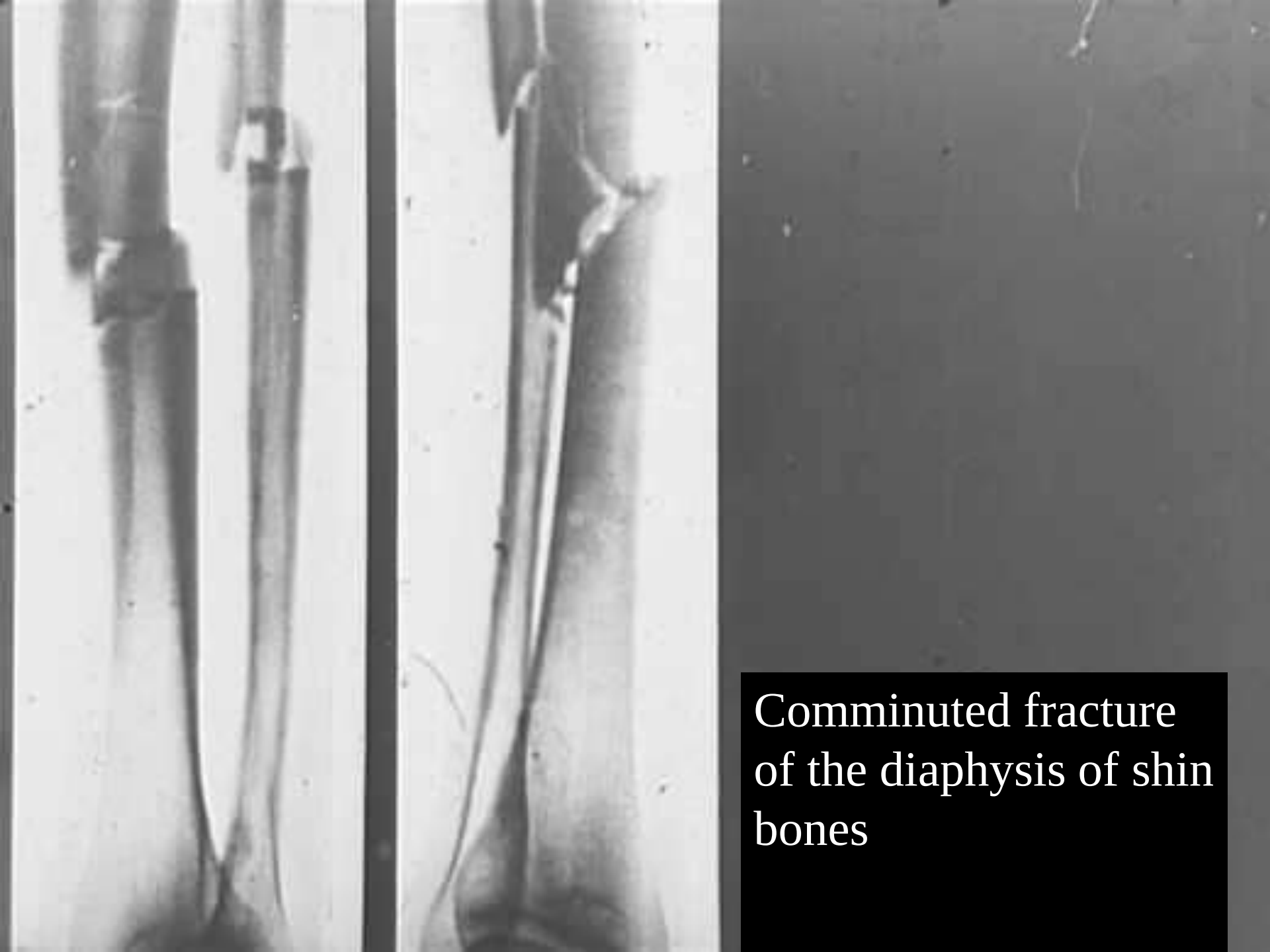
Adducent fracture of the surgical neck of the humerus

oblique fracture of the diaphysis of humerus

transverse fracture of the diaphysis of humerus

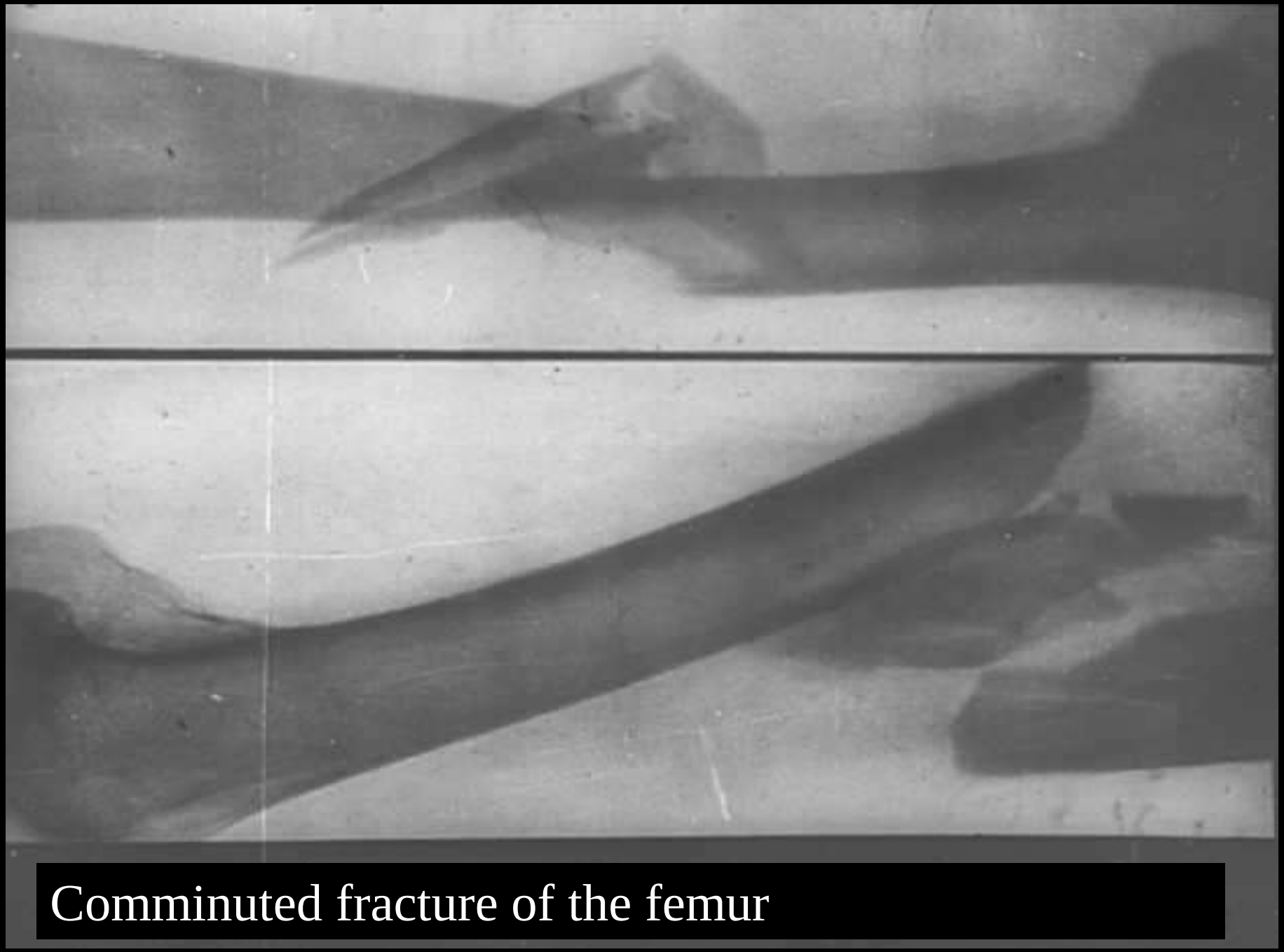
Comminuted fracture of the diaphysis of humerus

Comminuted fracture of the foot bones



Comminuted fracture of the diaphysis of shin bones

fracture of the fibula



Comminuted fracture of the femur

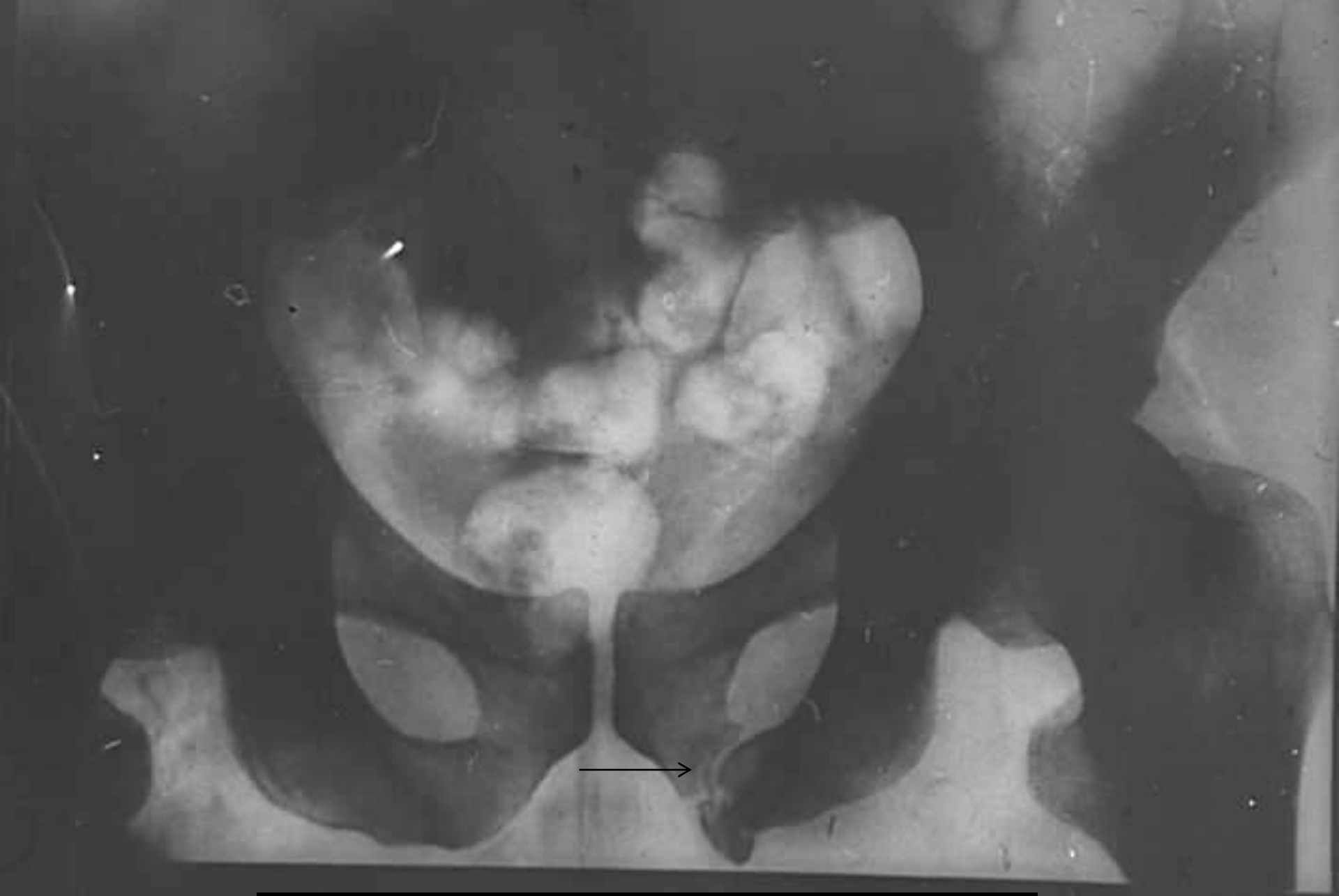
Transtrochanteric

fracture of the femur

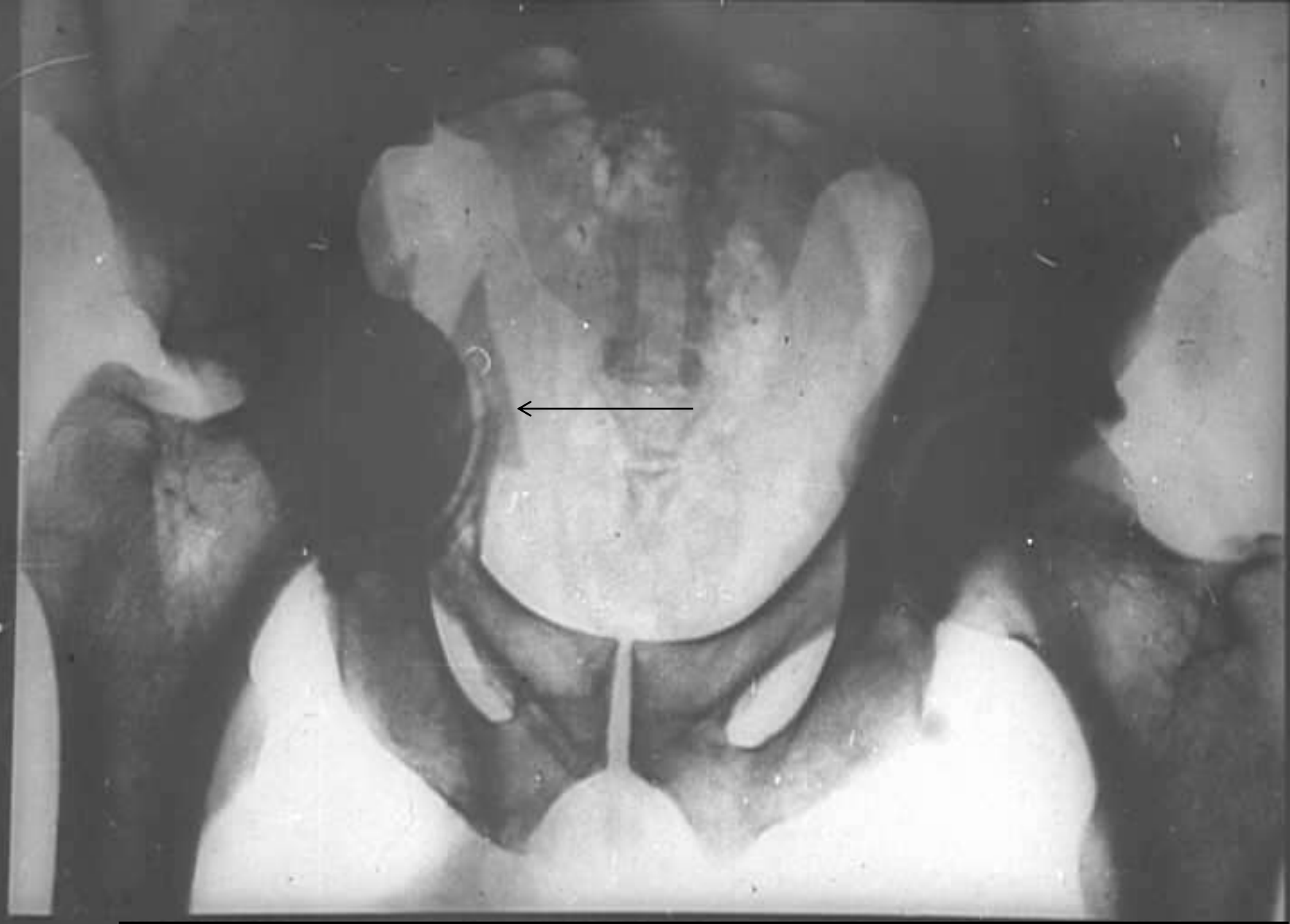
intertrochanteric fracture

of the femur

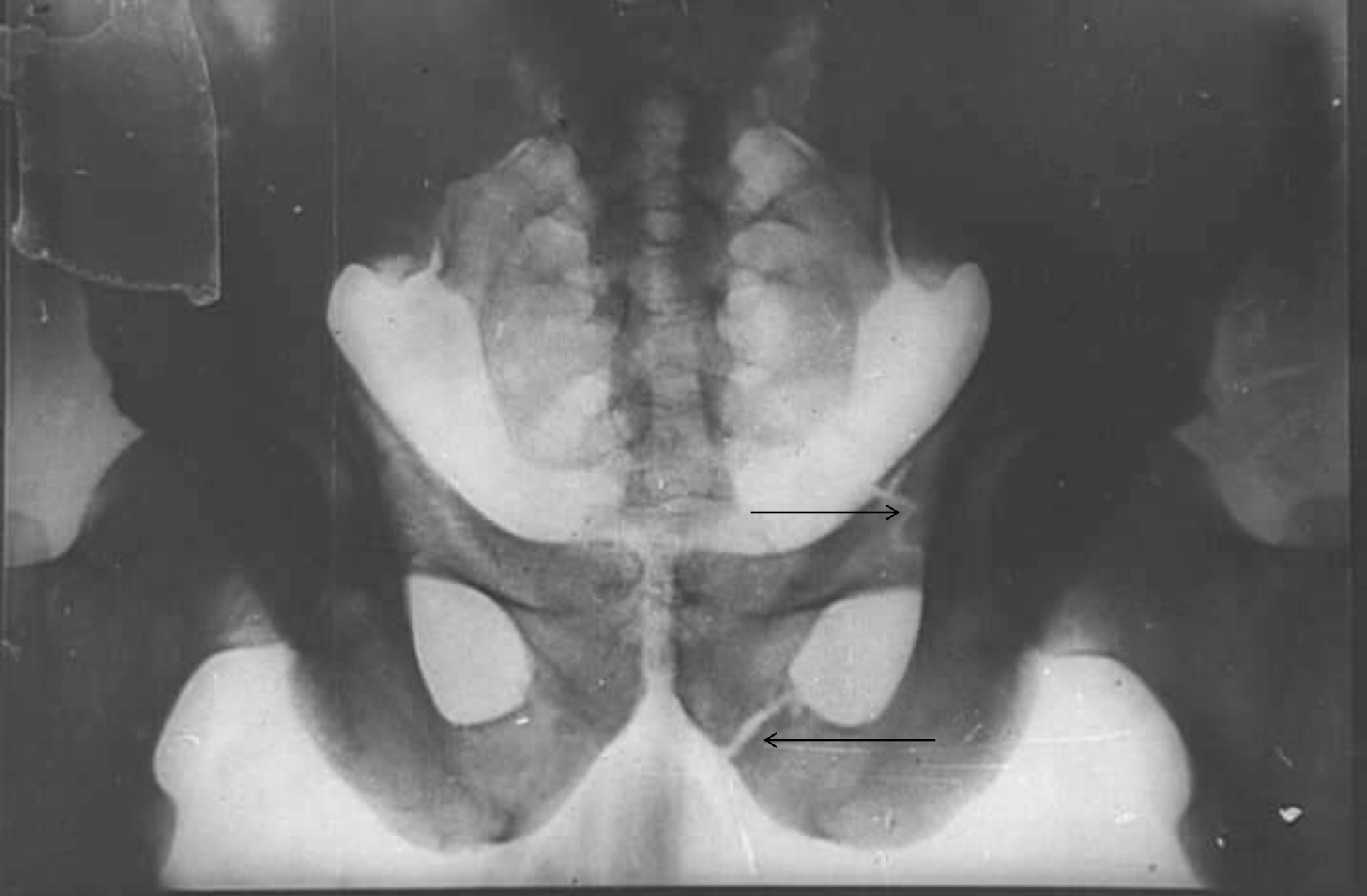
Rupture of the symphisis pubis



Fracture of the ishial bone



Fracture of the acetabulum



Fracture of the ishial and pubic bone

Compression fracture of vertebral body

Biology of Fracture Healing

I. Immediate injury response (phase of inflammation)

- **Hematoma forms at the fracture site**
  - Along cortex above periosteum and into the surrounding soft tissue

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- **Macrophage and inflammatory cell invasion**

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- **Undifferentiated cells adjacent to hematoma in the periosteum, muscle and surrounding tissue proliferate**
- **Macrophage and inflammatory cell invasion**
- **Formation of reparative granuloma**
- **Ends of bone are dead**

II. Endochondral Ossification

- Mesenchymal cells in granulation tissue synthesize cartilaginous matrix

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II. Endochondral Ossification

- Mesenchymal cells in granulation tissue synthesize cartilaginous matrix
- Similar to proliferating zone of growth plate
- Mesenchymal cells differentiate into chondrocytes
- "Soft callus"
- Anaerobic conditions favors cartilage formation
- Mechanobiological environment => cartilage formation

III. Intramembranous Ossification (Hard Callus)

- New bone matrix synthesized by osteoblasts b/w periosteum and underlying cortex

III. Intramembranous Ossification (Hard Callus)

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- No cartilaginous intermediates

III. Intramembranous Ossification (Hard Callus)

- New bone matrix synthesized by osteoblasts b/w periosteum and underlying cortex
- No cartilaginous intermediates
- "Hard callus"

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treatment of fractures

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main principles of treatment of fractures

- **Reposition of bone fragments;**
- **Immobilisation of repositioned bone fragments;**
- **Use of agents and physical methods that promote formation of new bone callus and bone consolidation.**

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Reposition of bone fragments

- is achieved with adequate analgesia, which removes the reflective muscle contraction.

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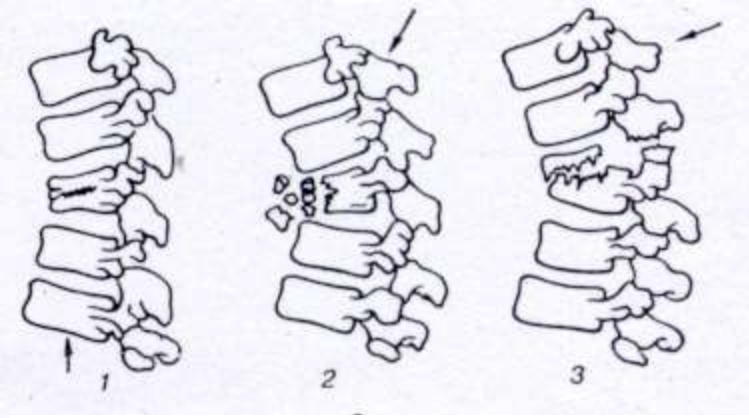
Reposition of bone fragments

- is achieved with adequate analgesia, which removes the reflective muscle contraction.
- Muscle contraction is the cause of the secondary displacement of fragments
- Repositioning of displaced bone splinters involves their accurate resetting of the bone fragments along the fracture line to provide for further consolidation.

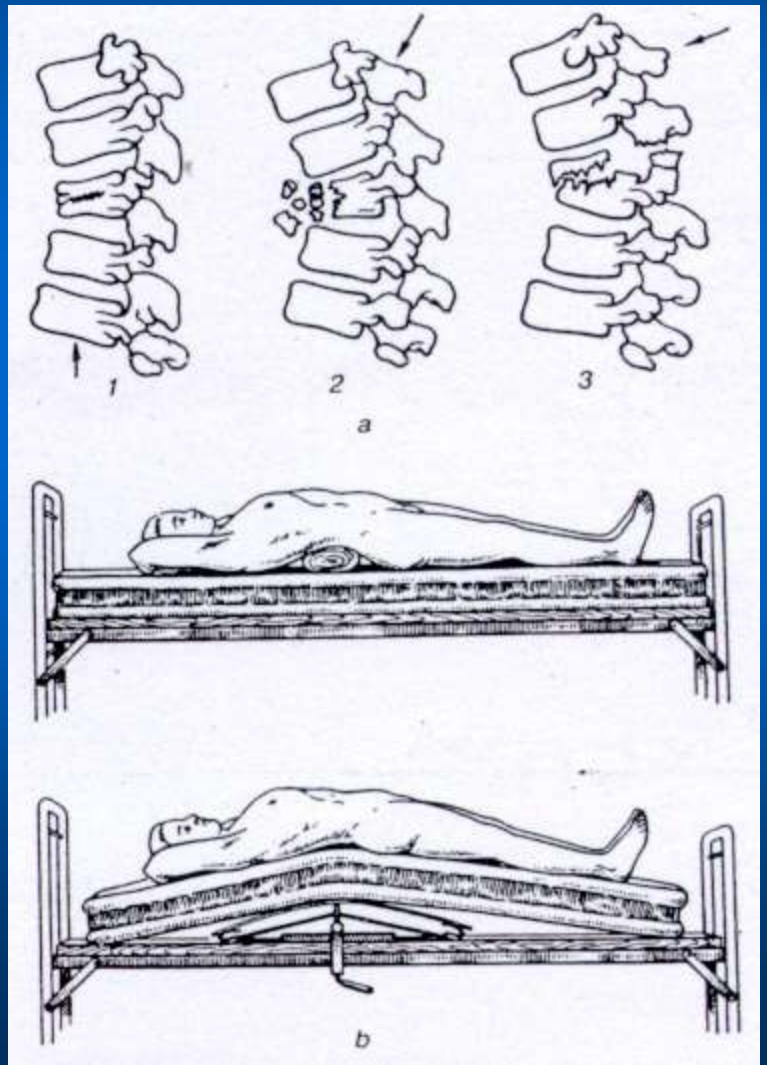
Manual reposition in radial fracture

Reposition in compression spinal fracture



Types of flexion fractures of vertebral bodies

Reposition in compression spinal fracture



Types of flexion fractures of vertebral bodies

reclination

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Methods of treatment of fractures

- Immobilisation with plaster bandage

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Methods of treatment of fractures

- Immobilisation with plaster bandage
- method of constant traction

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Methods of treatment of fractures

- Immobilisation with plaster bandage
- method of constant traction
- surgical treatment

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main principles of immobilisation with plaster bandage

- the limb must be placed in a functional position;
- the bone fragments must be repositioned properly
- the plaster bandage must be applied to cover the two neighbouring joints
- finger must be left uncovered

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types of plaster bandages

- plaster bar

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types of plaster bandages

- plaster bar
- circular
- plaster bar circular

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main principles of method of constant traction

- traction has to be done with the limb in the median physiologic position, i.e. there should be the equilibrium between antagonistic muscles

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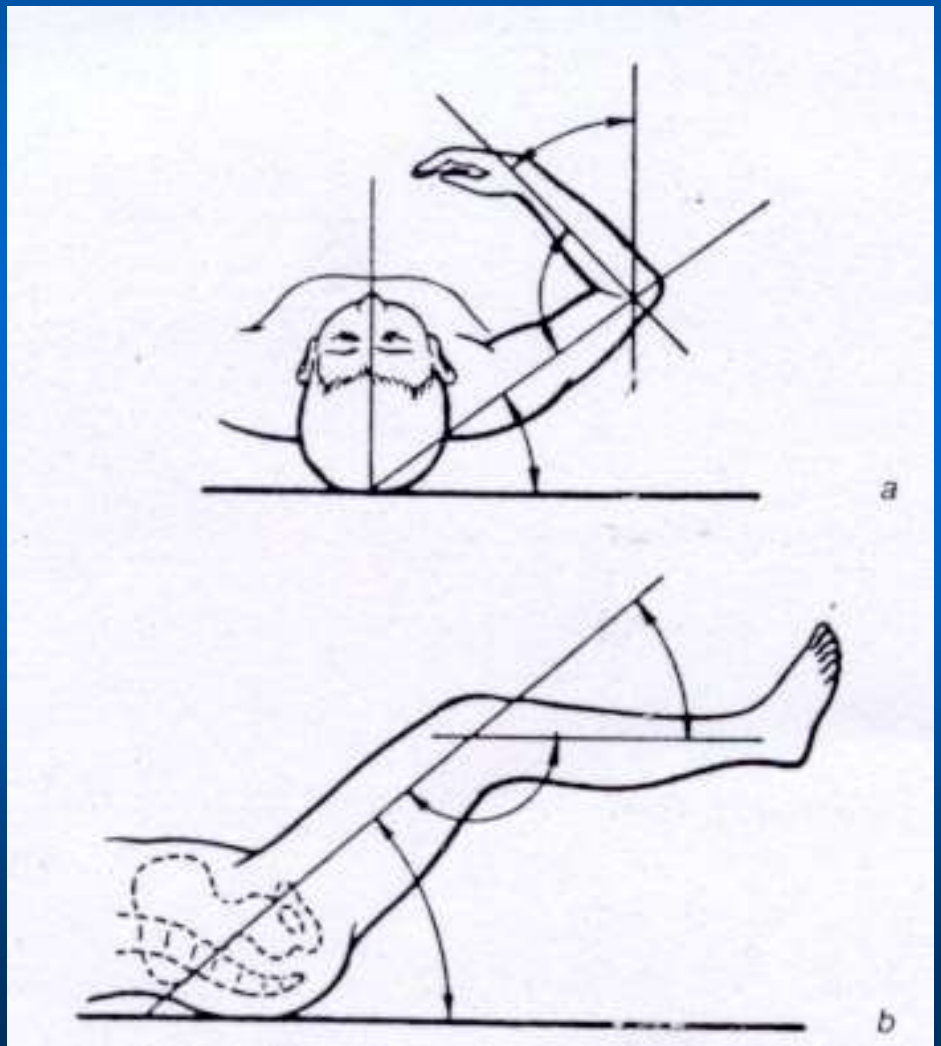
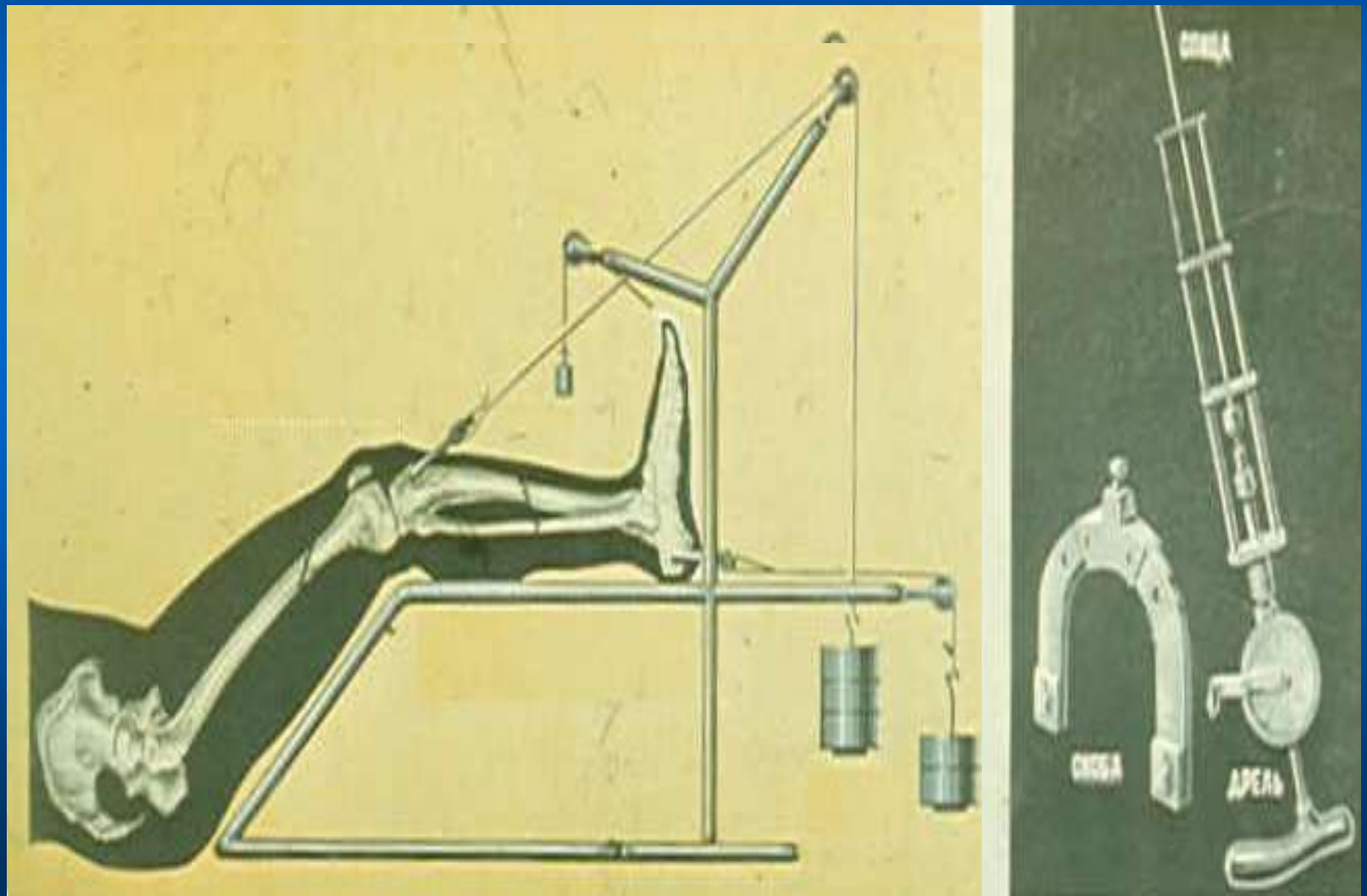
main principles of method of constant traction

- traction has to be done with the limb in the median physiologic position, i.e. there should be the equilibrium between antagonistic muscles
- resetting has to be done along the axis of the central bone fragment
- the weight for traction has to be added gradually

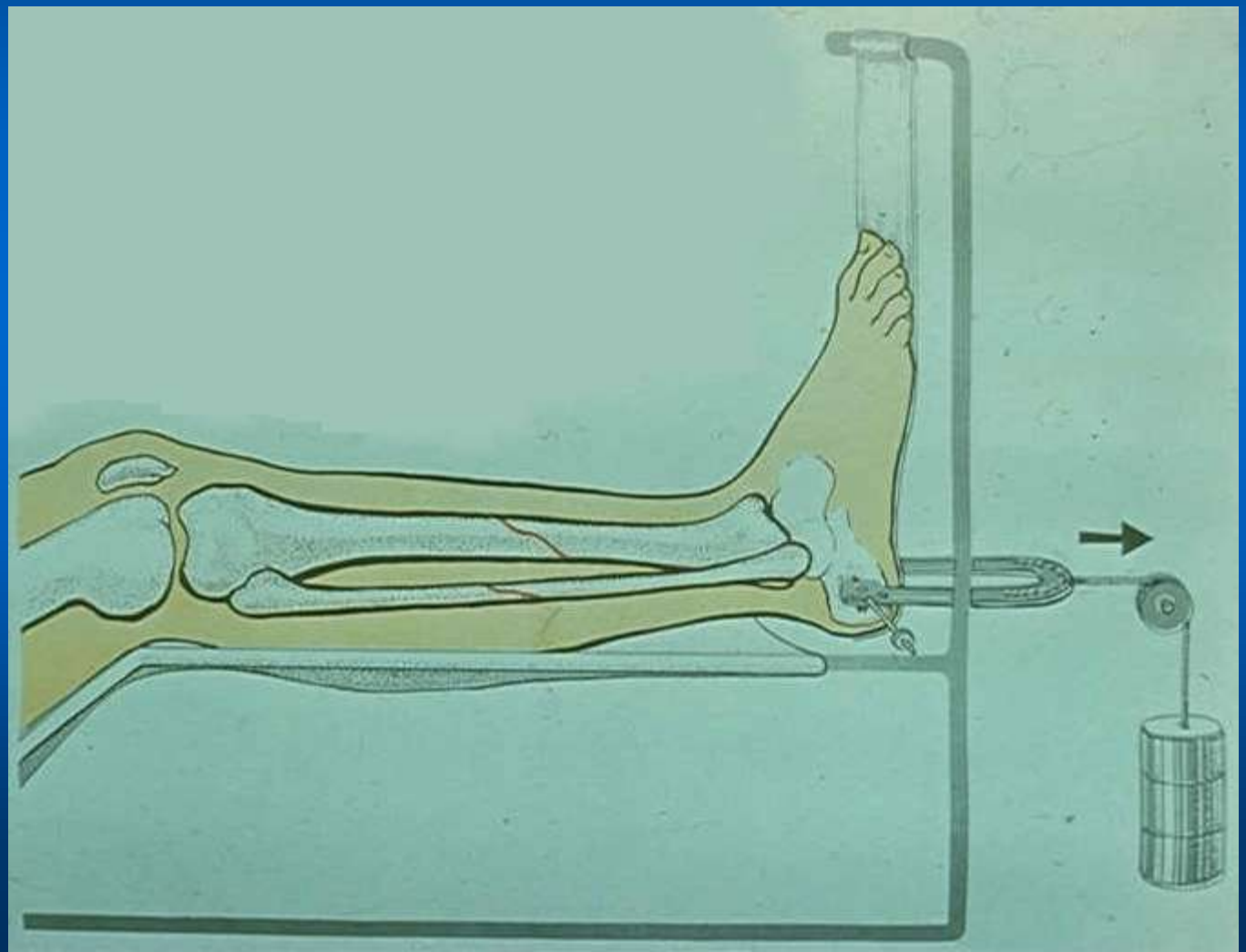
Physiologic position of the upper (a) and lower (b) limbs



Skeletal traction in femoral fractures



Skeletal traction in shin fractures



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Wire inserting

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Open reposition of fractures *(surgicdl treatment of fractures).*

The *absolute* indications:

- **Open fractures.**
- **Bone fragments damaging vital organs, major vessels and nerves of the limb.**
- **Interposition of soft tissues (e.g. muscles, tendons, fasciae - are trapped in between the bone fragments); this makes reposition and consolidation of bones impossible.**
- **Pseudoarthrosis.**
- **Purulent complications of bone fractures.**
- **Imperfectly united fracture with severe organ dysfunction.**

Pseudoarthrosis

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osteosynthesis

- Metal rods are passed into a bone (inlramedullar osteosynthesis)

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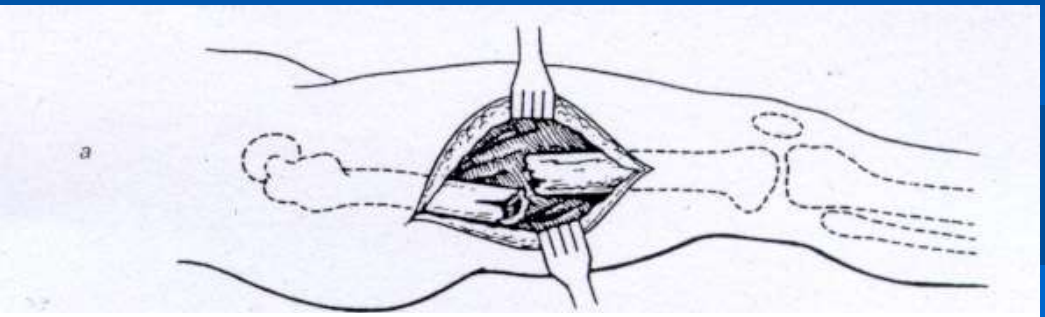
Intramedullary osteosynthesis in femoral fracture



Displacement of femoral bone fragment

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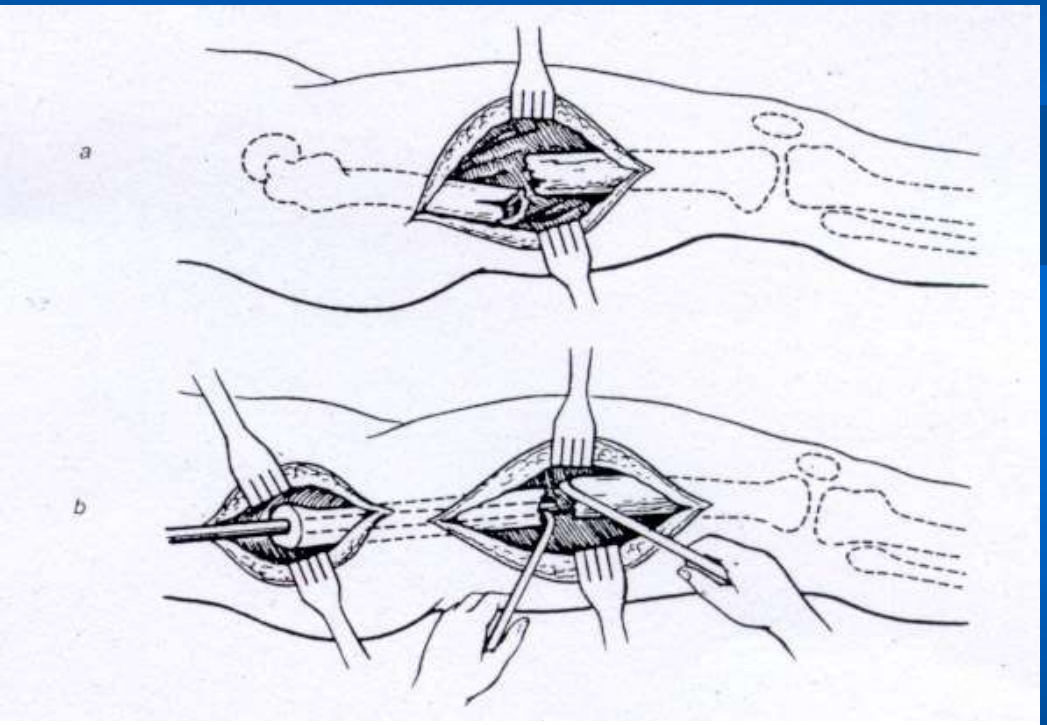
Intramedullary osteosynthesis in femoral fracture



Displacement of femoral bone fragment

Insertion of the metal rod in the proximal fragment

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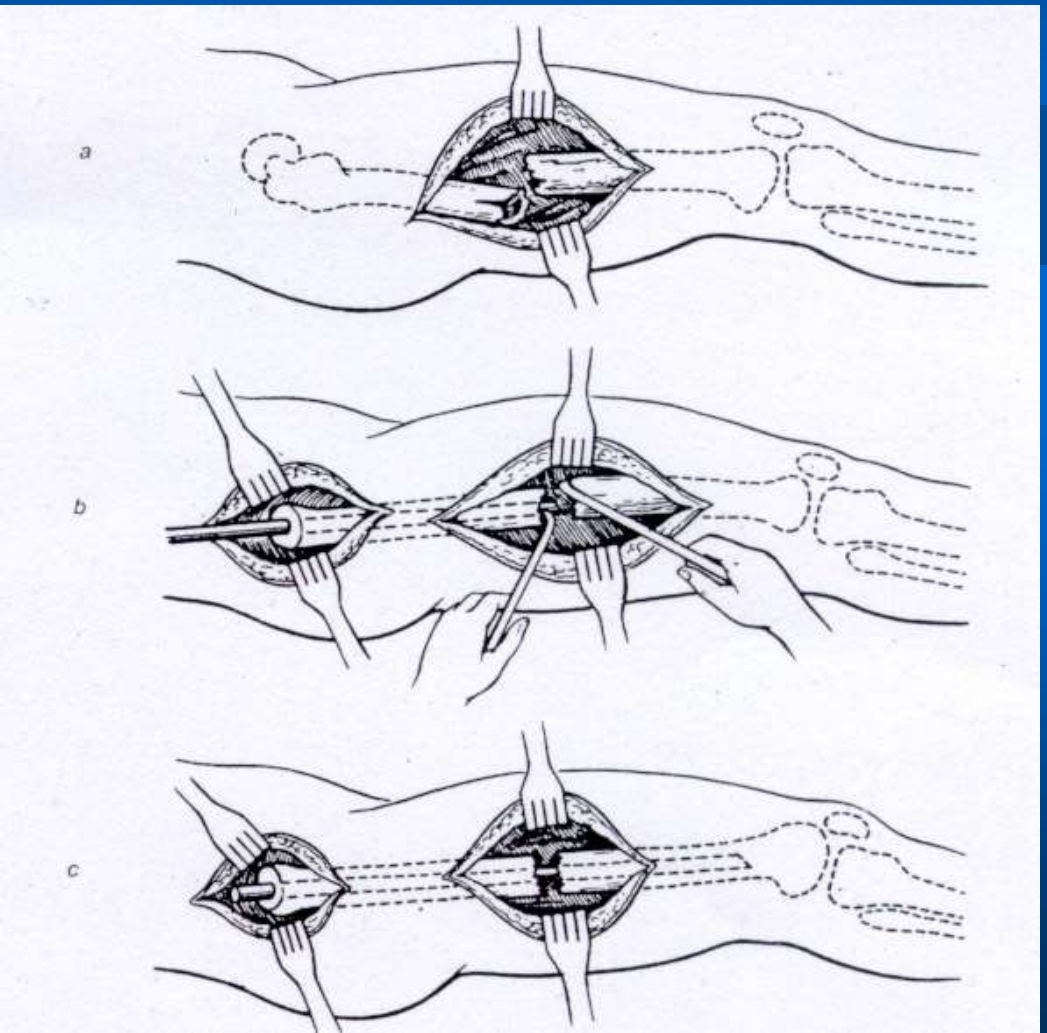
Intramedullary osteosynthesis in femoral fracture



Displacement of femoral bone fragment

Insertion of the metal rod in the proximal fragment

The metal rod inserted in the proximal and distal fragments

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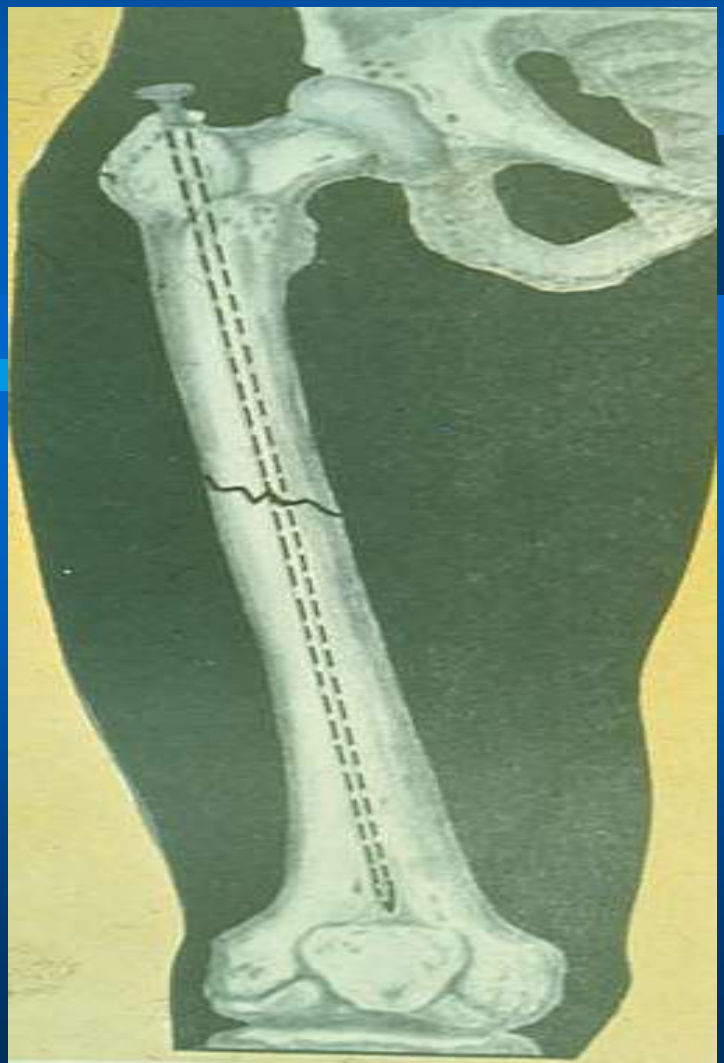
View of intramedullary osteosynthesis



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Modern osteosynthesis

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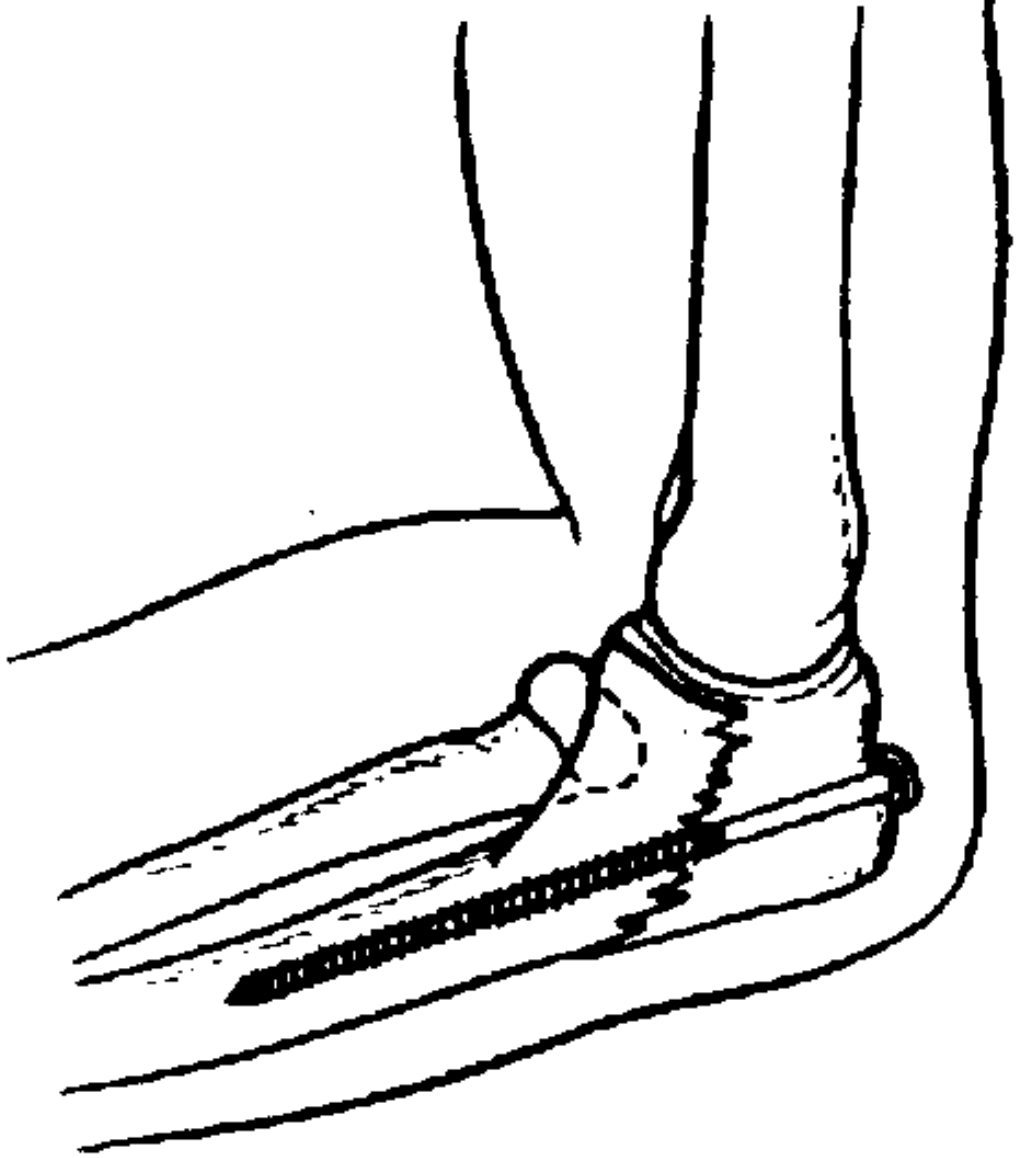
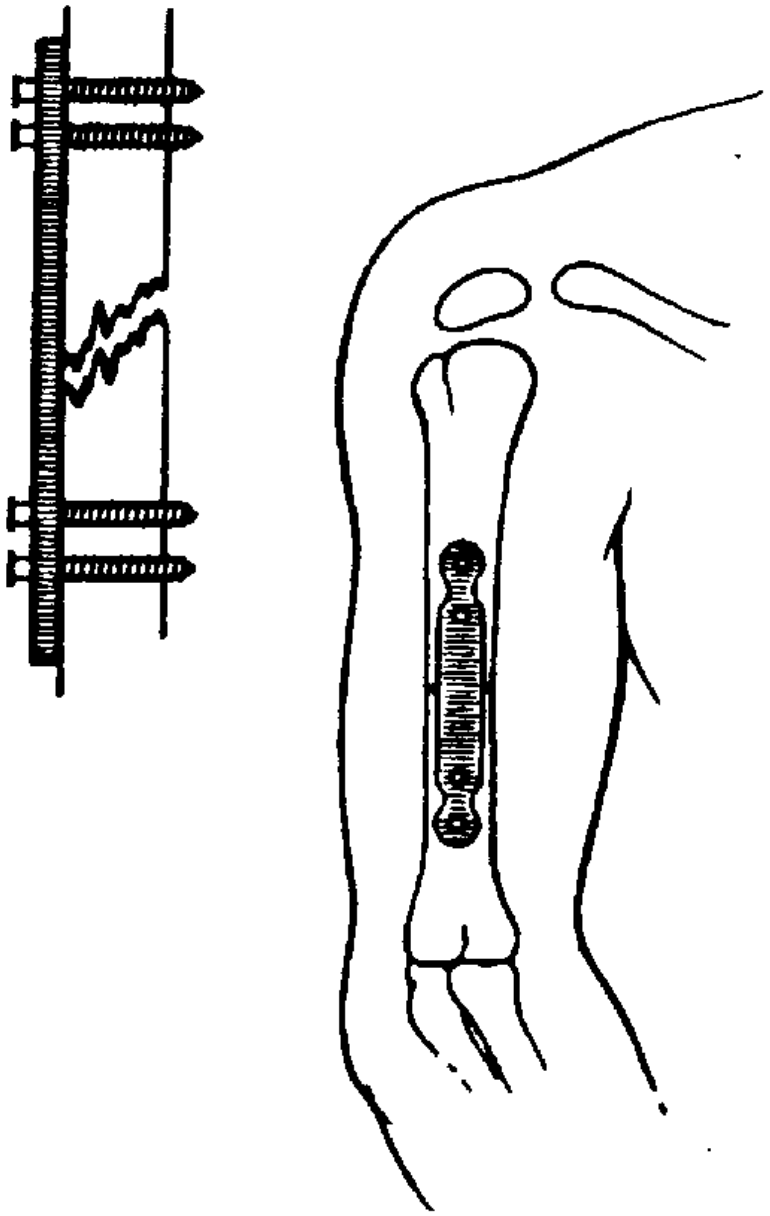
osteosynthesis

- Metal rods are passed into a bone (inlramedullar osteosynthesis)
- **metal plates are placed on the fragments and fastened with screws (extramedullar osteosynthesis)**



Extramedullary osteosynthesis (e.g. fixation the olecranon using a screw).



Extramedullary osteosynthesis (e.g. fixation of the humeral fragments using a plate and screws).

Disadvantages of method

- additional trauma to the tissues at the fracture site;
- traumatic character of the intervention;
- destruction of the bone marrow along the limbs (intramedullar osteosynthesis);
- the need for another operation to remove the metal after fracture consolidation

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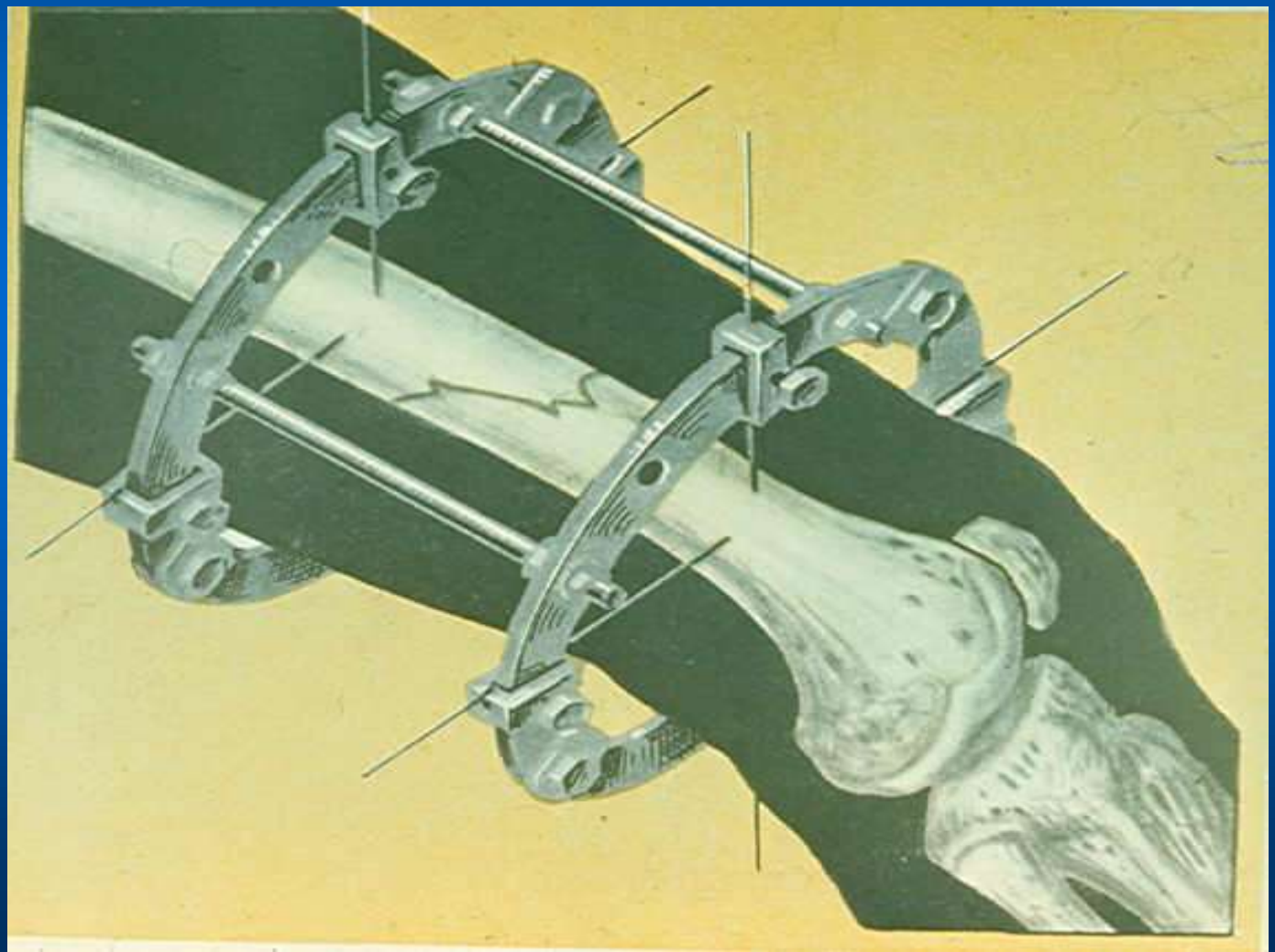
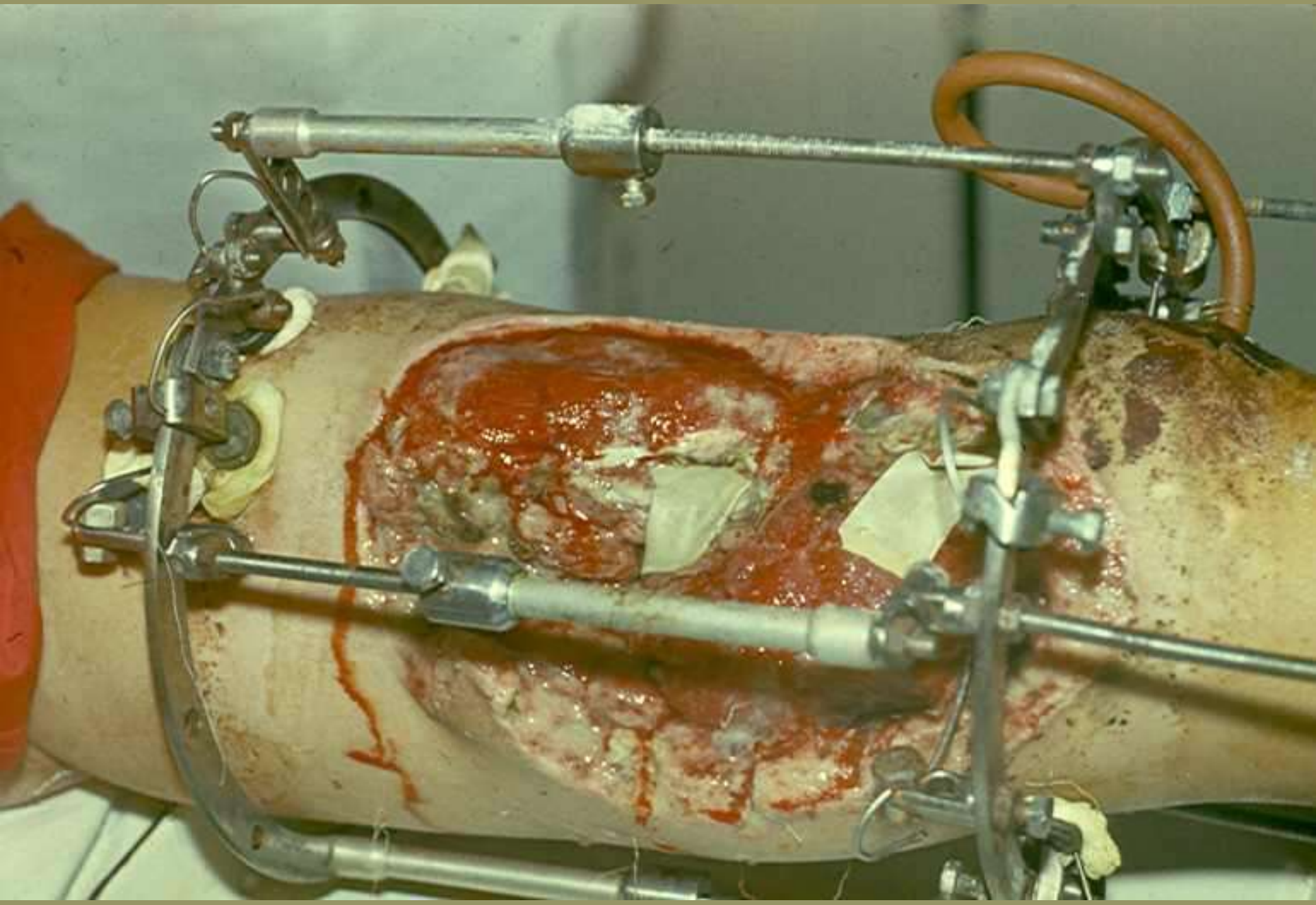
Extramedullar compression osteosynthesis

- apparatus helps to avoid the above-mentioned problems
- provide for reposition of bone fragments without operation at the fracture site

Extraosseus osteosynthesis using Ilizarov's apparatus





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