



Fractures

Lecture of General
surgery

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Poltava

- **Fracture**

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

Causes

- ***Trauma***

Might be a direct blow

*indirect violence such as falling on a hand or foot

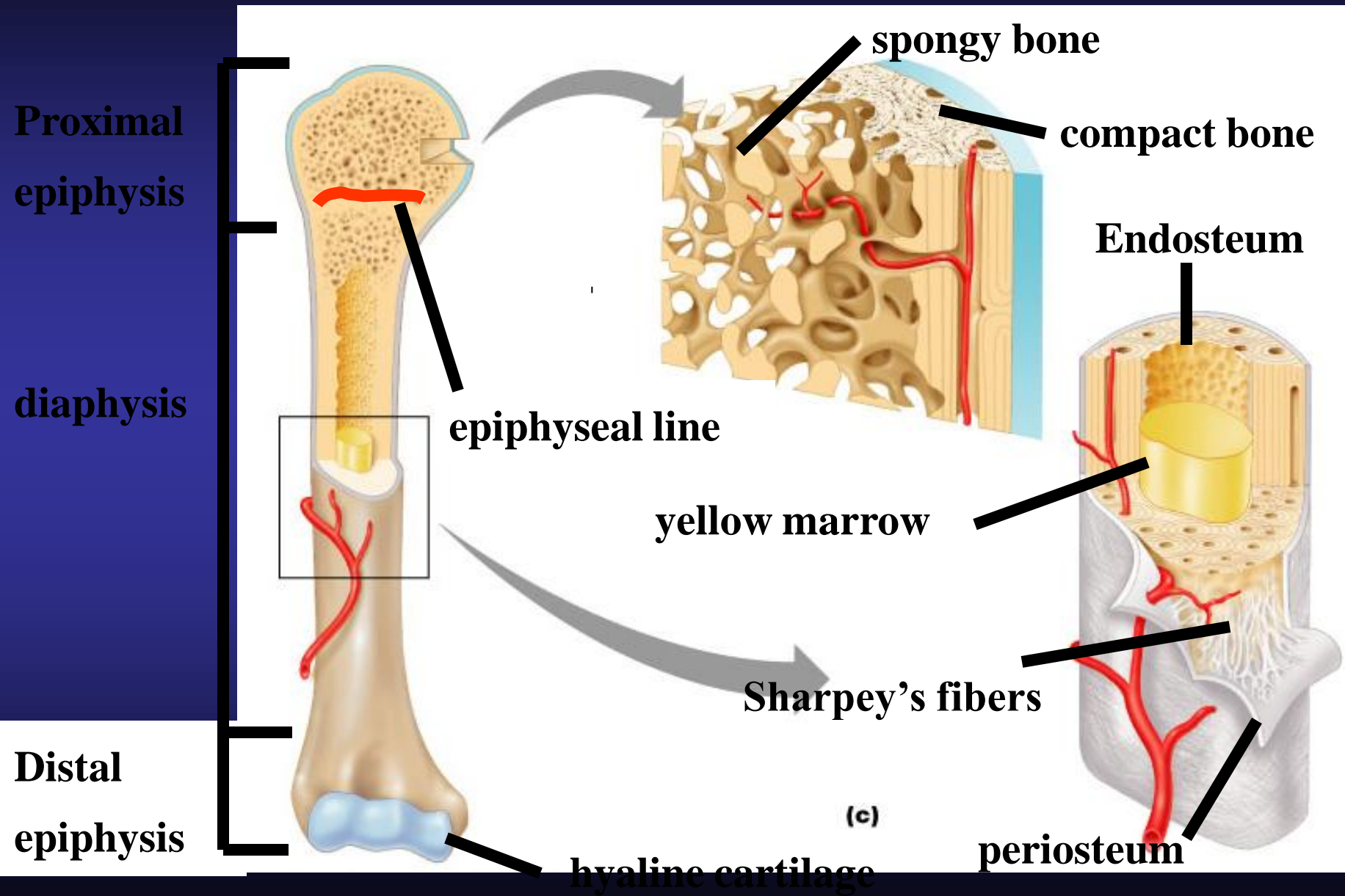
*caused by repeated minor trauma (stress or fatigue fractures)

- ***Pathological fractures***

*Occur as a result of disease such as carcinoma, osteogenesis imperfecta, Payer's disease and infection.

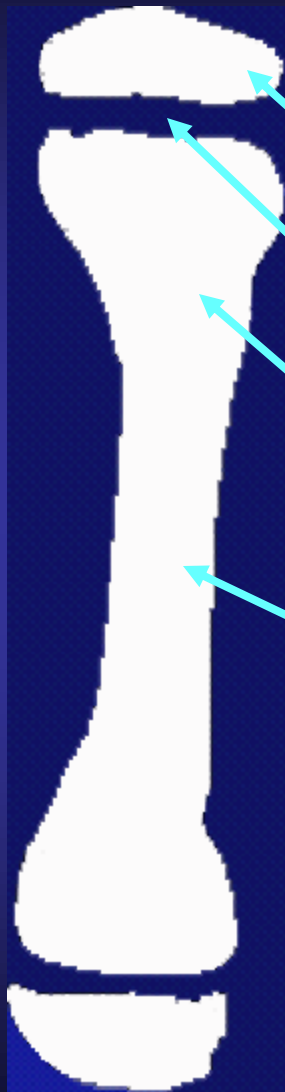
- The various terms are used in describing the various parts of long bones. The epiphysis represents the bony portion directly adjacent to the articular surface to which the articular surface is attached to and adjacent to the joint. The physis or epiphyseal plate represents a cartilaginous portion that exists during the developmental phases between the epiphysis and the adjoining metaphysis or the area typically broadened at the junction of the shaft of the long bone with the epiphysis. The shaft or central portion of the long bone referred to as the diaphysis.

Anatomy of a Long Bone



Normal Bone and Normal Ossification

Bone Terms

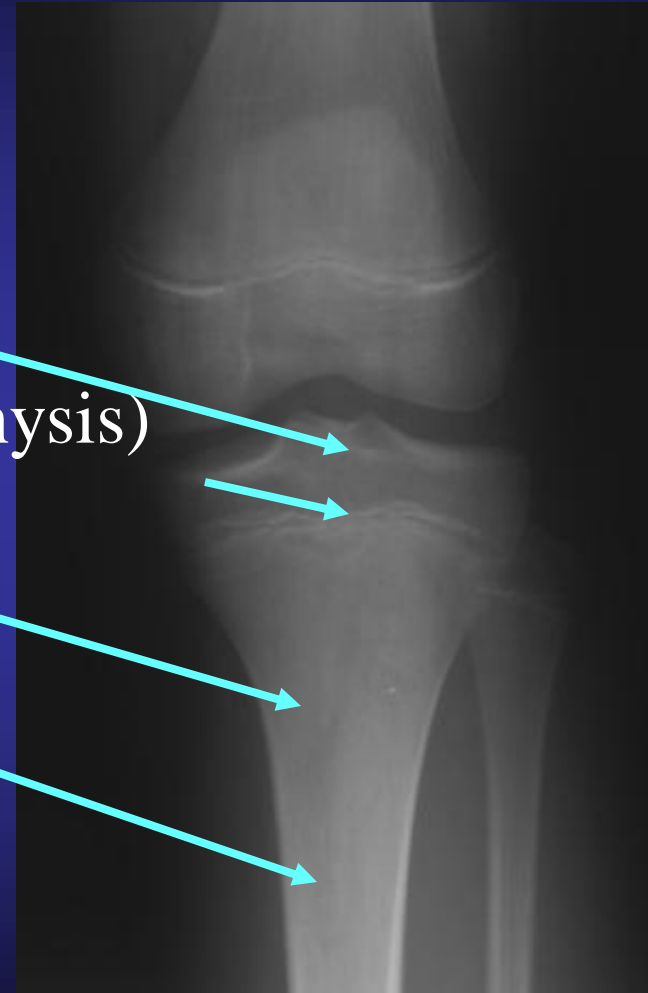


Epiphysis

Epiphyseal Plate (physis)

Metaphysis

Diaphysis



Fracture Classifications

G. Longitudinal

H. Transverse

I. Oblique

J. Spiral

K. Incomplete

L. “T” fracture

G. Impacted,
compressed

H. Comminuted

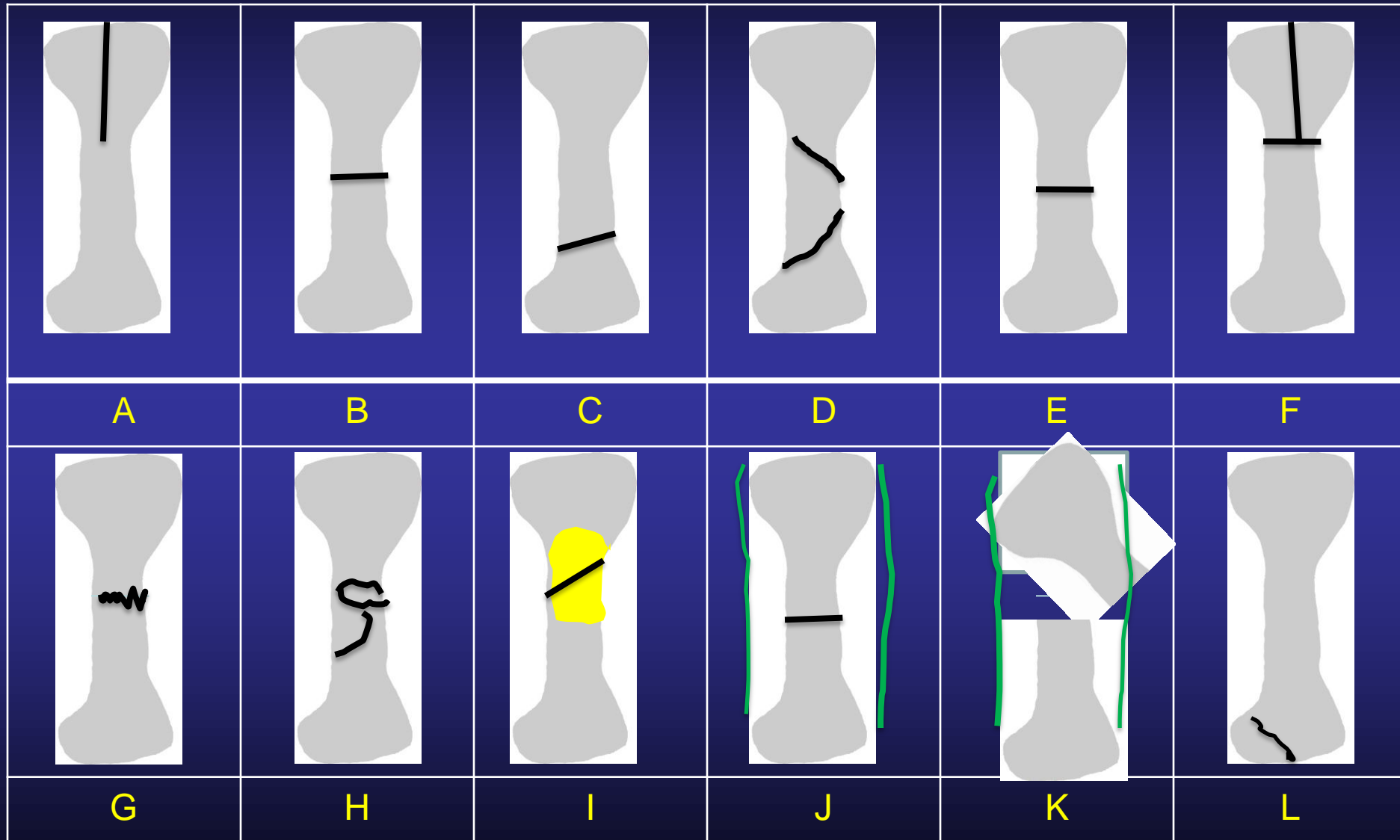
I. Pathological

J. Closed fracture

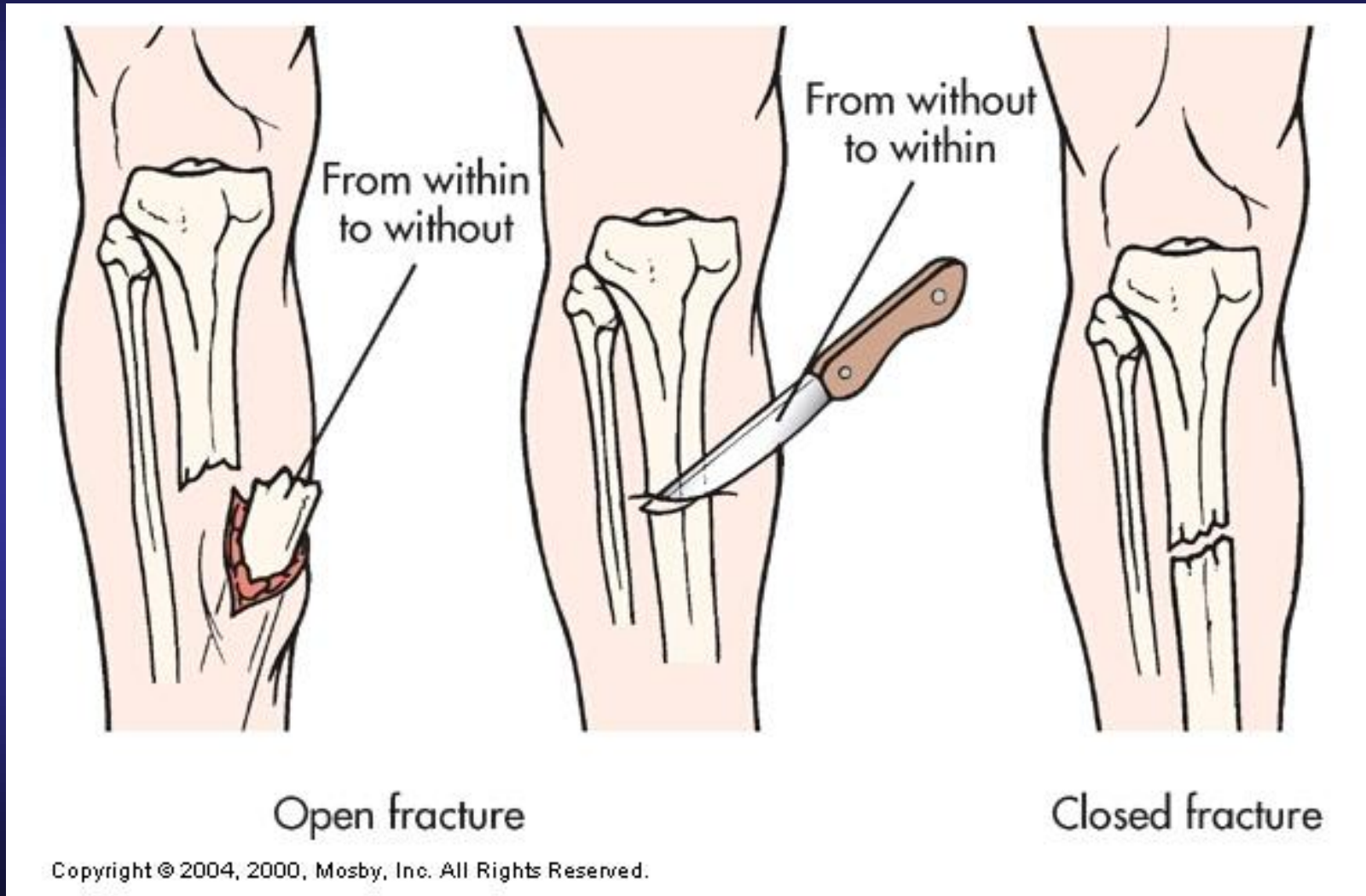
K. Open fracture

L. Avulsion fracture

Fracture Classifications



Classification by Communication with External Environment



Clinical features



Immediately after fracture

- *Shock*
- *Pain*
- *Deformity*
- *Oedema*
- *Marked local tenderness*
- *Muscle spasm*
- *Abnormal movement and crepitus*
- *Loss of function*

Following reduction and fixation

- *Pain*
- *Oedema*
- *Loss of functions*

After removal of the fixation

- *Pain*
- *Oedema*
- *Limitation of joint movement*
- *Weak muscles*
- *Loss of functions*

Fracture Position

Distal Relationship to Proximal

- Displacement
- Angulation
- Shortening
- Rotation
- Dislocation (complete loss of continuity at a joint)
- Subluxation (partial loss of continuity at a joint)
- Fracture-dislocation (same bone with a fracture and a dislocation)

Diagnosis

- Physical Exam
 - Palpate the bones
 - Crepitus
 - Related
 - Skin
 - Neurovascular exam
- X-ray
 - Linear radiolucency through bone
 - Indirect signs
- What's the diagnosis in this case?



Correct answer

- Right femur shaft (R32)fracture
 - Even better
 - Wedge Comminution (32-A)
 - Transverse (32-A3)
 - Middle 1/3 (32-A3.3)
- Right patella fracture (R34)
 - Insufficient information for further designation
- Incorrect
 - “broken leg”
 - “subtroch”
 - “femur fracture” (not specific enough-need “Right femur shaft” to be correct)

Functions of the X-ray

- Localises fracture and number of fragments
- Indicates degree of displacement
- Evidence of pre-existing disease in bone
- Foreign bodies or air in tissues
- May show other fractures
- MRI, CT or ultrasound to reveal soft tissue damage

Fracture Evaluation

- X-ray **films should be taken in at least 2 projections** usually AP and lateral view
- X-ray films should be large enough to **include one end of joint and adjacent soft tissue**

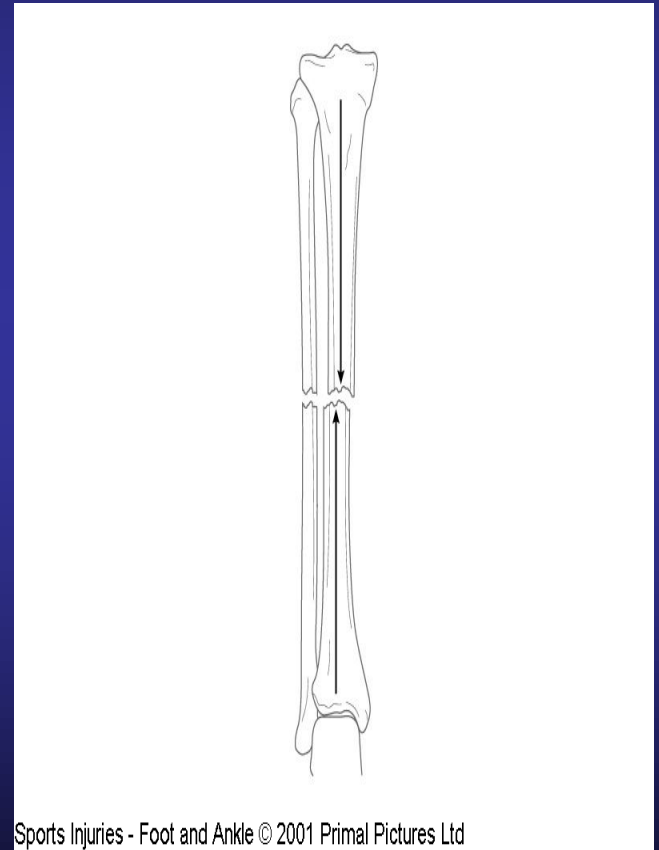
Fracture Evaluation

- In a child, the healthy opposite side occasionally is examined for comparison
- For special questions, some special studies
 - Oblique view
 - Stress film
 - Flexion and extension views
 - Delayed films

Transverse fracture



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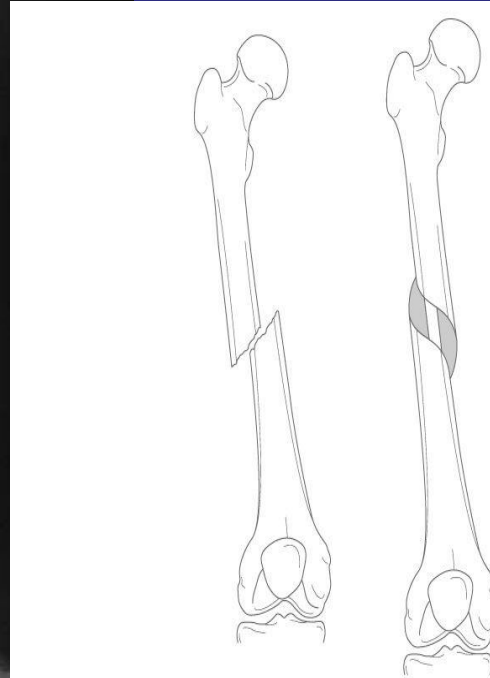
Oblique fracture



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Greenstick fracture

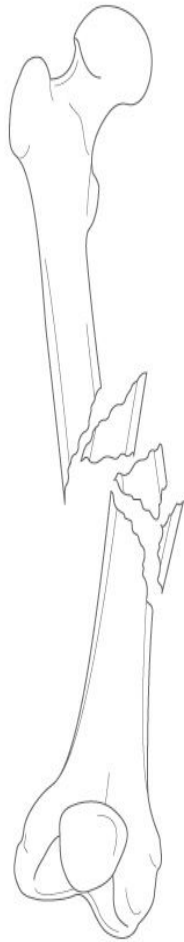


Crush fracture



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Comminuted fracture

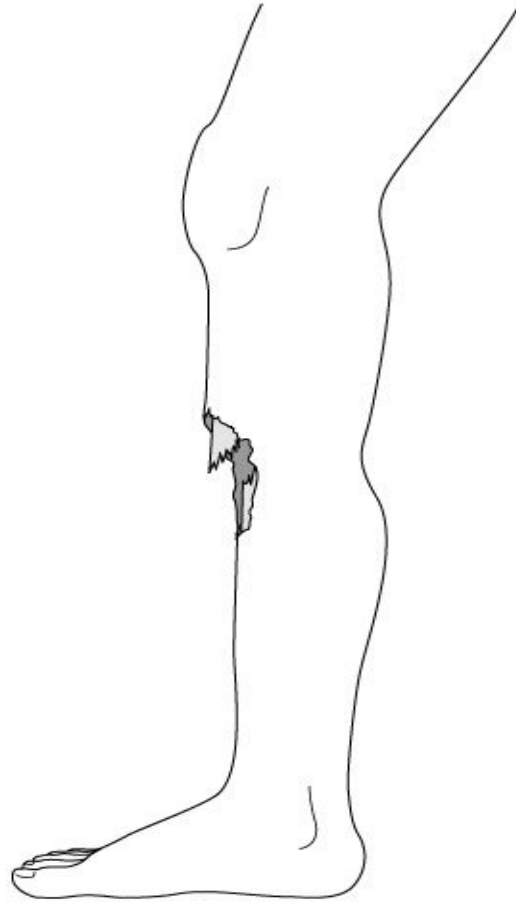


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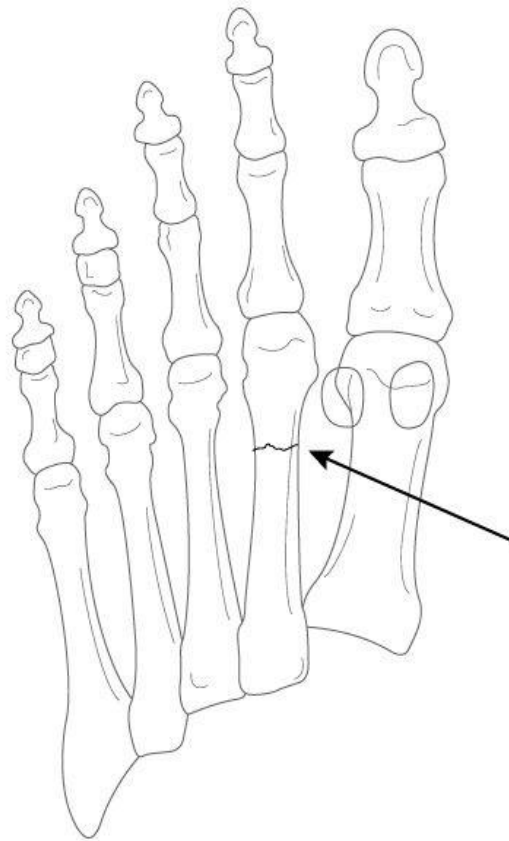


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Compound or Open fracture

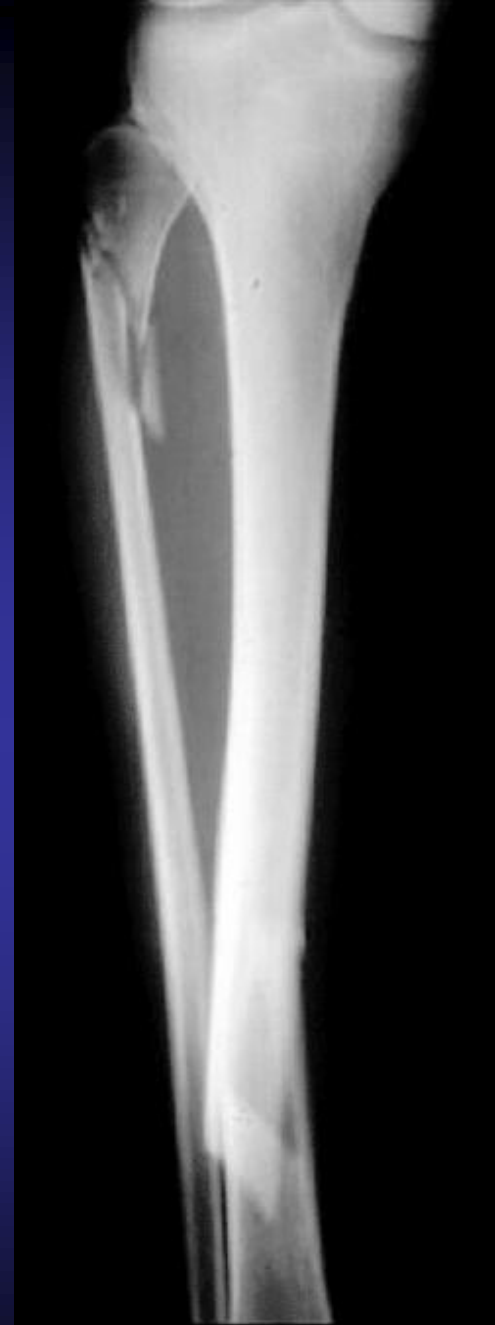


Stress / March fracture



Lower Leg Fracture

- Frontal view
- Oblique fracture tibia
- Angulation convex lateral at fracture
- Slight medial displacement distal fragment
- Comminuted fracture of fibula
- Lateral displacement
- Angulation convex lateral at fracture



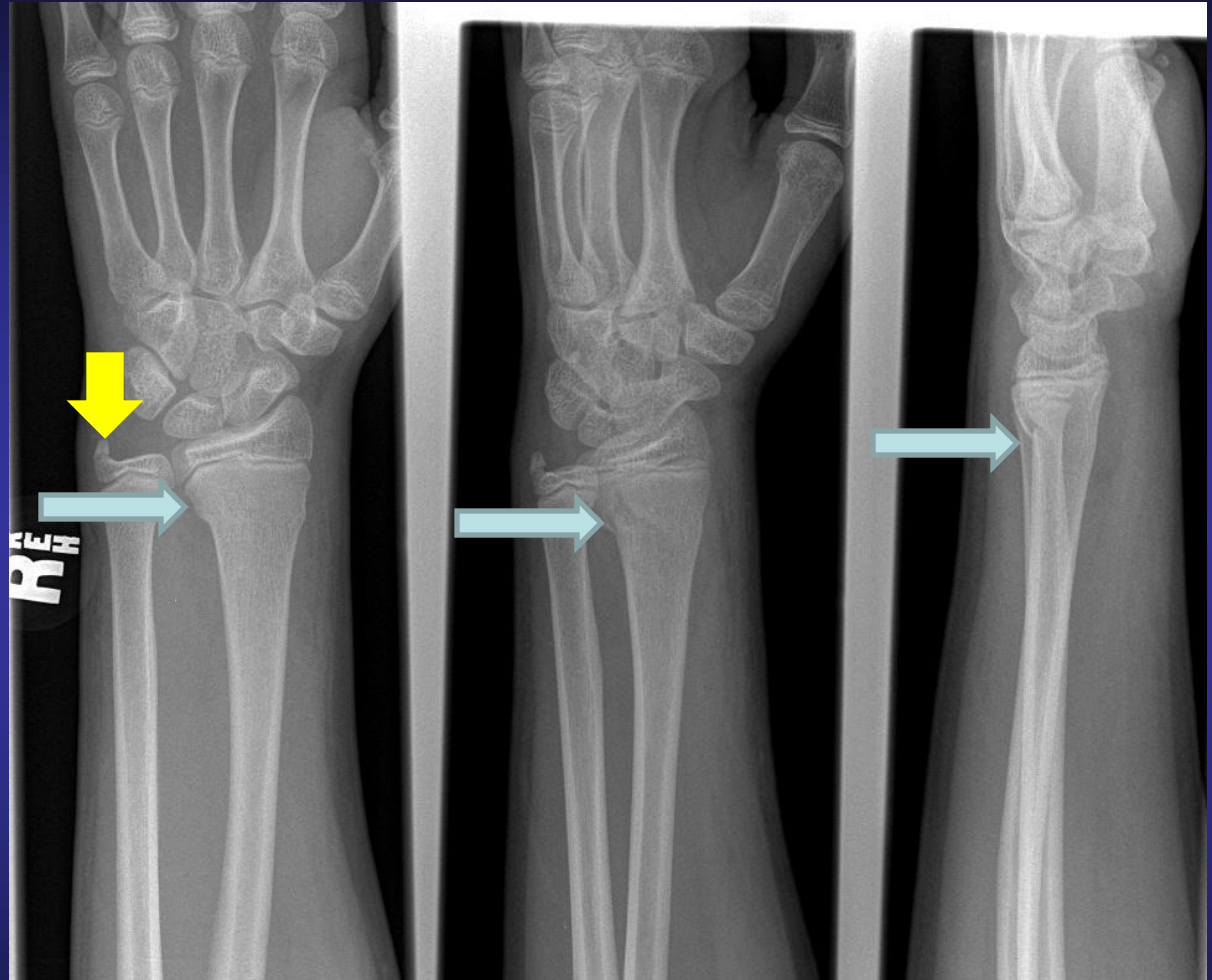
A lateral view radiograph of a lower leg fracture. The image shows the tibia and fibula. There is a clear fracture line in the tibia, with a significant posterior displacement of the distal fragment. The fibula also shows a fracture line, but it is less distinct. The overall alignment is slightly angulated.

Lower Leg Fracture Lateral View

- Posterior displacement of tibia fracture
- Slight angulation convex anteriorly at the fracture site
- Inadequate films with fibular fracture not included

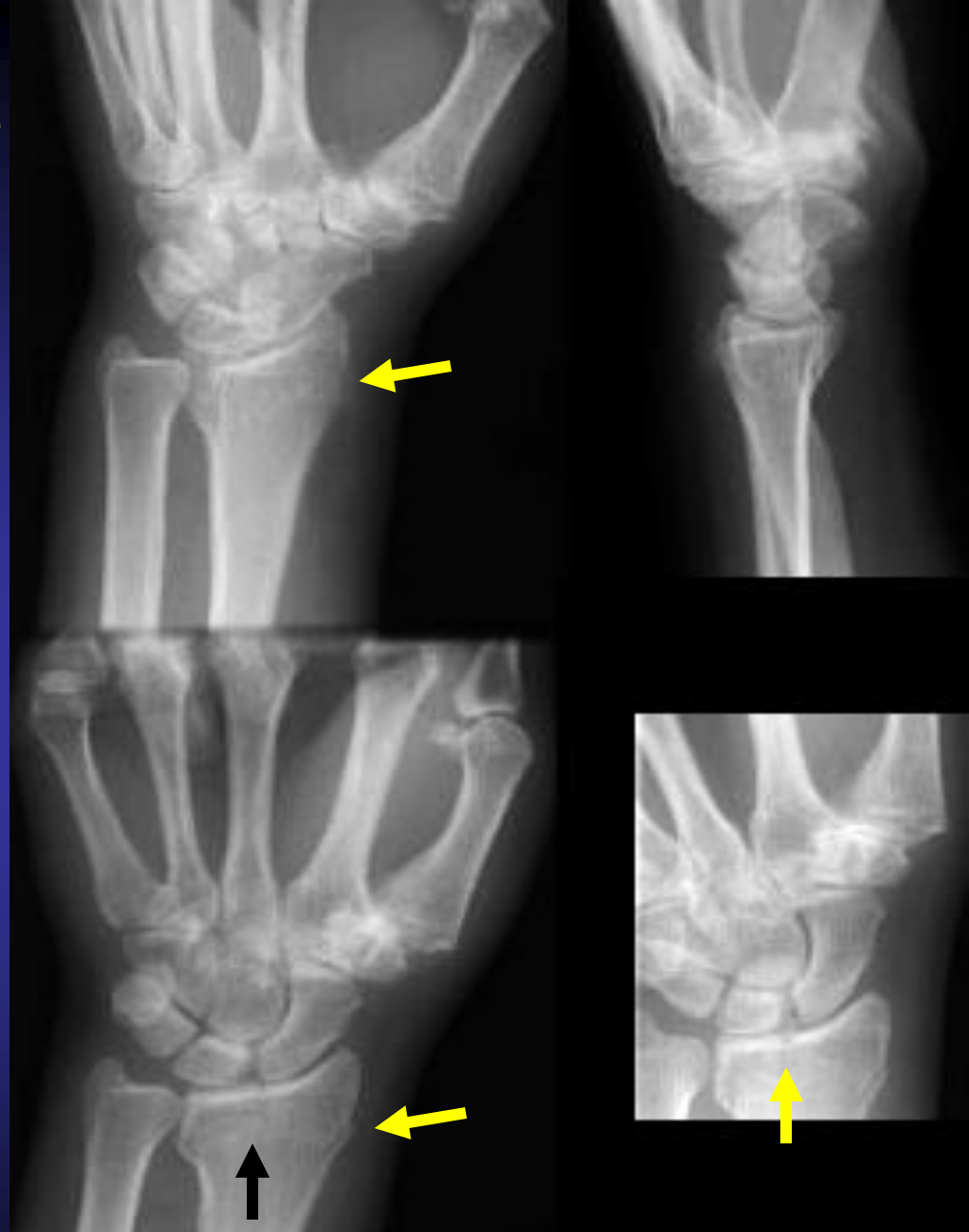
Forearm Fracture

- No angulation
- Transverse slightly impacted fracture radius
- Associated ulnar fracture evident

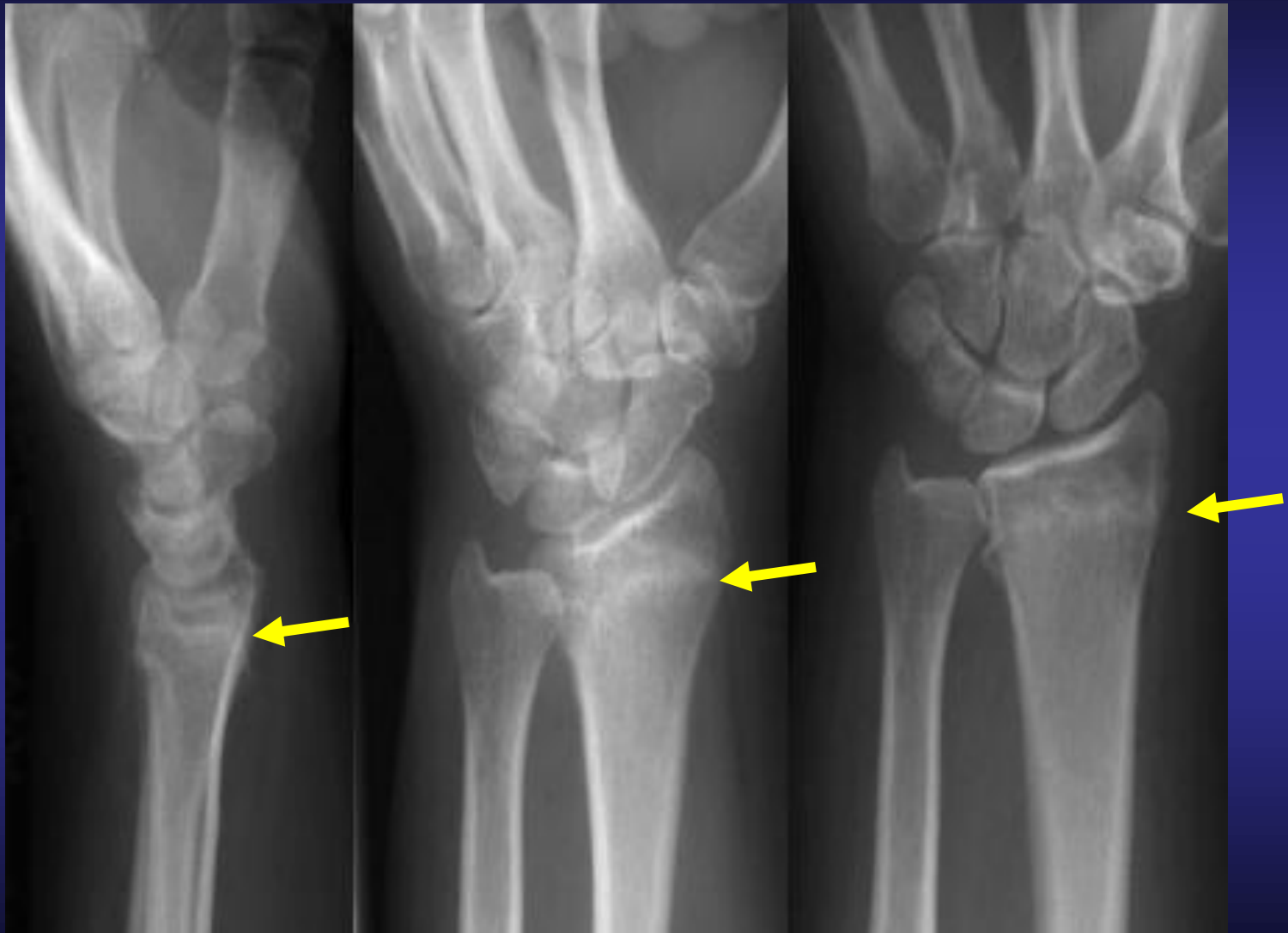


T Type Fracture

- Vertical component somewhat lucent
- Horizontal component slight impaction with increased density



Impaction Fracture Radius



Tibia Fracture

- Oblique, almost spiral fracture line
- Barely visible on the frontal study



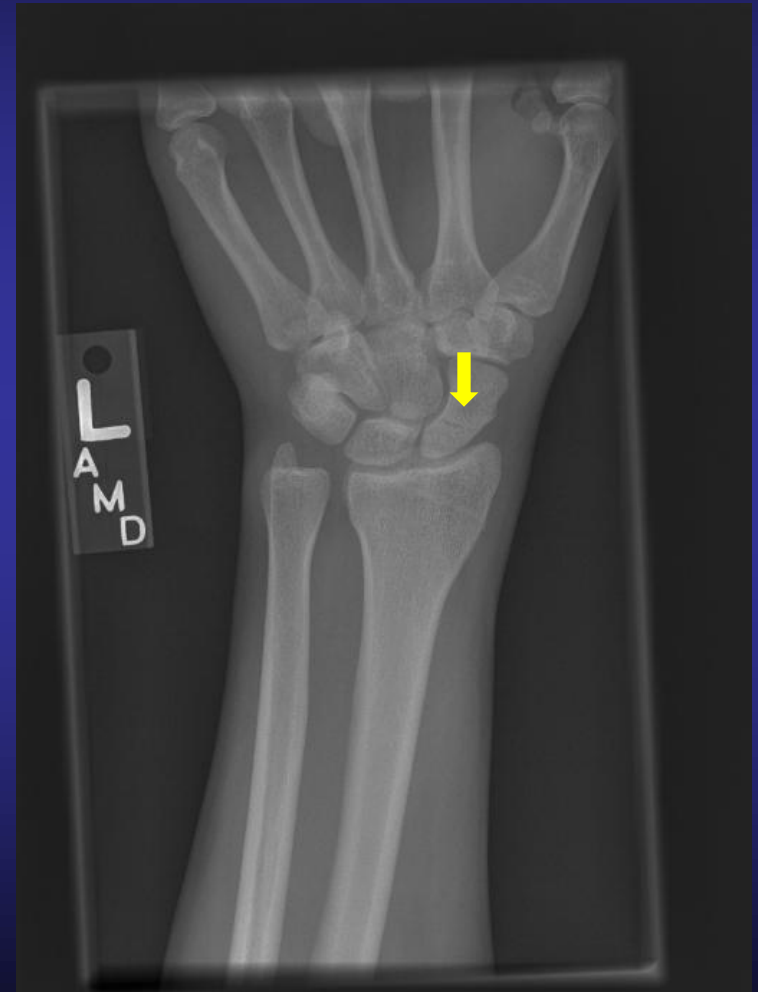
Comminuted Fracture

- Comminuted fracture of distal radius
- Anterior angulation
- Extension into the joint space



Scaphoid Fracture

- Undisplaced fracture
- Only lucent line identified



Scaphoid Fracture Old



Scaphoid Fracture

- Sclerosis of proximal portion
- Avascular necrosis of the proximal portion *
- Blood supply distal to proximal



Radial Head Fracture

- Small joint effusion with small anterior and posterior fat pads
- Minimally depressed radial head fracture



Pathologic Scaphoid Fracture

- Small cystic zone in scaphoid
- Fracture through the cyst



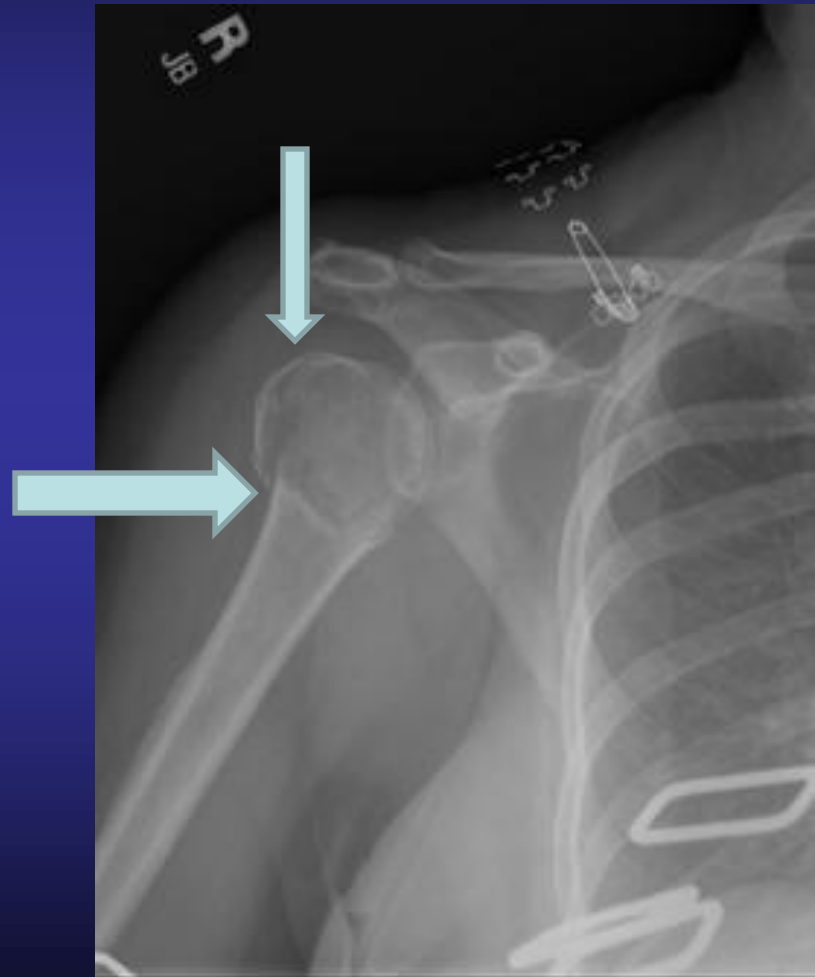
Salter I Fracture

- Posteriolateral displacement of epiphysis



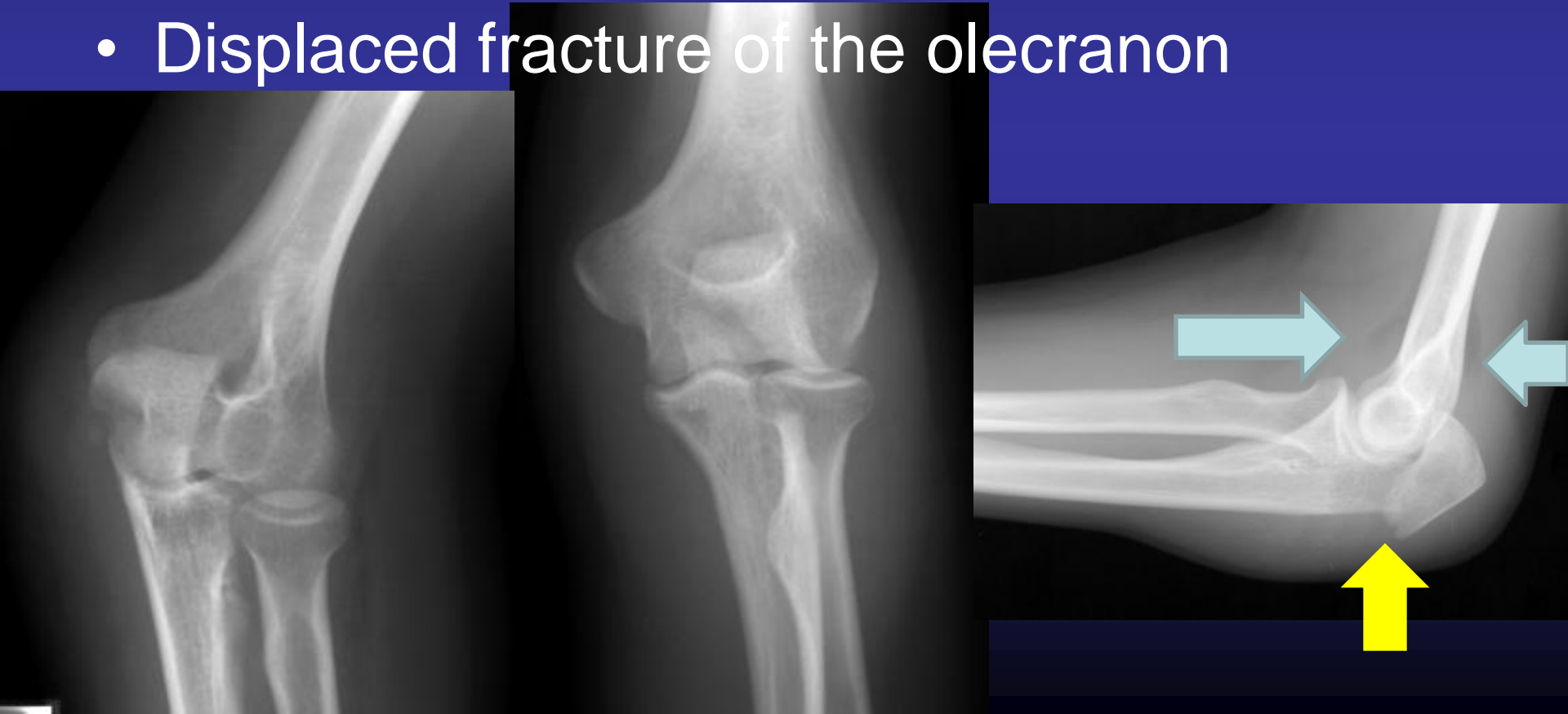
Humerus Fracture

- Shoulder trauma
- Surgical neck involvement
- Somewhat comminuted



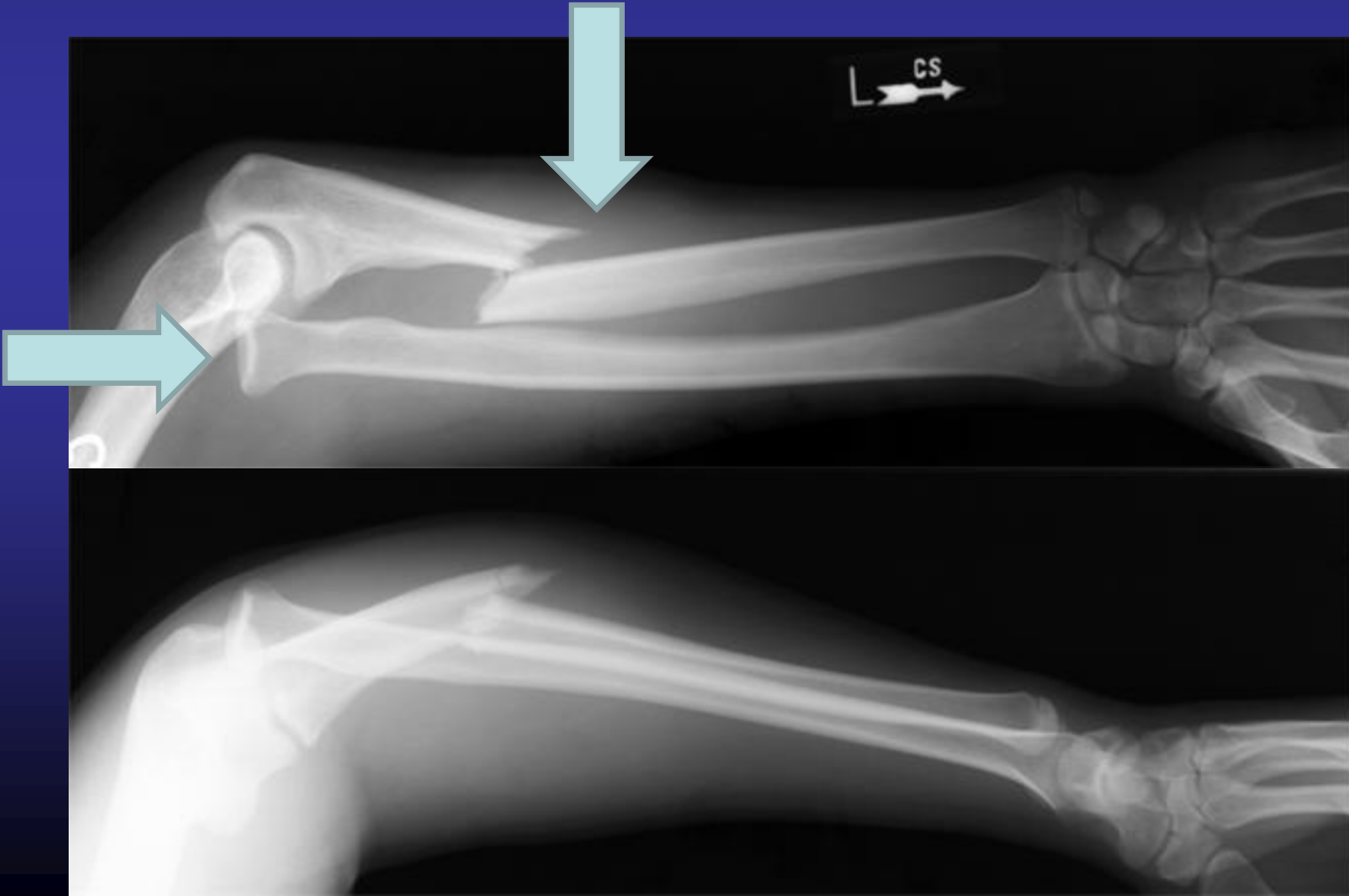
Olecranon Fracture

- Joint effusion, anterior and posterior fat pads
- Displaced fracture of the olecranon



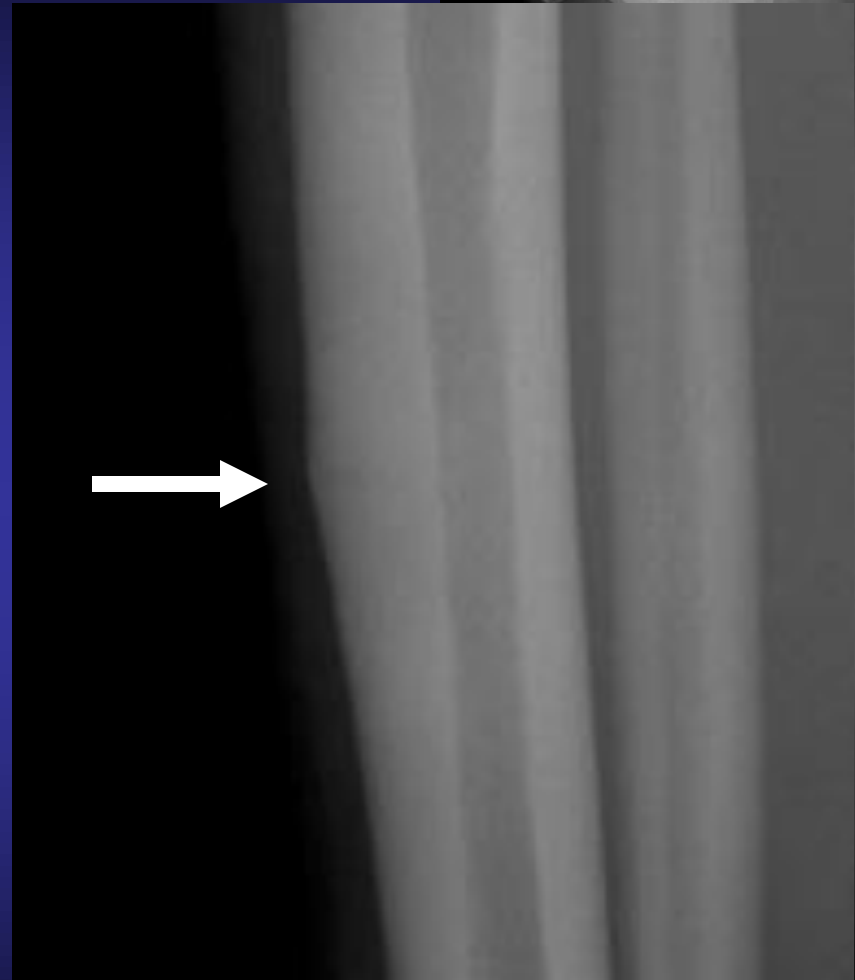
Monteggia's Fracture

- Ulnar fracture
- Radial dislocation
- Paired bones – almost always both involved



Tibial Stress Fracture

- Femur, tibia, metatarsals common locations
- Bone scan and MRI useful
- Plain film negative many cases
- Linear fracture with some callus in this case



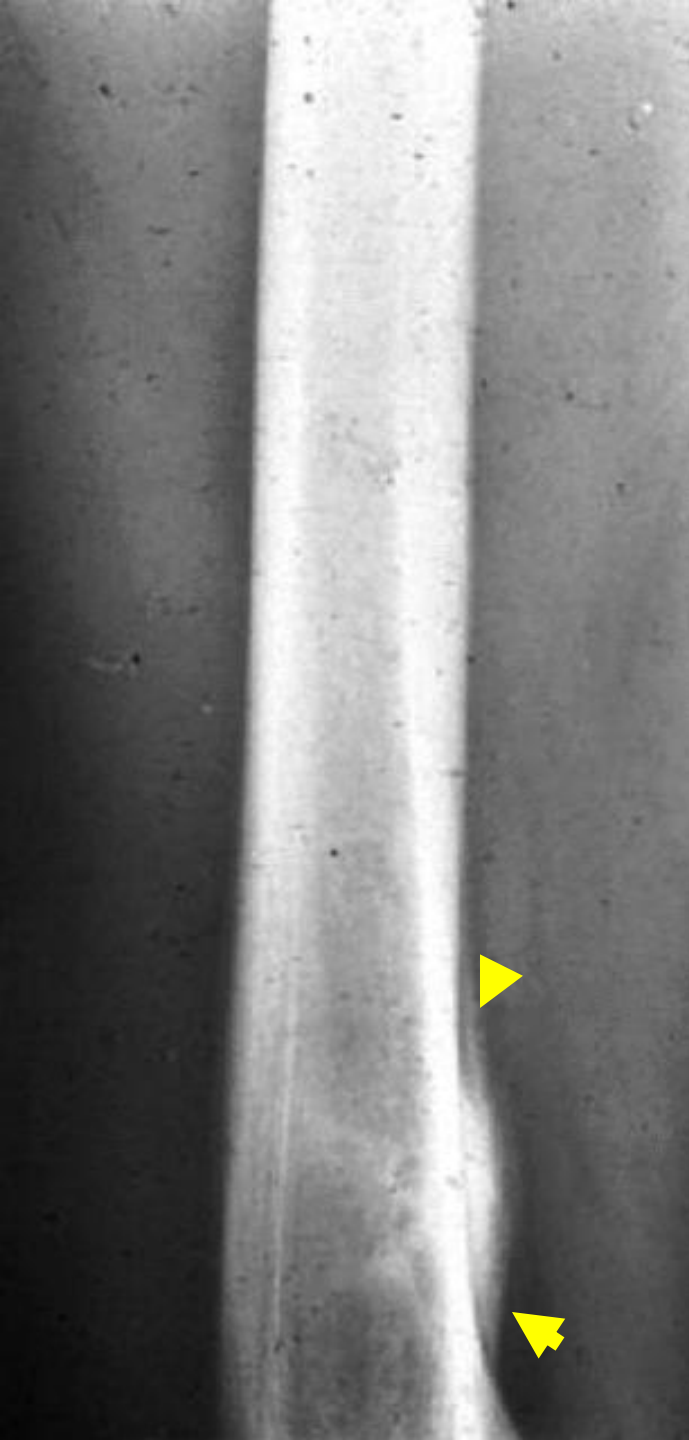
Healing Stress Fracture

- Periosteal reaction
- Resorption along the fracture line
- Early healing



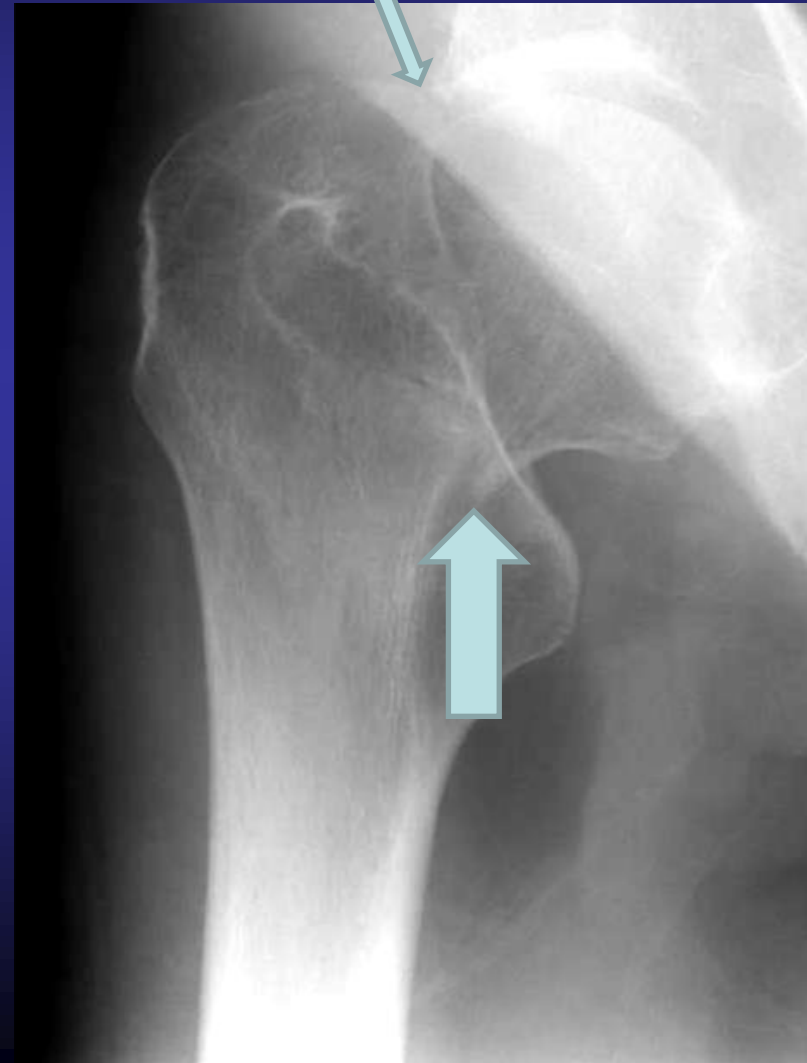
Distal Femoral Stress Fracture

- Stress fracture distal posterior cortex
- Periosteal elevation restricted to area of injury

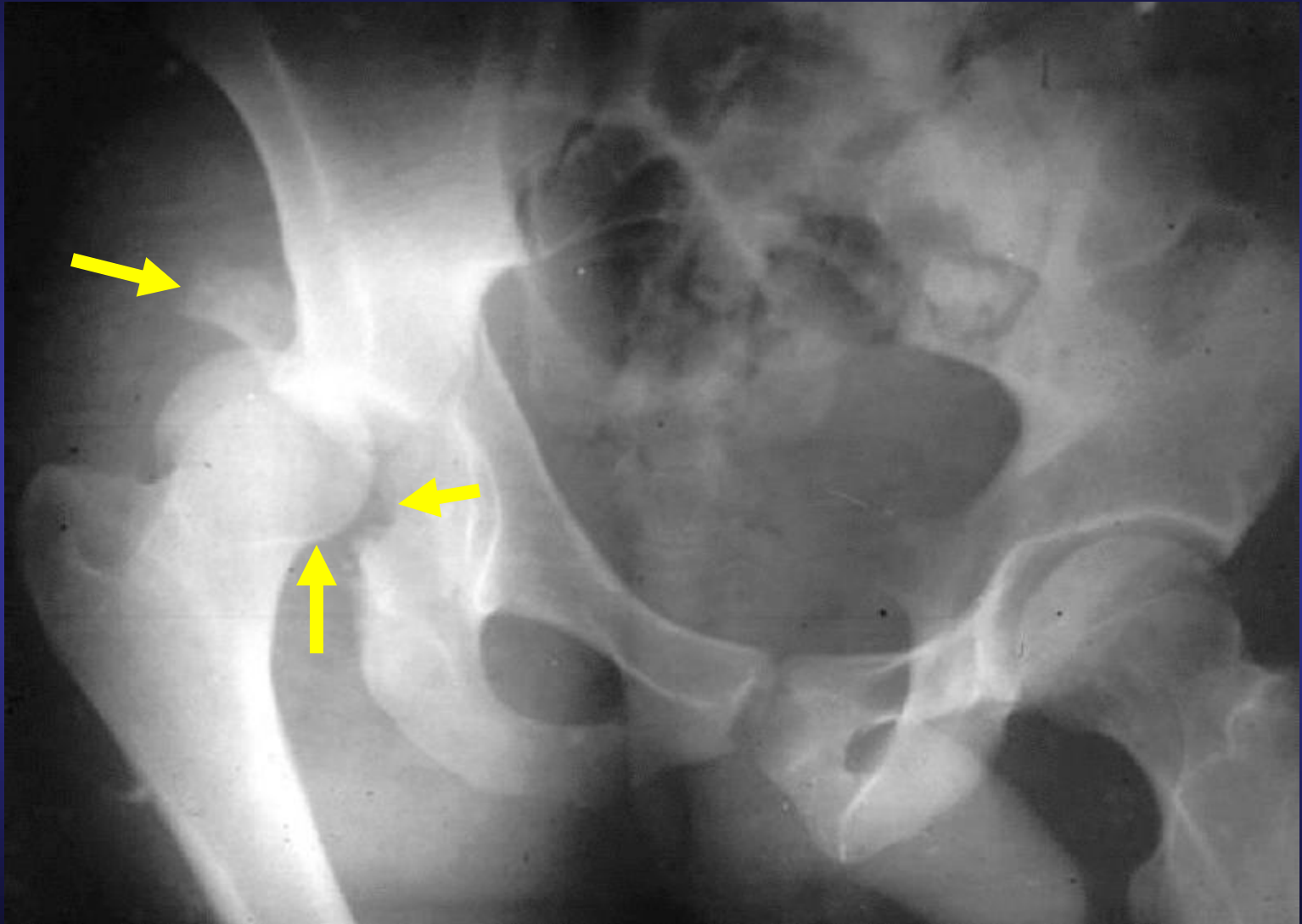


Femoral neck fracture (traumatic s/p fall)

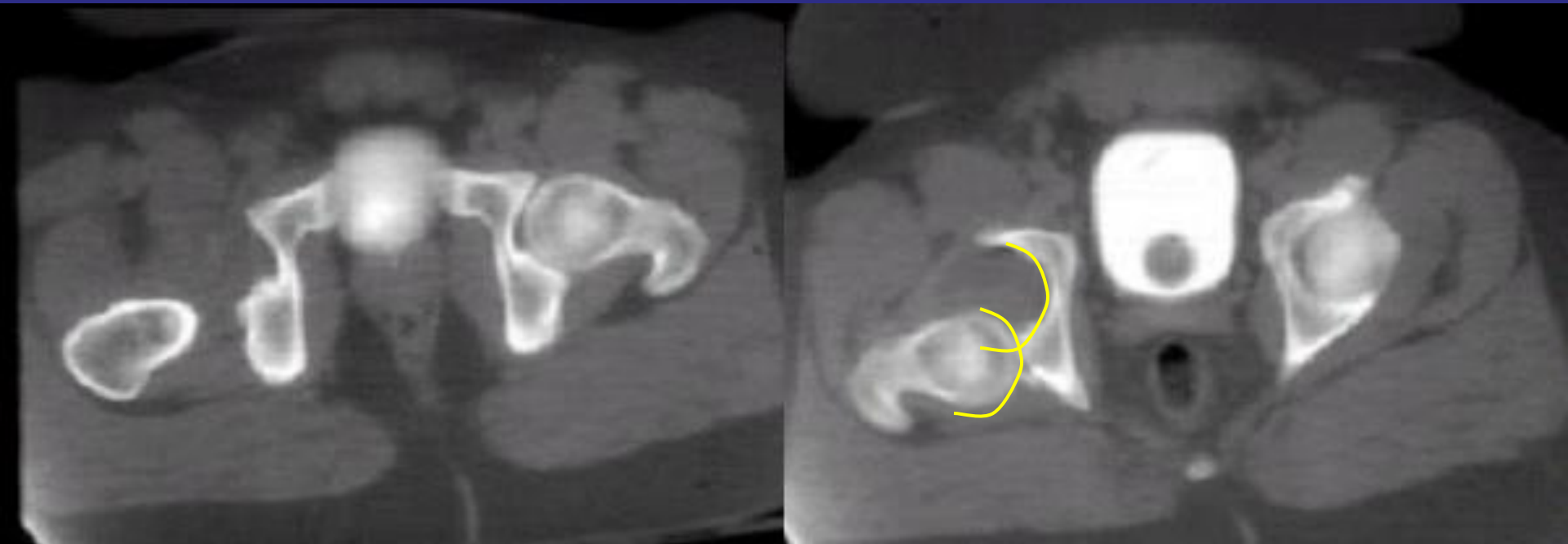
- Recent fall
- Disruption of femoral neck



Hip Dislocation – Acetabular Fracture

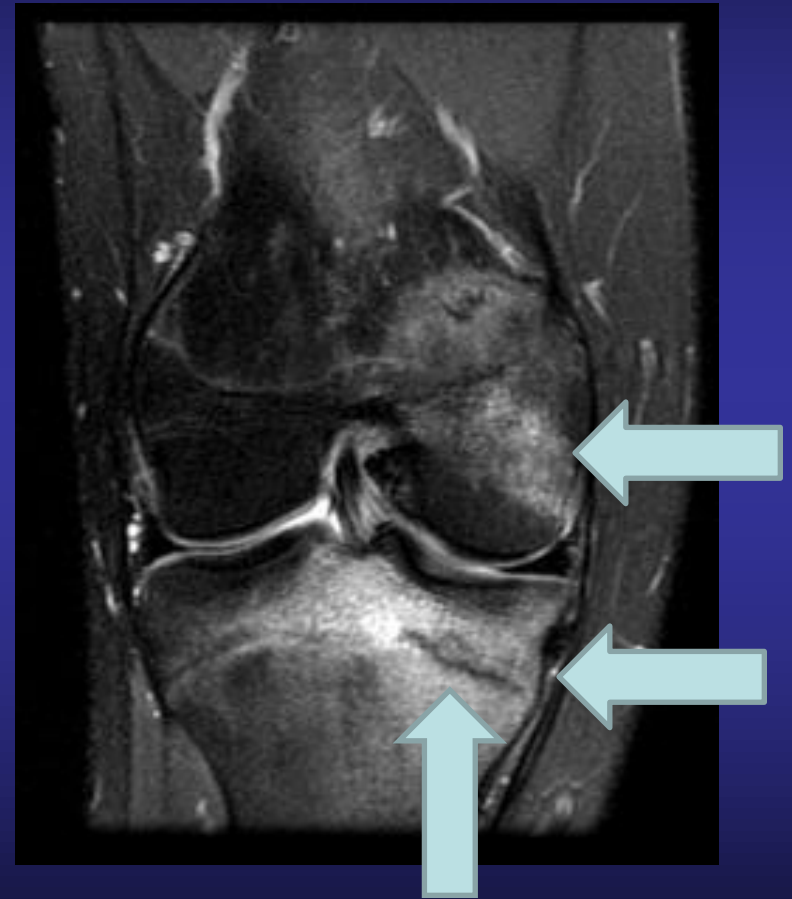


Posterior Hip Dislocation

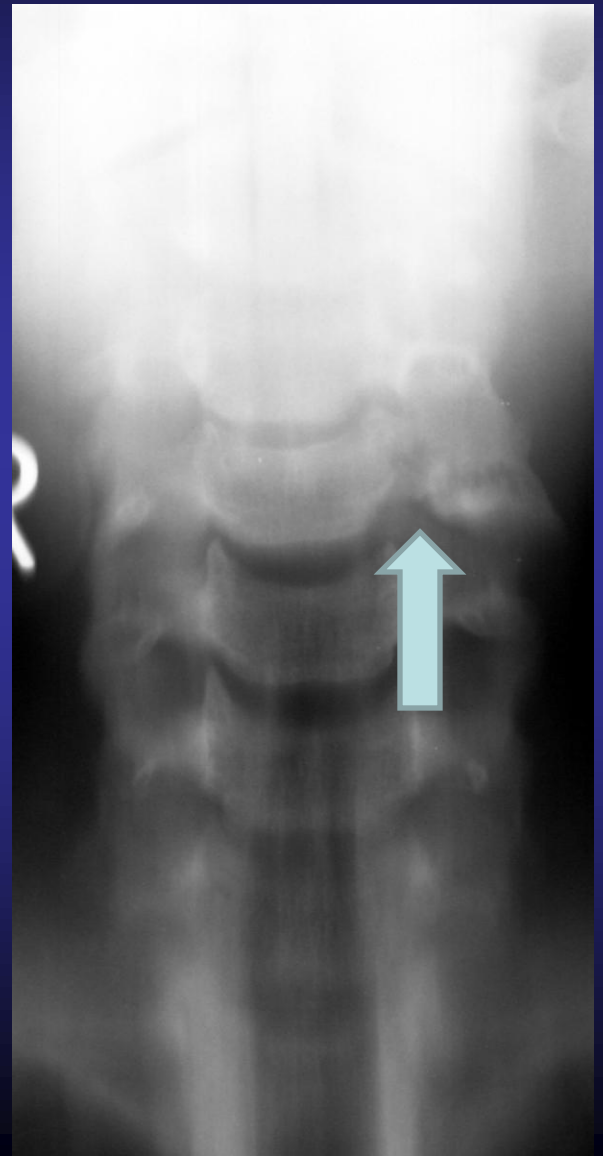


Tibial Plateau Fracture

- Transverse tibial plateau fracture through growth plate
- Edema medial femoral condyle, tibial plateau



C-3 Fracture/ dislocation



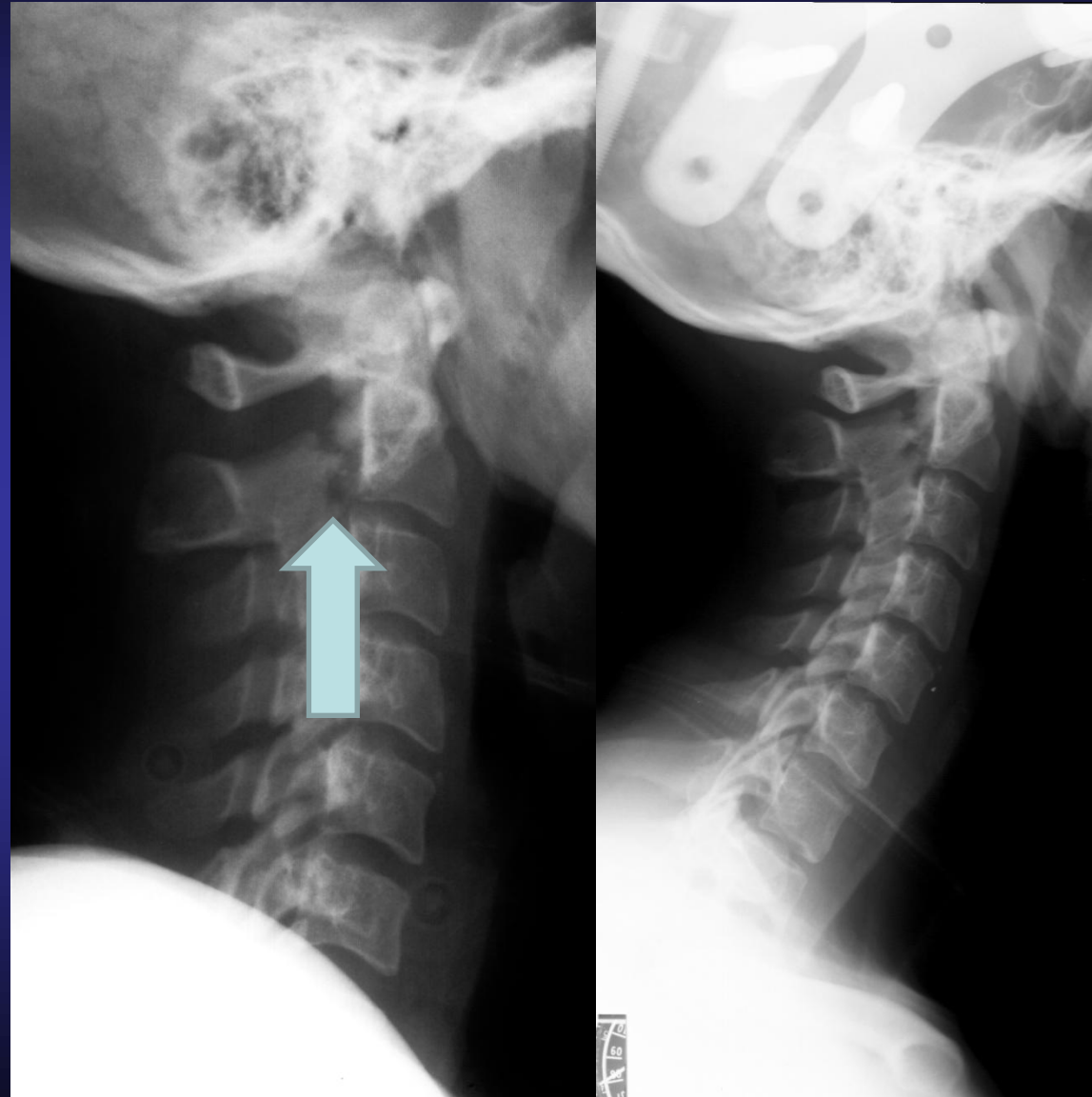
C-2 Fracture

- C2 Fracture
- Anterior subluxation
- “hangman’s” fracture



Post Op – Halo placement

- C2 Fracture – minimal displacement
- Post-Op placement of a halo device



Cervical Dislocation C4-5

- Anterior dislocation C4-5
- Facet joint dislocation



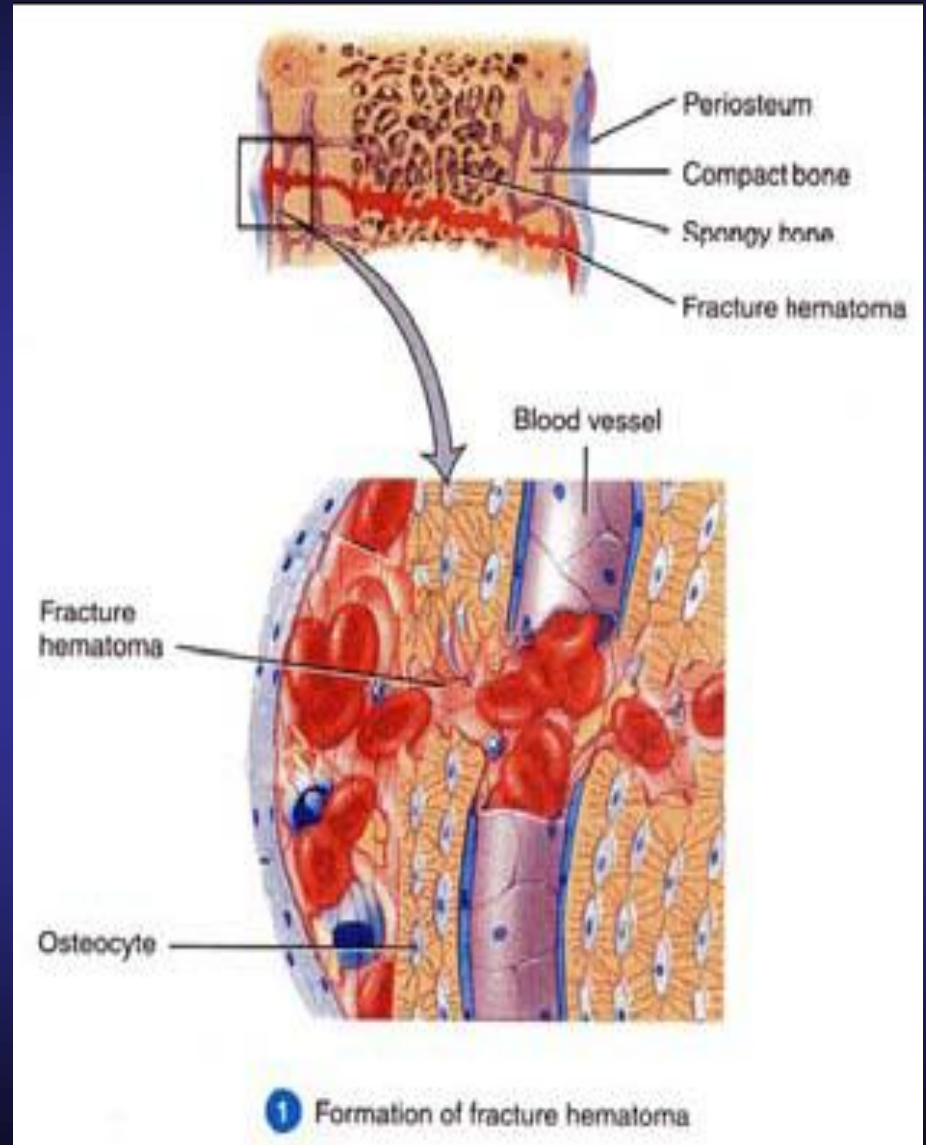
Fracture Healing

- Reparative process of self-healing (*union*) occurs in the following stages:
 1. Fracture hematoma (d/t bleeding, edema)
 2. Granulation tissue → osteoid (3 – 14 days post injury)
 3. Callus formation (minerals deposited in osteoid)

Bone Healing

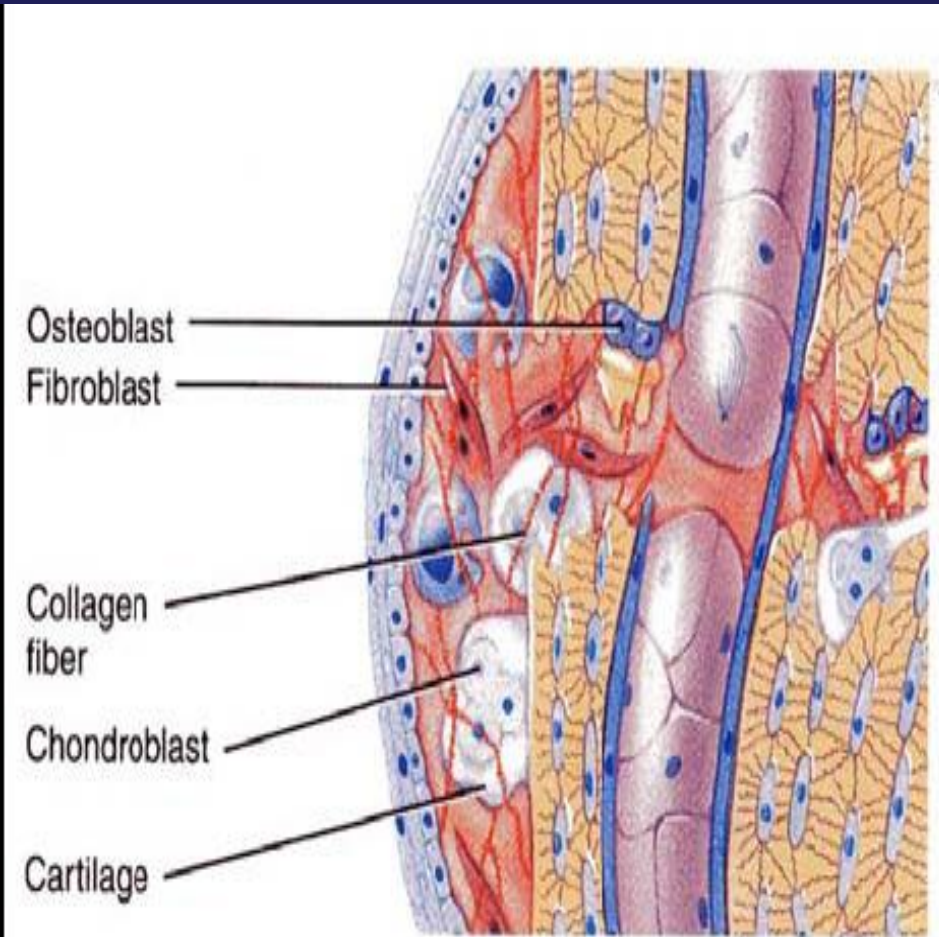
1. Fracture hematoma

- blood from broken vessels forms a clot.
- 6-8 hours after injury
- swelling and inflammation to dead bone cells at fracture site



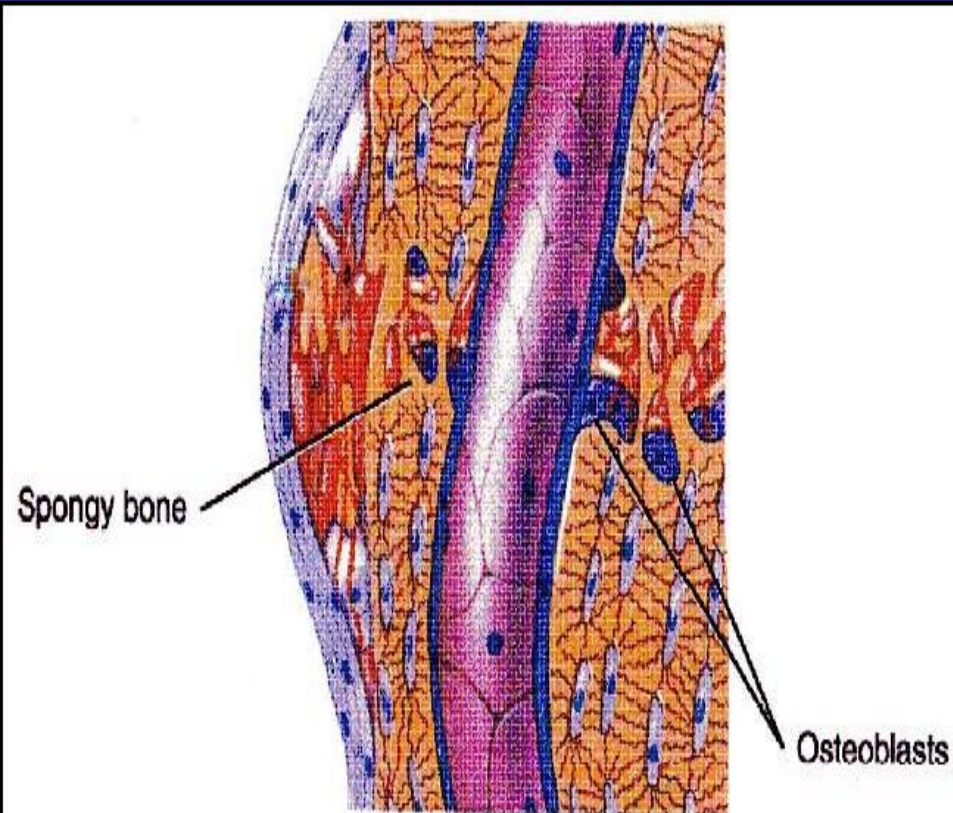
2. Fibrocartilaginous callus

- (lasts about 3 weeks (up to 1st May))
 - new capillaries organise fracture hematoma into granulation tissue - 'procallus'
 - Fibroblasts and osteogenic cells invade procallus.
 - Make collagen fibres which connect ends together
 - Chondroblasts begin to produce fibrocartilage,



3. Bony callus

- (after 3 weeks and lasts about 3-4 months)
 - osteoblasts make woven bone.

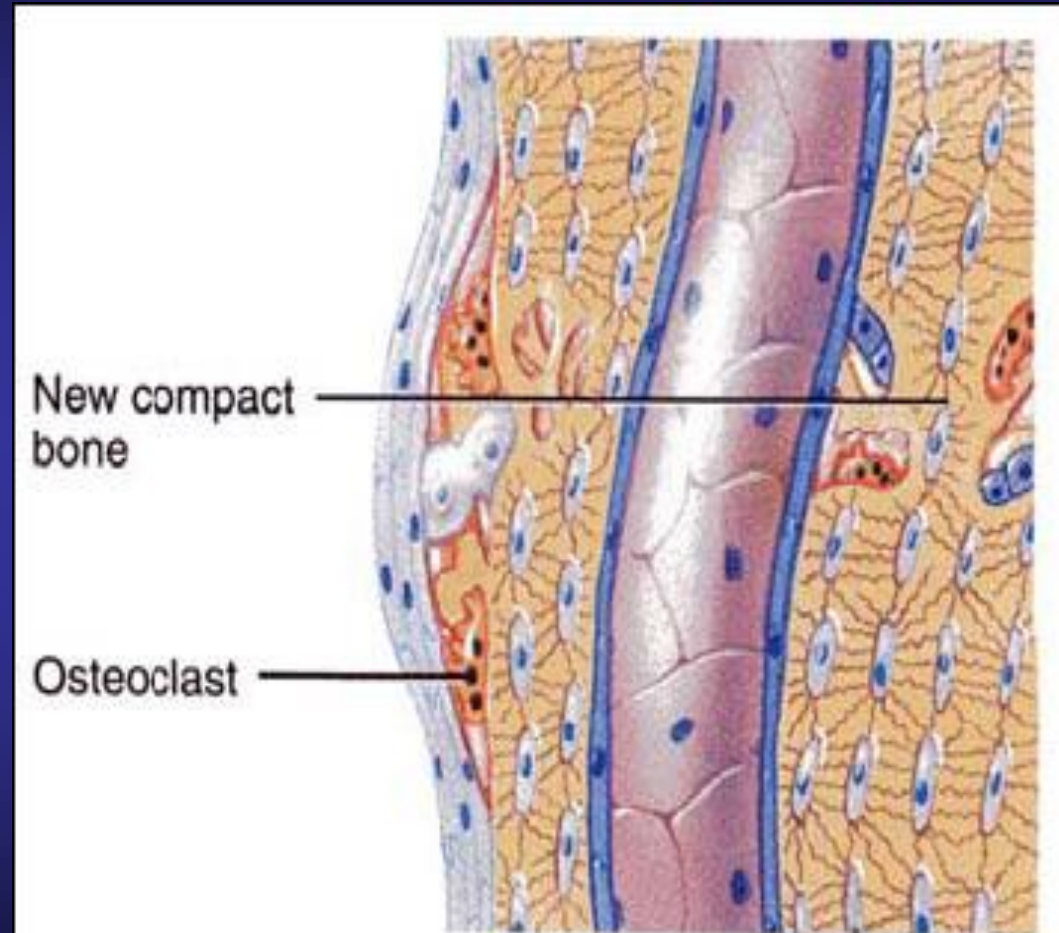


Fracture Healing

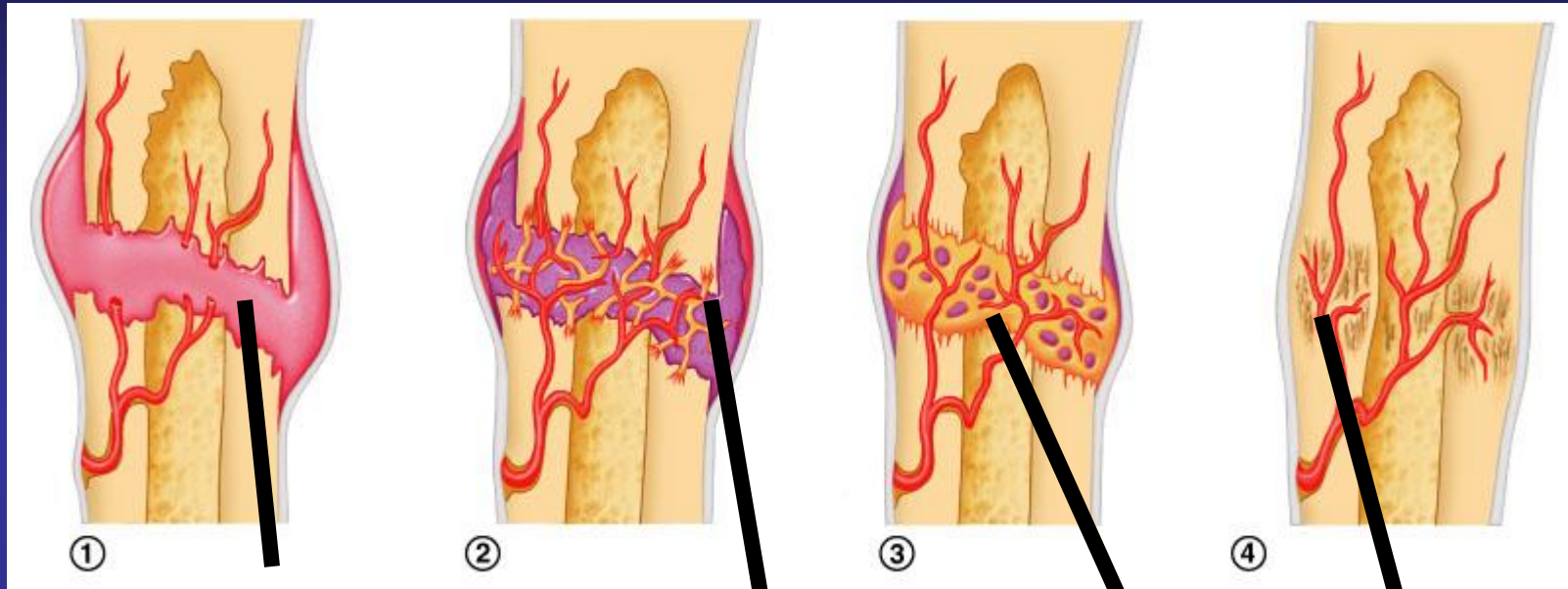
- Reparative process of self-healing (*union*) occurs in the following stages:
 4. **Ossification** (3 wks – 6 mos)
 5. **Consolidation** (distance between fragments decreases \Rightarrow closes).
 6. **Remodeling** (union completed; remodels to original shape, strength)

4. Bone Remodeling

- Osteoclasts remodel woven bone into compact bone and trabecular bone
 - Often no trace of fracture line on X-rays.



Repair of Fractures



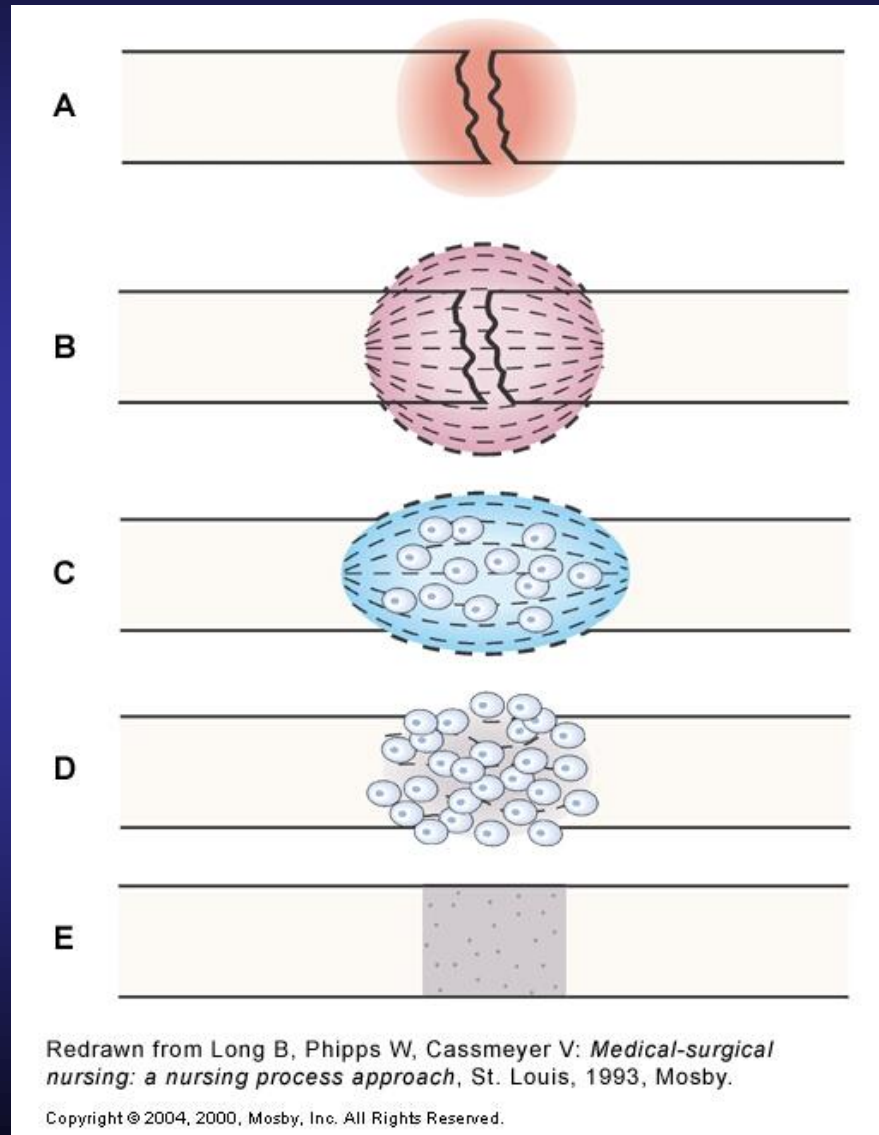
hematoma

callus

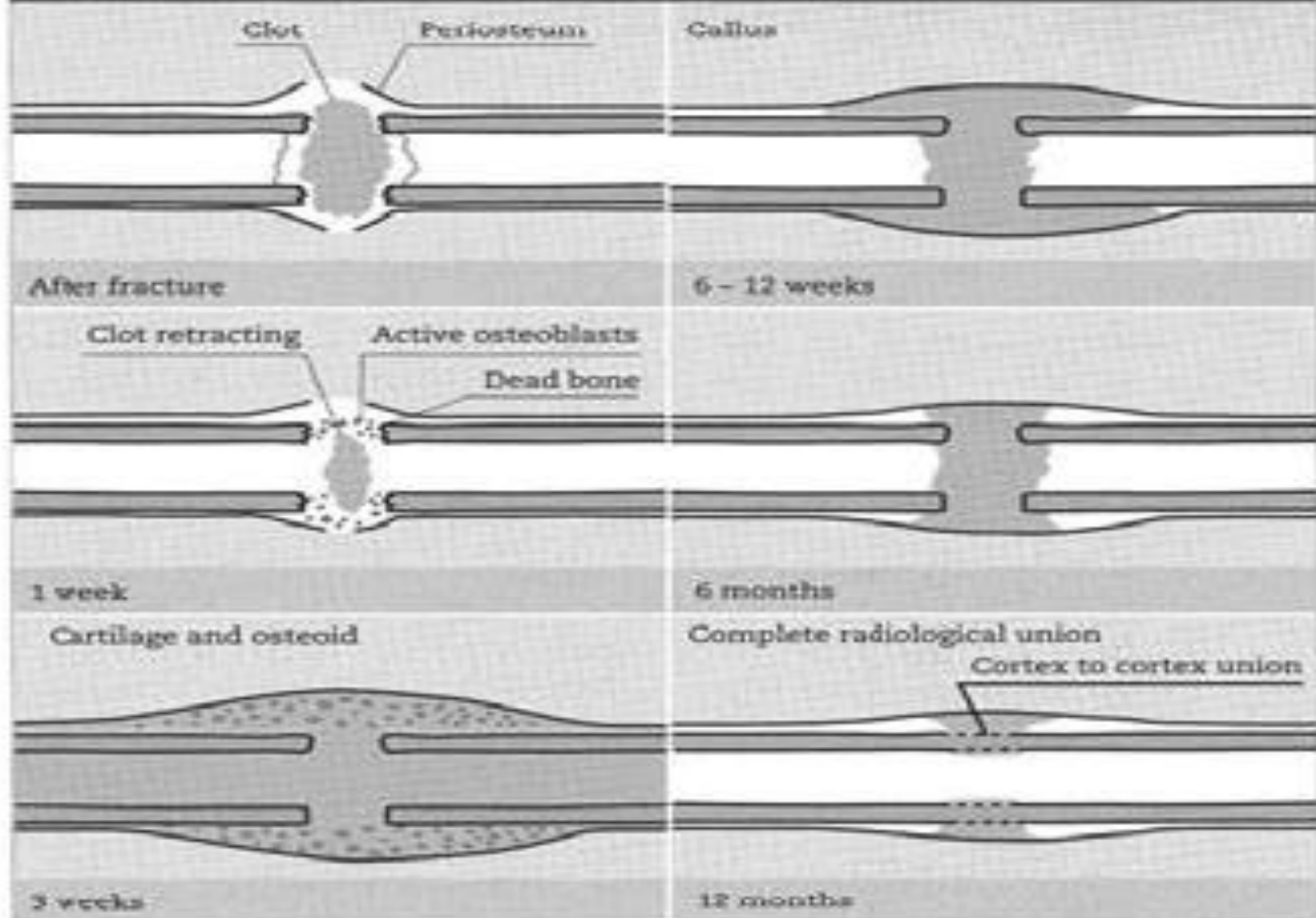
bony callus

bone
remodeling

Bone Healing



HEALING OF A FRACTURE



Fracture treatment

- Immobilize the fracture
- Mobilize the patient
- Avoid “fracture disease”
- Avoid complications
- Allow healing

Principles of management

Initial Treatment - *First aid*

- Splint - *The patient should not be moved*
Possible further fractures should be prevented
- Analgesia
- Elevation
- Follow-up

Principles of management

Principles of treatment by surgeon

- In the case of severe injury, there may be other problems that take priority over treatment of the fracture: shock, bleeding, maintenance of airway and ventilation, and possibly other injury.
- The surgeon will aim to obtain good reduction and alignment of the fracture, followed by immobilization that is sufficient to promote good healing and restoration of function.

Collaborative Care

- Overall goals of treatment:
 - Anatomic realignment of bone fragments (reduction)
 - Immobilization to maintain alignment (fixation)
 - Restoration of normal function

Collaborative Care

Fracture Reduction

- Closed reduction
 - Nonsurgical, manual realignment
- Open reduction
 - Correction of bone alignment through a surgical incision

Collaborative Care

Fracture Reduction

- Traction (with simultaneous counter-traction)
 - Application of pulling force to attain realignment
 - Skin traction (short-term: 48-72 hrs)
 - Skeletal traction (longer periods)

Collaborative Care

Fracture Immobilization

- Casts
 - Temporary circumferential immobilization device
 - Common following closed reduction

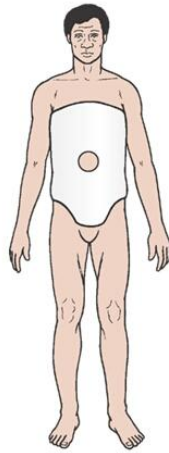
Casts



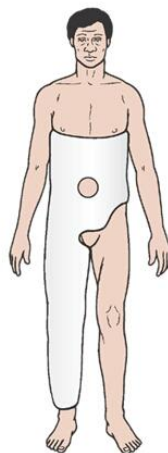
Short arm cast



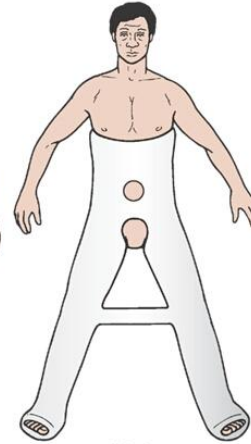
Long arm cast



Body jacket cast



Single hip spica



Double hip spica



Long leg cast



Short leg cast

Fig. 61-9

How to Handle Fractures

- Reduction
 - Open reduction
 - Allows very accurate reduction
 - Risk of infection
 - Usually when internal fixation is needed
- Manipulation
 - Usually with anaesthesia
- Traction
 - Fractures or dislocation requiring slo

Holding the reduction

- 4-12 weeks
- External fixation
- Internal fixation
 - Intermeduallly nails, compression plates
- Frame fixation

Collaborative Care

Fracture Immobilization

- External fixation
 - Metallic device composed of pins that are inserted into the bone and attached to external rods

External fixation

- Used for fractures that are too unstable for a cast. You can shower and use the hand gently with the external fixator in place.



Collaborative Care

Fracture Immobilization

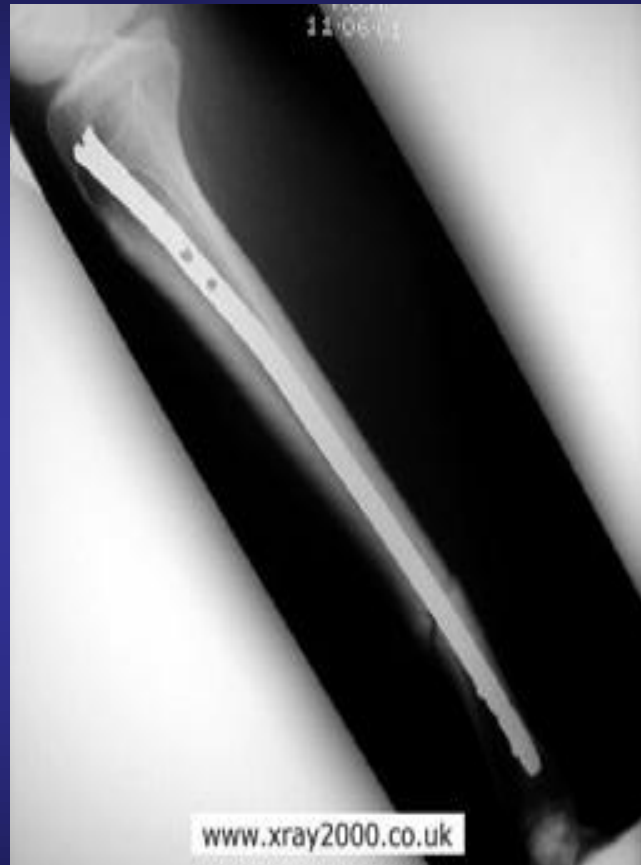
- Internal fixation
 - Pins, plates, intramedullary rods, and screws
 - Surgically inserted at the time of realignment

Frame fixation

- Allows correction of deformities by moving the pins in relation to the frame.



Internal fixation



Collaborative Care

Fracture Immobilization

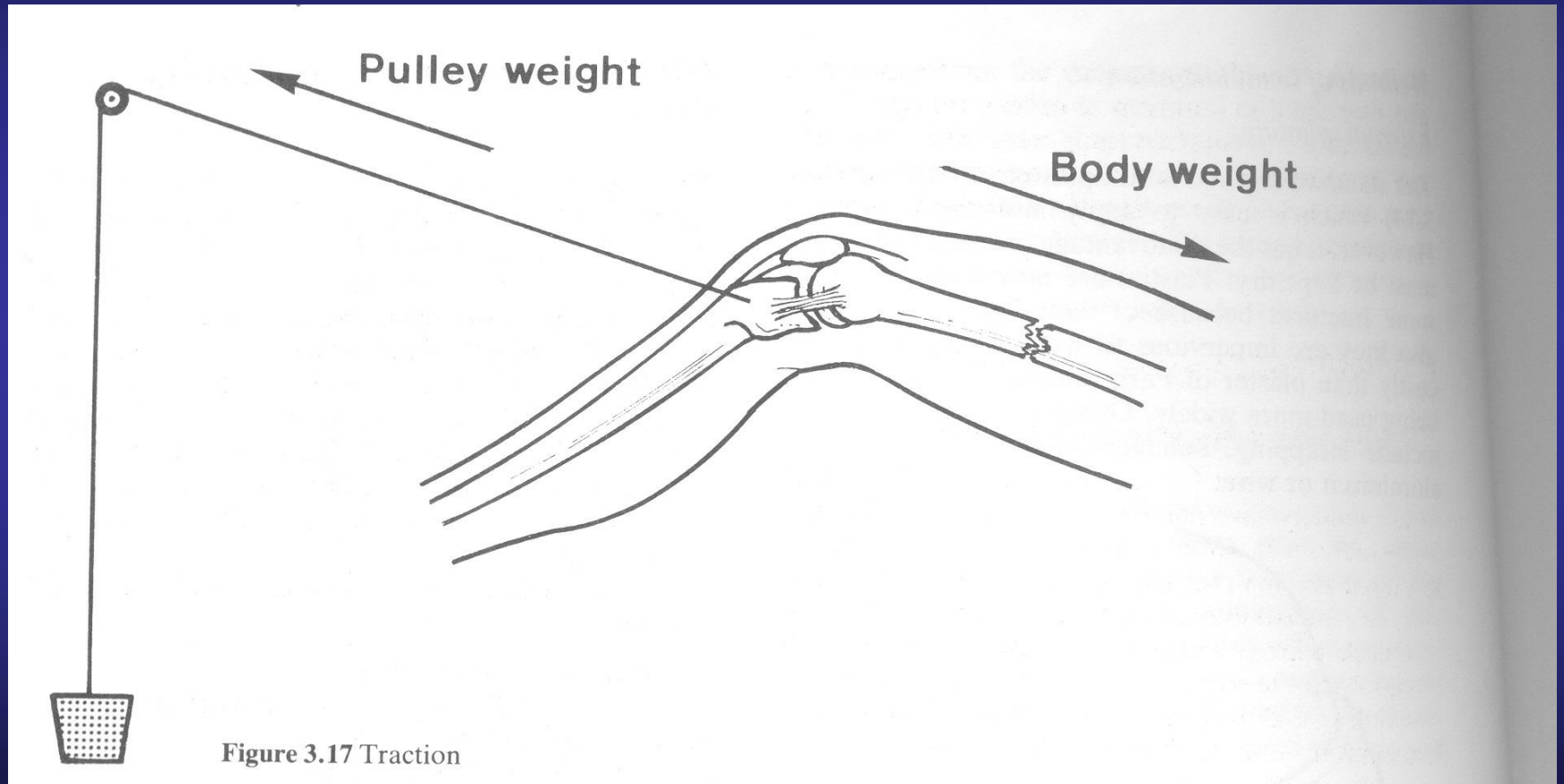
- Traction
 - Application of a pulling force to an injured part of the body while countertraction pulls in the opposite direction

Collaborative Care

Fracture Immobilization

- Purpose of traction: Prevent or reduce muscle spasm
- Immobilization
- Reduction
- Treat a pathologic condition

traction



Cervical traction

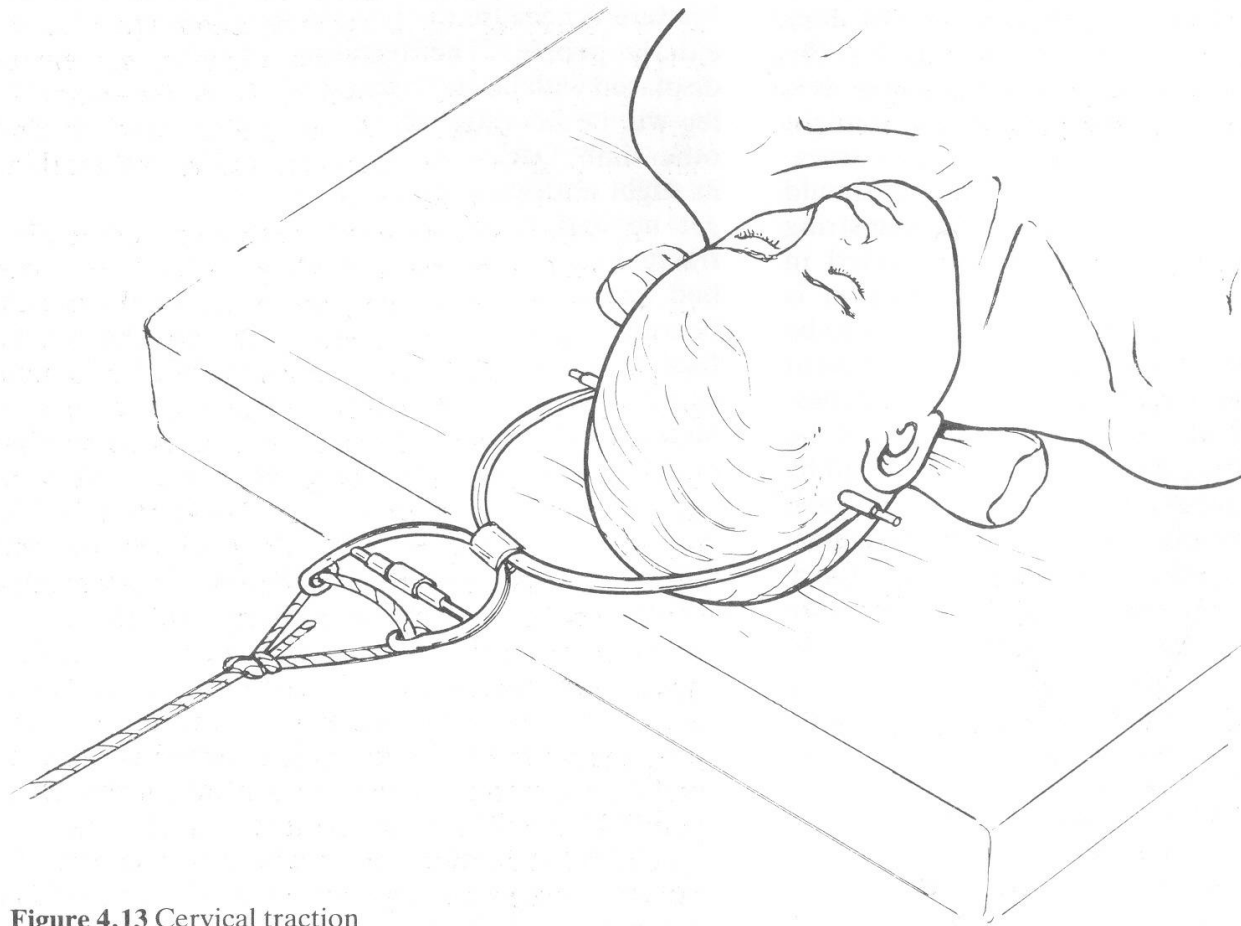


Figure 4.13 Cervical traction

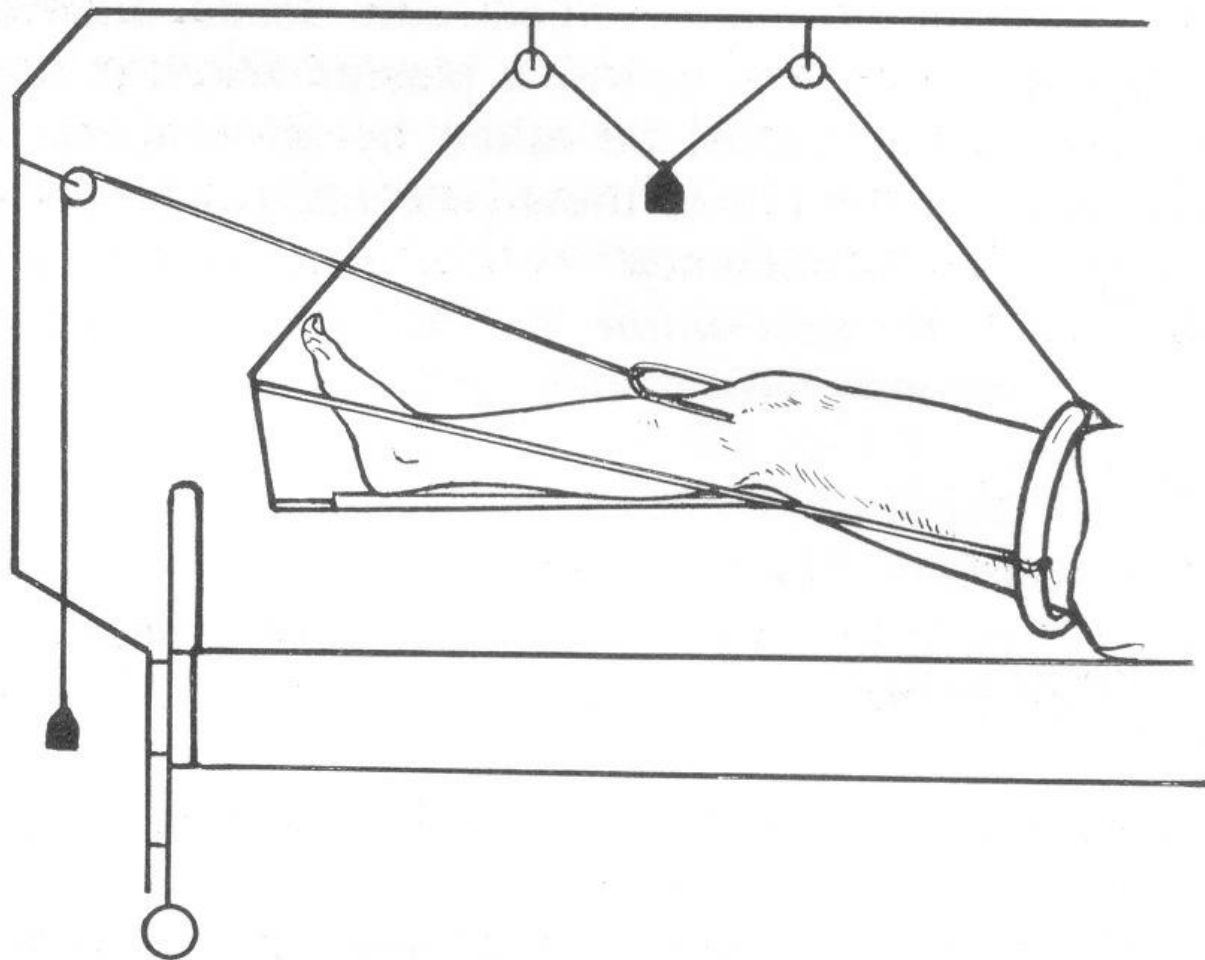


Figure 4.10 Continuous traction with balanced suspension for fractured shaft of femur

TRACTION FOR CHILD WITH FRACTURED SHAFT OF FEMUR

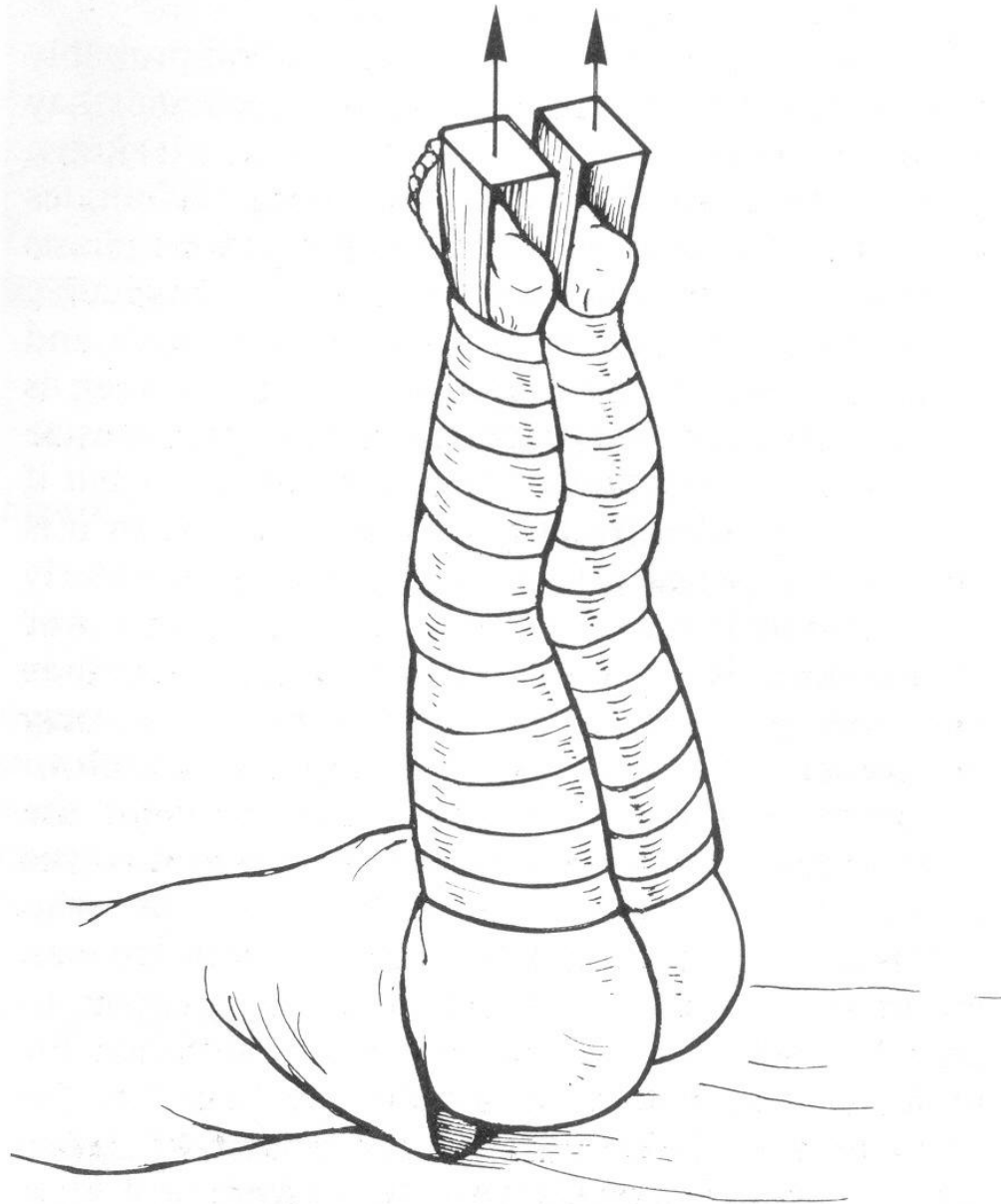


Figure 4.11 Gallow's traction for fractured shaft of femur



Complications

- Infection
- Avascular necrosis
- Mal-union (deformity of shortening)
- Joint disruption
- Adhesion
- Injury to large vessels
- Injury to muscle
- Injury to nerves
- Sudeck's atrophy
- Injury to viscera
- Contracture

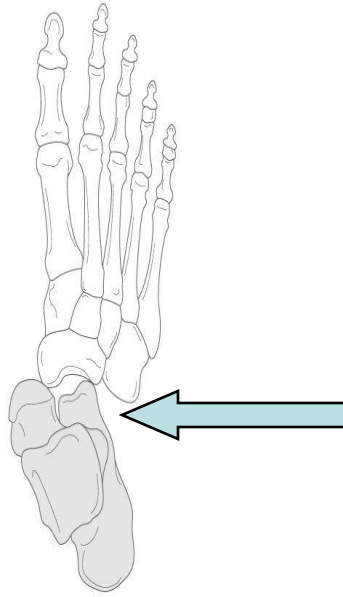
Physiotherapy during immobilization

- Reduce oedema – to prevent the adhesion formation
- Assist the maintenance of the circulation – active exercise either by static or isotonic muscle activity
- Maintain muscle function by active or static contraction
- Maintain joint range where possible
- Maintain as much function as allowed by the particular injury and the fixation
- Teach the patient how to use special appliances such as crutches, sticks, frames, and how to care for these or any other apparatus

Physiotherapy after the removal of fixation

- To reduce any swelling
- To regain full range of joint movement
- To regain full muscle power
- To re-educate full function

Dislocation



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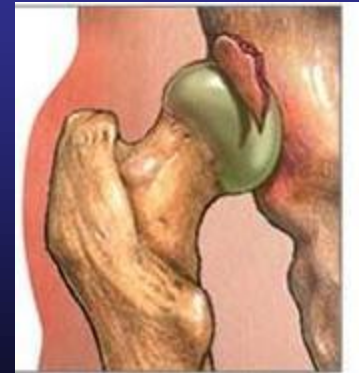


JOINT DISLOCATIONS

Definition

- A dislocation is a separation of two bones where they meet at a joint. A dislocated bone is no longer in its normal position. A dislocation may also cause ligament or nerve damage. Dislocations may be associated with a periarticular fracture

Normal
hip



Dislocated
hip

SUBLUXATION

A subluxation is an incomplete or partial dislocation. For example, a nursemaid's elbow is the subluxation of the head of the radius in the elbow.

DISLOCATION CAUSES

- Dislocations are usually caused by a sudden impact to the joint. This usually occurs following a blow, fall, or other trauma

DISLOCATION SYMPTOMS

- History of injury
- Pain
- Swelling
- Difficulty moving the joint
- Numbness and paresthesias

DISLOCATION SIGNS

- Visibly out-of-place, discolored, or misshapen joint
- Limited joint movement
- Swollen or bruised
- Intensely painful, especially if you try to use the joint or bear weight on it or move it.
- Decreased sensation distal to the joint
- Decreased pulse, cool extremity distal to the joint

NOMENCLATURE FOR DISLOCATIONS

- Name the **JOINT**
- Name the dislocation by the position of the **DISTAL FRAGMENT** in relation to the proximal fragment
- Add **FRACTURE** to the name if there is a periarticular fracture.
- Add **OPEN** if a wound communicates with the dislocation

RADIOGRAPHS

- Two planes at 90 degrees to each other
- Good quality
- Standard views
- See the entire joint



Dislocated Elbow



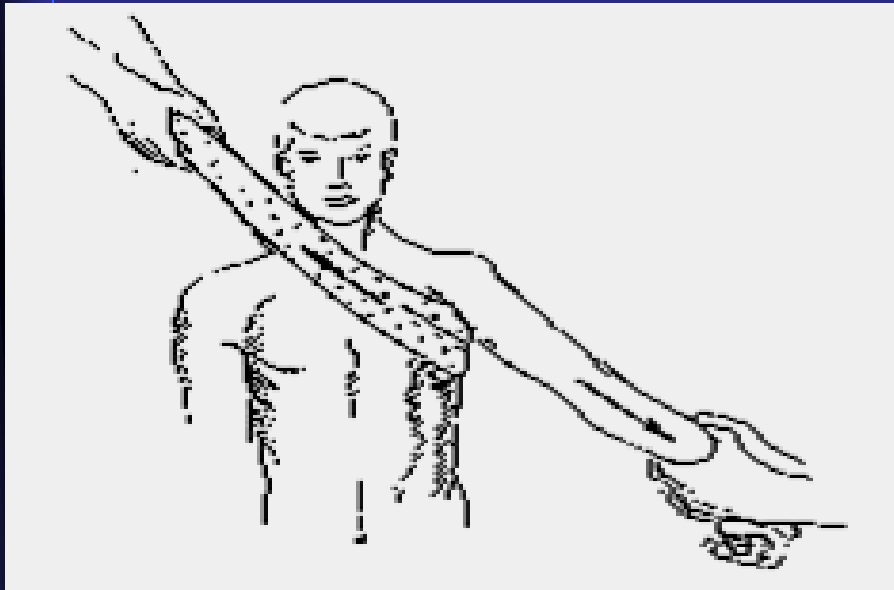
TREATMENT

- Reduce the dislocation as soon as possible
- Check Neurovascular function distally
- Take post reduction radiograph
- Immobilize the joint

REDUCTION TECHNIQUE

- Start IV
- Give sedation
- Apply traction force
- Manipulate joint

SHOULDER REDUCTION

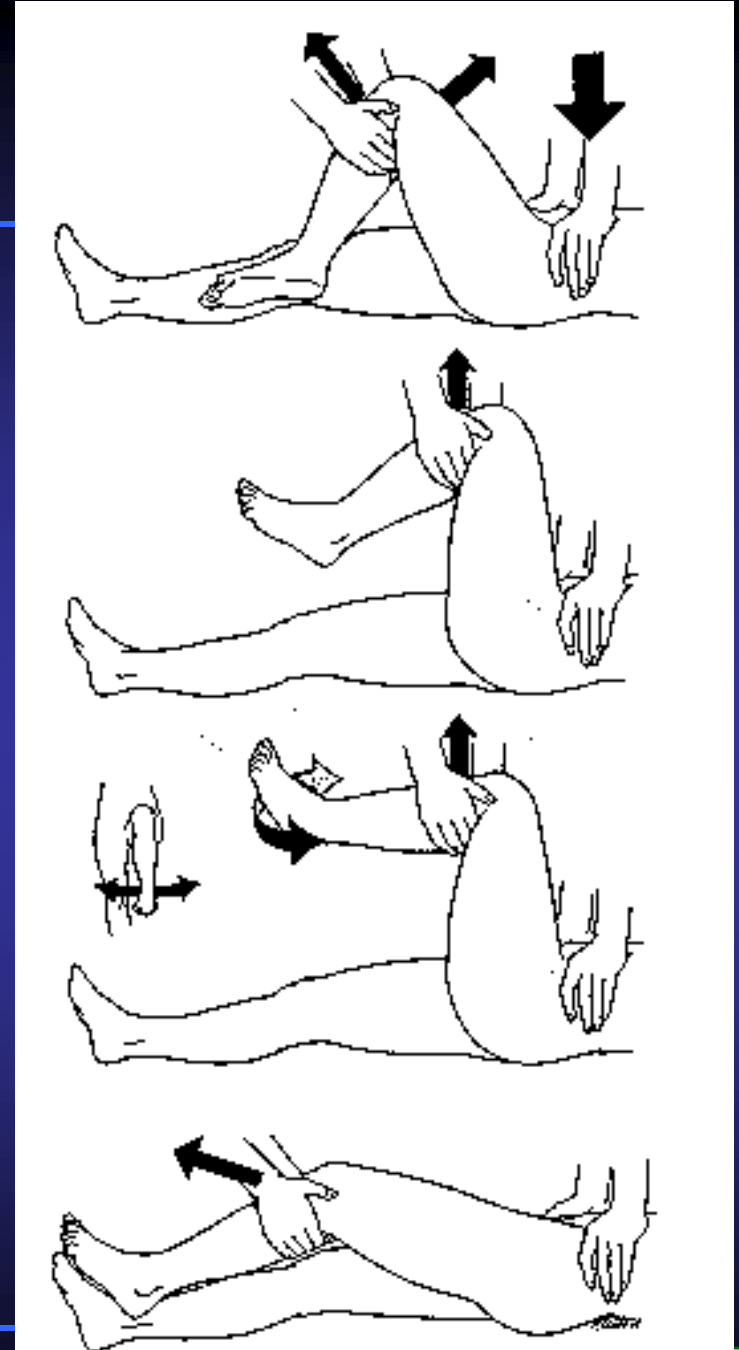


- Sedation
- Apply traction and counter traction
- Lift humeral head into the glenoid

HIP REDUCTION

- Sedation
- Relaxation, flexion, traction, and rotation
- Gentle and atraumatic

Relocation should be palpable and permit significantly improved ROM. This often requires very deep sedation.

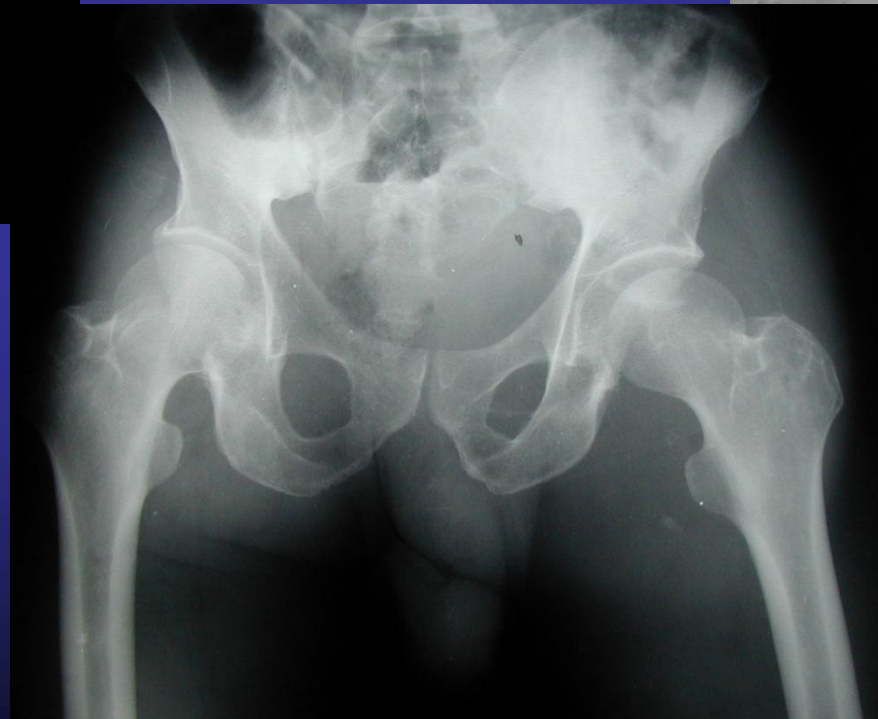
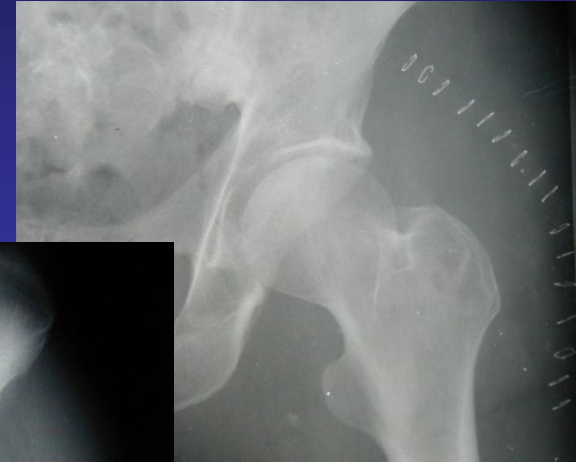


PIPJ DISLOCATION



Hyper-extend the joint, apply traction then flex the joint. Follow with a post reduction x-ray, check for avulsion fracture.

TEST CASE



TEST CASE

History: 21 YO fell from tree on his left arm 2 days ago and complains of pain, inability to move the elbow and has numbness in his little finger.

Exam: Patients elbow is swollen, painful on movement with marked limitation of range of motion. Pulses normal but decreased sensation over the palmar aspect of the little finger and he can not spread his fingers.





Thank You!