Orthopedics Detailed Dossier

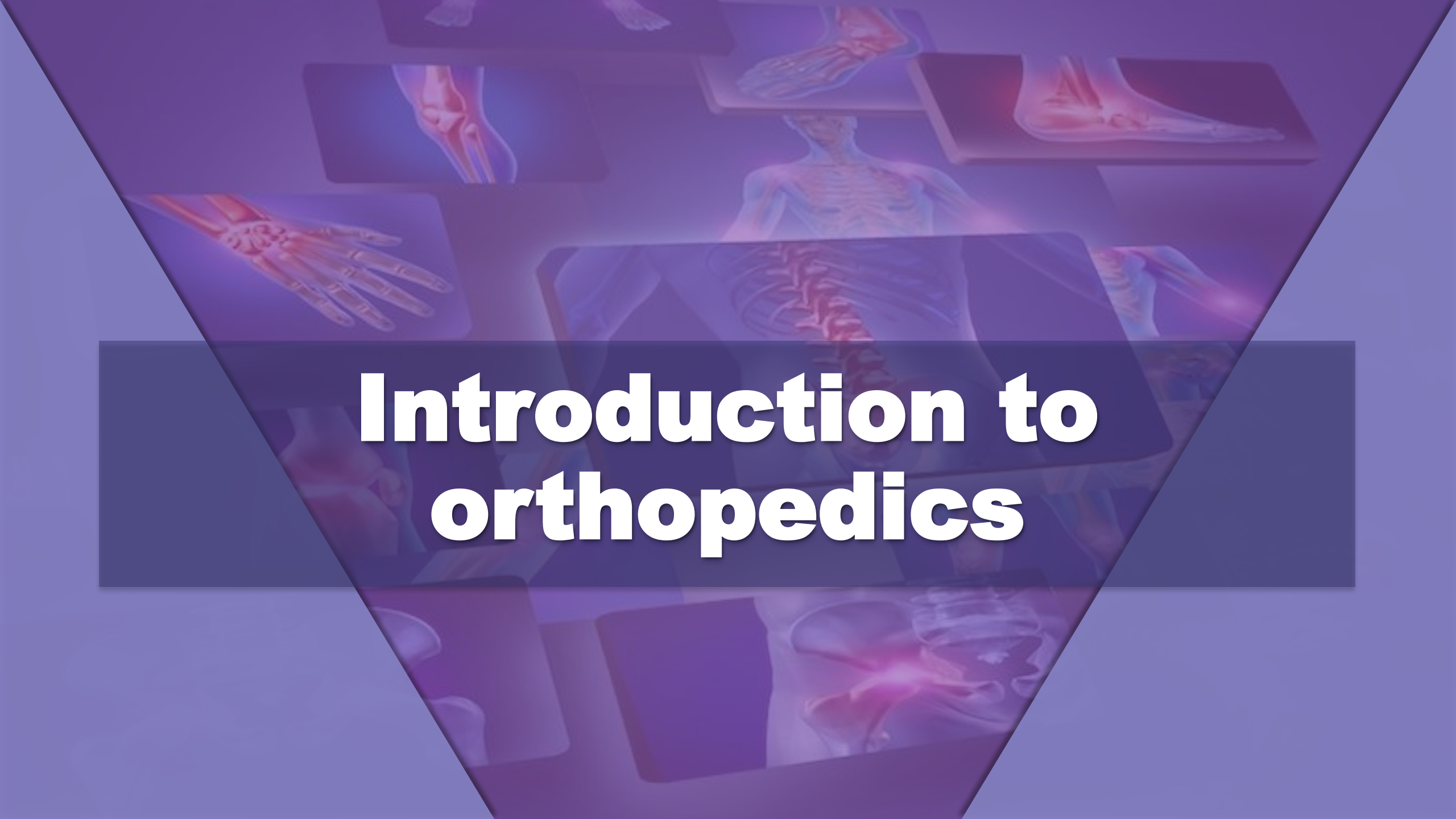
2023 edition

إعداد محمود بركات

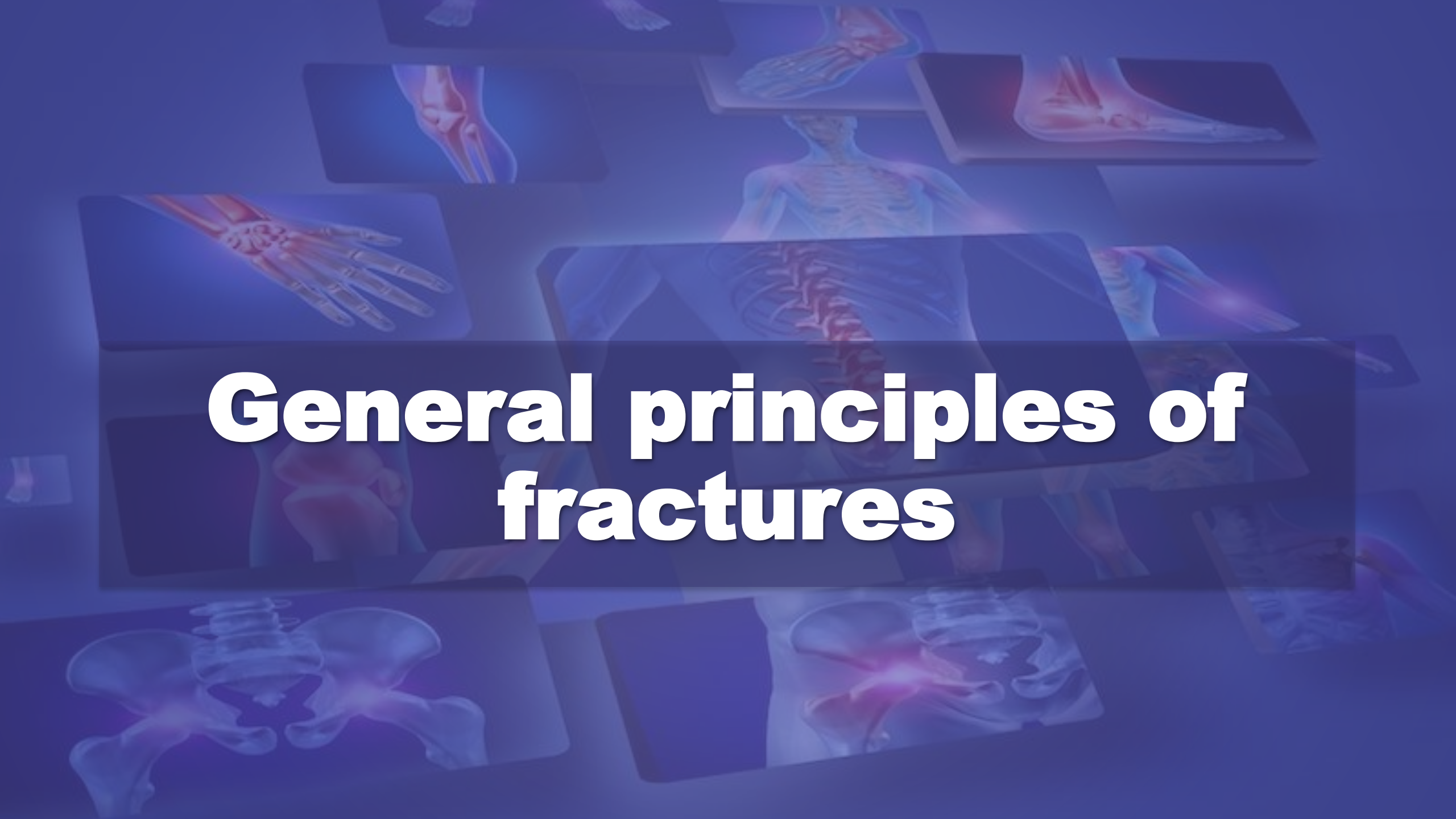
ملاحظات

- شامل لأسئلة سنوات حتى نهاية 2022
- المصادر: سلايدات الدكاترة، بعض الملاحظات الي كتبتها خلال الدوام، موقع "Amboss"
- غير شامل للأناتومي (لأنه أحا الدوسية حتطلع فوق الألف) فمعلش عيني لا تنسى تراجع اناتومي لأنه بيجي بالامتحان أسئلة أناتومي مثلا شو اسم هاي العضلة، أسئلة السنوات على الأناتومي موجودة غير هيك شرح للأناتومي ما ضفت
- الملف مرتب حسب المواضيع تحت كل موضوع فيه ملاحظات الدكاترة وأسئلة السنوات
- أسئلة السنوات المكررة تم جمعها بسؤال واحد ووضع عدد مرات تكرار السؤال في هامش أعلى الصفحة من جهة اليمين أو على يسار السؤال
- أي كتابة بصندوق يعتبر هامش للملاحظات
- معاني الألوان: المهم، ملاحظات أو إضافات أو أسئلة من عندي، الخيارات من عندي لأنه السؤال كان ناقص، معلومات إضافية
- الكلام الي بلغتكم فيه بدوسيه الأشعة قائم برضو على هذا الملف وأي الملفات ثانية اشتغلتها ويا ريت بس هبل

Last update: 01/2023



Introduction to orthopedics



General principles of fractures

General principles of fractures

- **Fracture**: Discontinuity of bone cortex
- **Etiology**:
  - Traumatic (Most common cause): Direct vs Indirect
  - Pathological (Osteoporosis, Bone tumors, Metastasis, Paget disease)
  - Stress
    - Due to repeated minor loading or trauma
    - Seen in military installations, ballet dancers, athletes
    - Lower limbs more commonly affected than upper limbs
    - Metatarsal bone are most common beside tibia and femur neck

Mechanism of injury in trauma

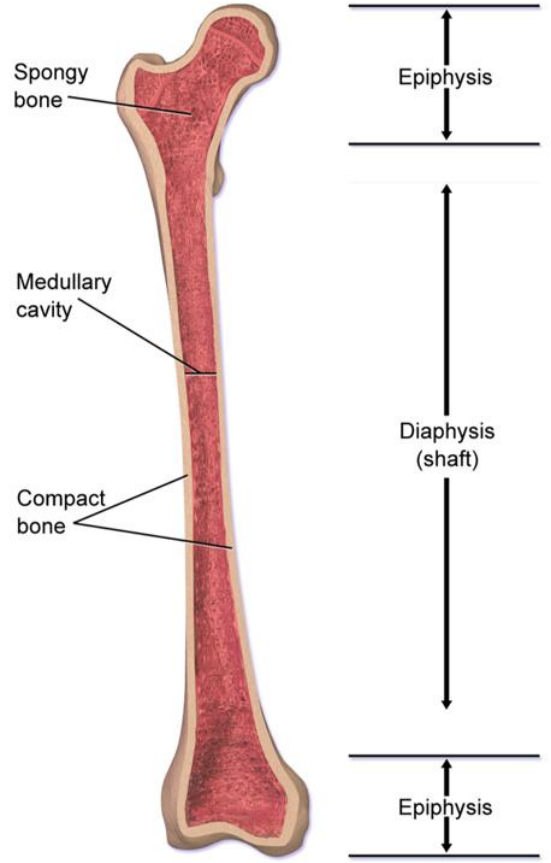
- **Direct trauma**:
  - **Tapping**: target force acting on small area ⟶ transverse fracture
  - **Crush**: large force acting on small area ⟶ extensive soft tissue damage, and comminuted
  - **Penetrating**: large force acting on small area (velocity more important than mass) ⟶ High velocity, Low velocity
- **Indirect trauma**:
  - **Traction**: avulsion fracture, patella, olecranon, and medial malleolus.
  - **Angulation**: transverse or with triangular fragment. convexity under tension, concavity under compression.
  - **Rotational**: complete rotation around the circumference joined by vertical line.
  - **Compression fracture**: axial loading

Fracture classification

1. **Anatomy**
   - **Location**: affected bone (proximal, distal)
   - **Position**: diaphysis, metaphysis, epiphysis
   - **Growth plate involvement (pediatric fractures)**: Salter-Harris fractures
2. **Extent**
   - Complete, Incomplete (Seen in pediatric)
3. **Fragmentation**
   - Simple fractures, Comminuted fracture, Segmental fracture
4. **Orientation**
   - Transverse, Oblique, Spiral
5. **Displacement**
6. **Soft tissue involvement**
   - Closed fracture, Open fracture

Fracture classification – 1.Anatomy

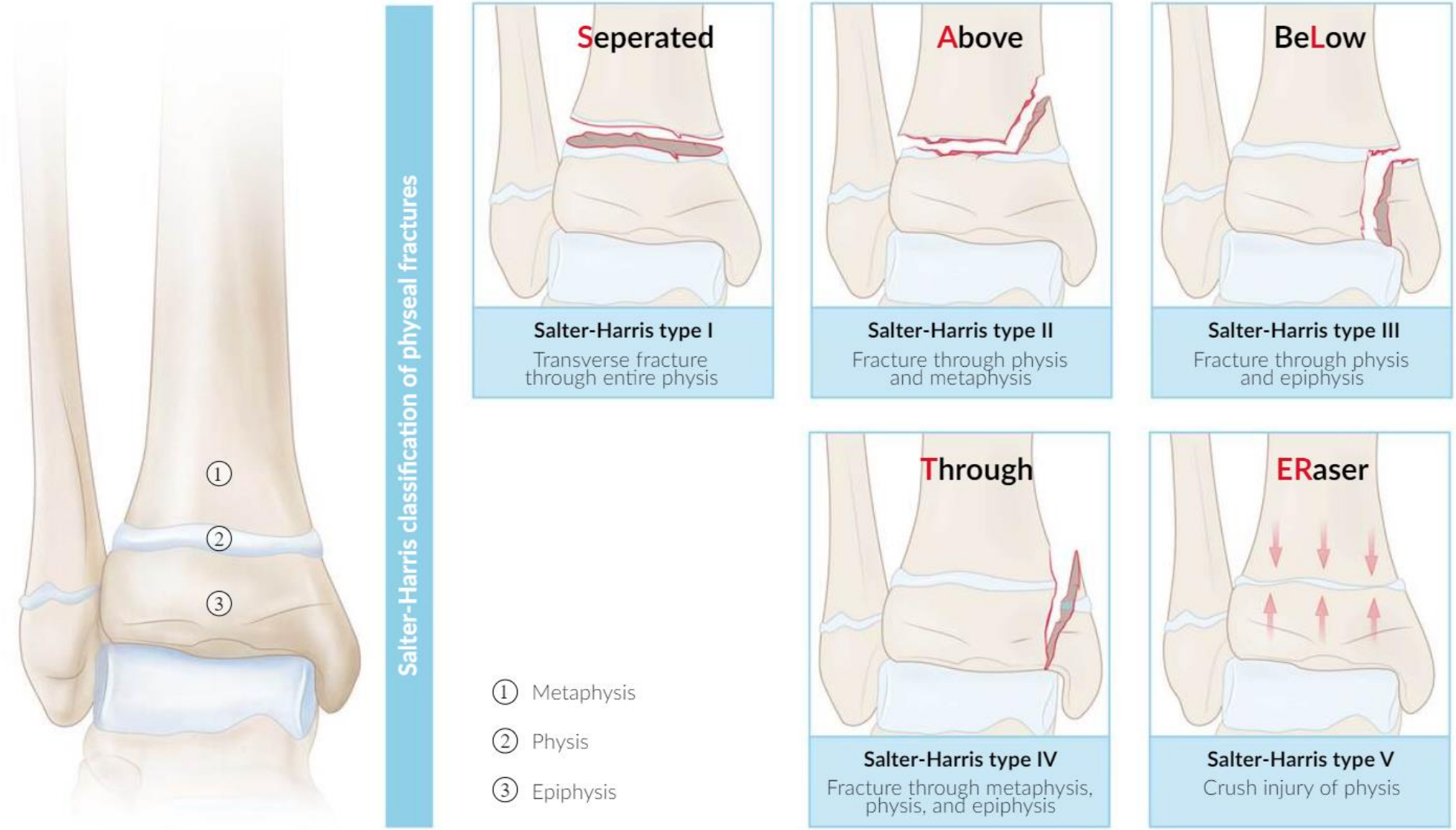
- **Location**: affected bone (proximal, distal)
- **Position**: epiphysis, metaphysis, diaphysis
  - **Epiphysial fractures**
    - **Intraarticular**: difficult reduction, joint stiffness and arthritis
    - **Intracapsular**: hemarthrosis that affects union, tamponade leads to pain and necrosis, blood supply
  - **Metaphyseal fractures**
    - Good blood supply, Malunion rather than nonunion
  - **Diaphyseal fractures**
    - Proximal, middle, distal 1/3, Extra-articular, Easier to reduce and Better results, Non-union
- **Growth plate involvement (pediatric fractures)**:
  - Salter-Harris fractures



Fracture classification – 1.Anatomy

- AO principles: AO FOUNDATION
  - **Epiphysial fractures**
    1. Anatomic reduction
    2. Rigid stability
    3. Soft tissue preservation and early ROM
  - **Metaphyseal fractures**
    1. Restoration of length ,alignment and rotation
    2. Relative stability
    3. Soft tissue preservation and early ROM
  - **Diaphyseal fractures**
    1. Restoration of length ,alignment and rotation
    2. Relative stability
    3. Soft tissue preservation and early ROM

Salter-Harris fracture classification



Salter-Harris fracture classification

- **Type I**:
  - Clinical diagnosis; X-ray usually normal or widening of physis thus can be missed (Order 2 limbs)
  - Excellent prognosis
- **Type II**:
  - Most common
  - Good prognosis
- **Type III**:
  - Intra-articular
  - Poor prognosis unless perfect reduction

Salter-Harris fracture classification

- **Type IV**:
  - All parts are involved
  - Poor prognosis
- **Type V**:
  - Decreased physis width.
  - Can be missed as no fracture seen on Xray.
  - Diagnosed retrospectively.
  - Very poor prognosis as result of growth arrest.

وصف شكل الكسر على الصورة ما رجعت عدته ☺

According to Salter-Harris classification

What is the type of this fracture ?

a. Type I
b. Type II
c. Type III
d. Type IV
e. Type V

According to Salter-Harris classification

What is the type of this fracture ?

a. Type I
b. Type II
c. Type III
d. Type IV
e. Type V

According to Salter-Harris classification

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According to Salter-Harris classification

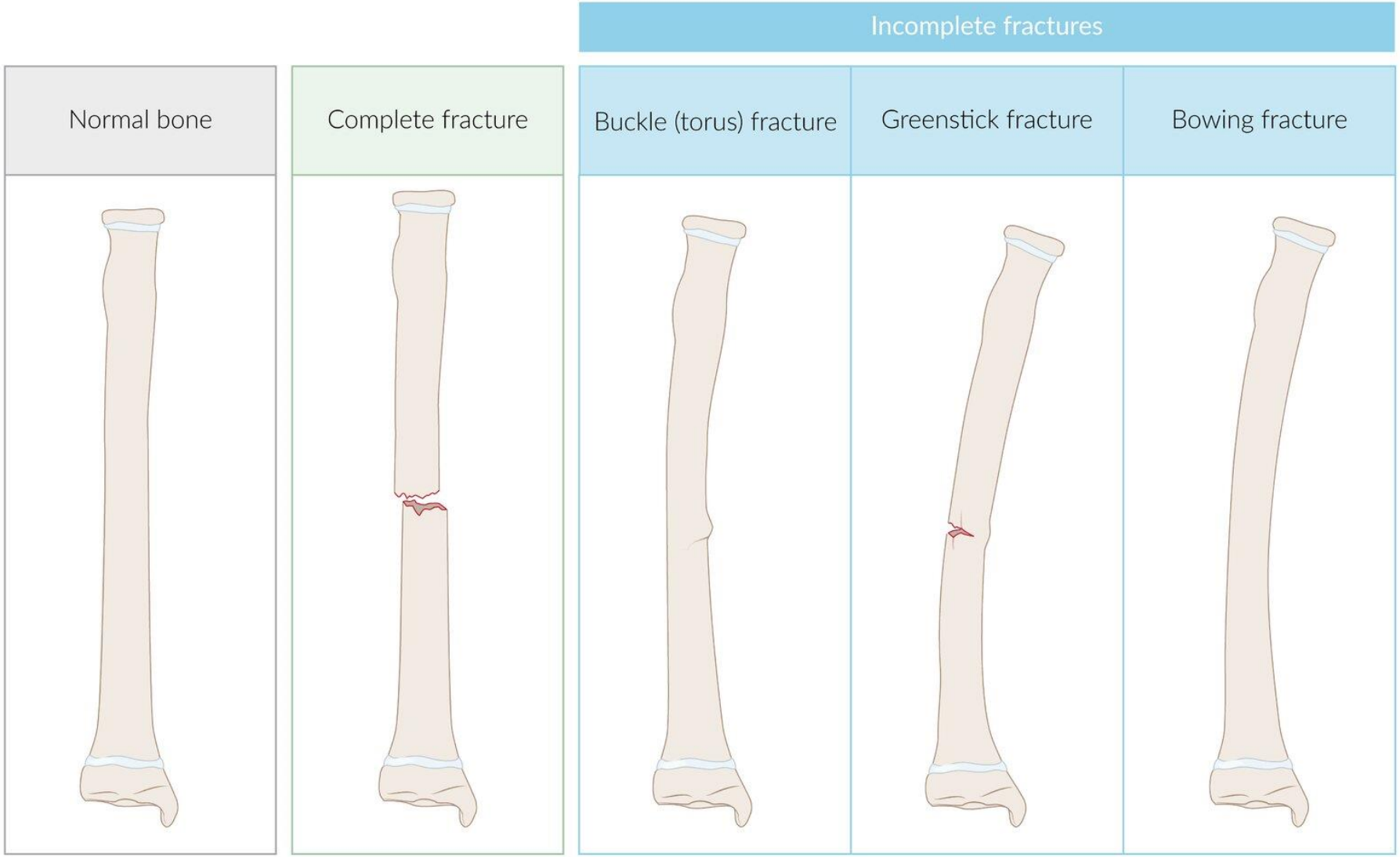
What is the type of this fracture ?

a. Type I
b. Type II
c. Type III
d. Type IV
e. Type V

Fracture classification – 2.Extent

- In a complete fracture, there is discontinuity between the bone fragments, whereas in incomplete fractures the fracture line is either absent or does not completely traverse the width of the bone.
- Incomplete fractures are more common in pediatric patients due to the thicker, stronger periosteum and greater elasticity of growing bones.
- **Types of incomplete fractures include**:
  - **Buckle (torus) fracture**: A compressive force results in bulging ("buckling") of the cortex. Strictly speaking, this is a "buckle fracture" when there is bulging of only one side of the cortex (the concave side) and a "torus fracture" when the bulge is circumferential, but the terms are frequently used interchangeably.
  - **Greenstick fracture**: There is discontinuity of the cortex and periosteum on the convex (tension) side of the fracture but only bending on the concave (compression) side.
  - **Bowing fracture (Plastic deformation)**: There is angulation but no discontinuity of the cortex or periosteum.

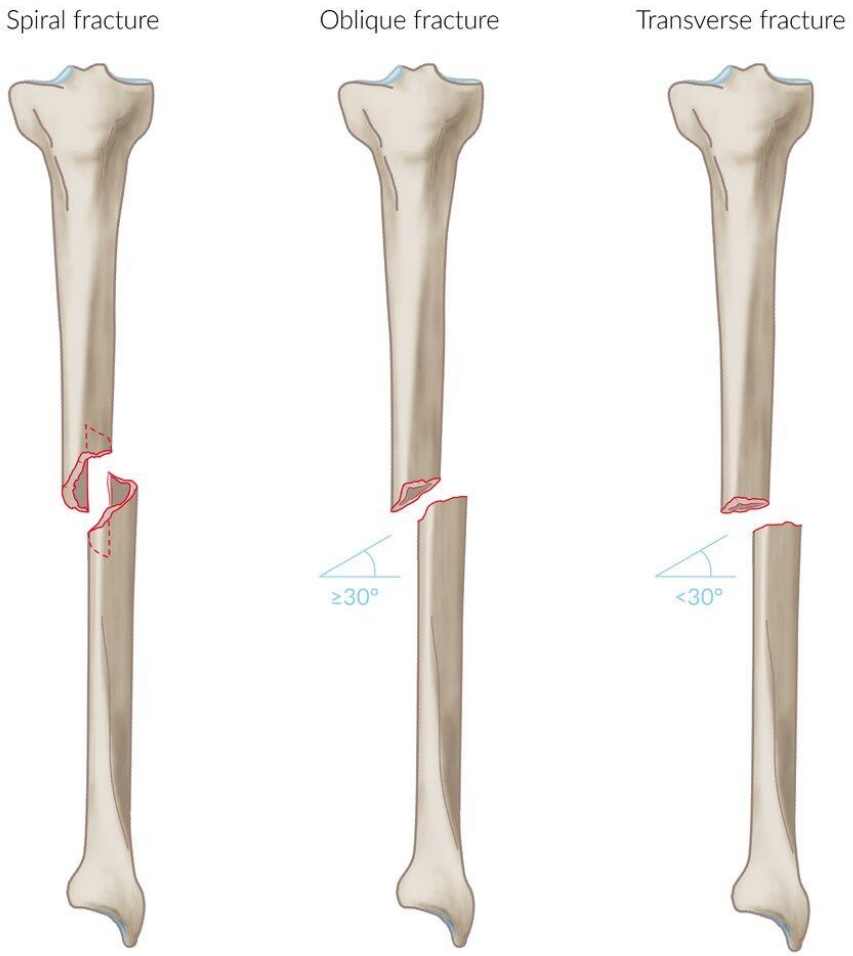
Fracture classification – 2.Extent



Fracture classification – 3. Fragmentation

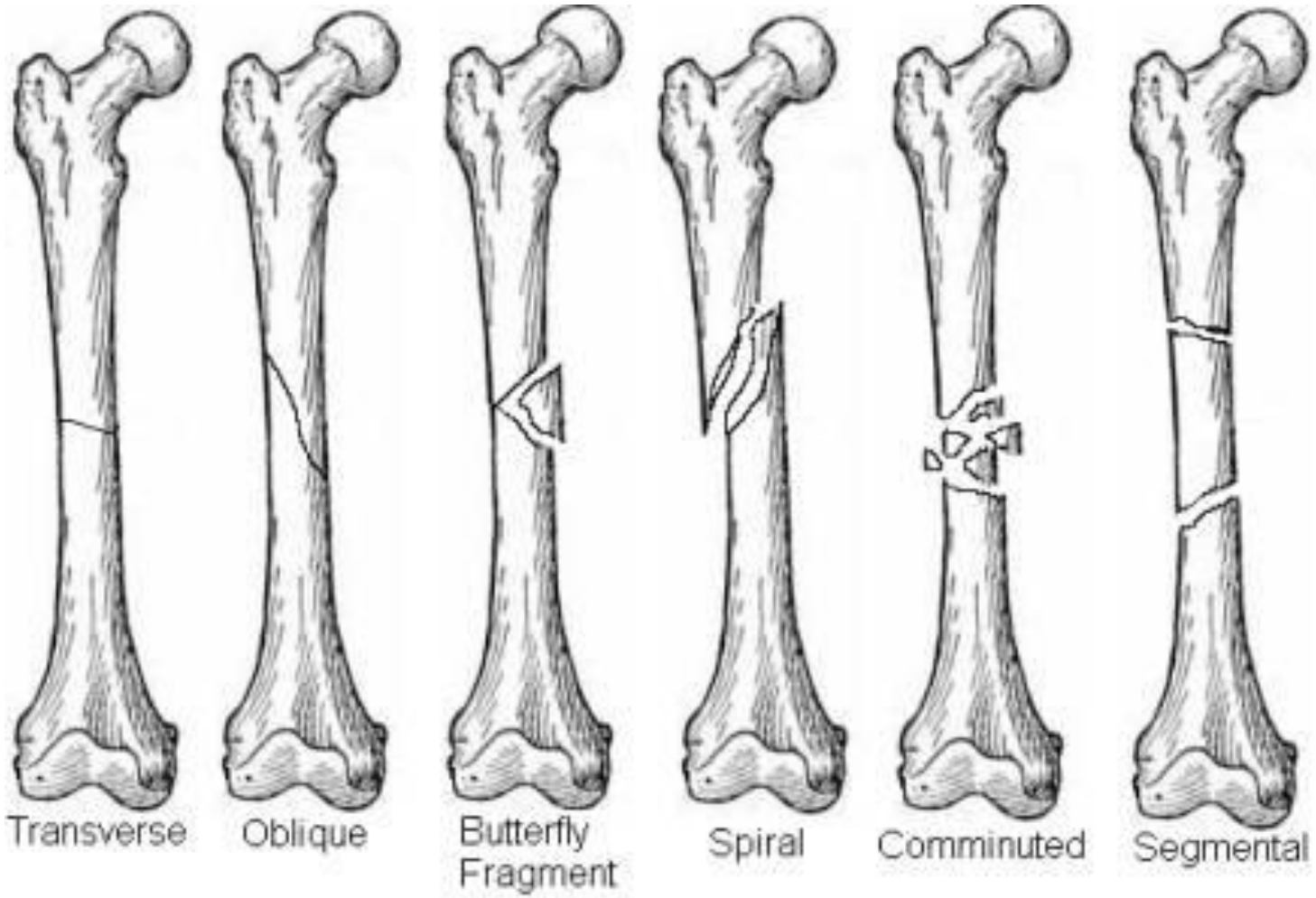
- **Simple fractures**: are fractures that only occur along one line, splitting the bone into two pieces
- **Comminuted fracture**: more than two fracture lines resulting in multiple bone fragments
- **Segmental fracture**: two fracture lines with a bone fragment between the proximal and distal portions of the bone

Fracture classification – 4.Orientation



- **Transverse fracture**: the fracture line runs at an angle of less than 30° to the bone's long axis
- **Oblique fracture**: the fracture line runs at an angle of more than 30° to the bone's long axis
- **Spiral Fracture**: A fracture where at least one part of the bone has been twisted. Two plans fracture

Fracture patterns



Fracture: Mechanism of trauma

- **Transverse**: Direct trauma or Indirect trauma
- **Oblique**: Indirect trauma
- **Spiral**: Twisting trauma
- **Comminuted**: Direct trauma

Note: Butterfly fragments are large, triangular fracture fragments seen commonly in comminuted long bone fractures.

What is the pattern of these fractures ?

Fibula: Oblique
Tibia: Transverse

Oblique fracture

Butterfly fracture

Multifragmentary (Comminuted)

What is the mechanism of these fractures ?

Twisting injury

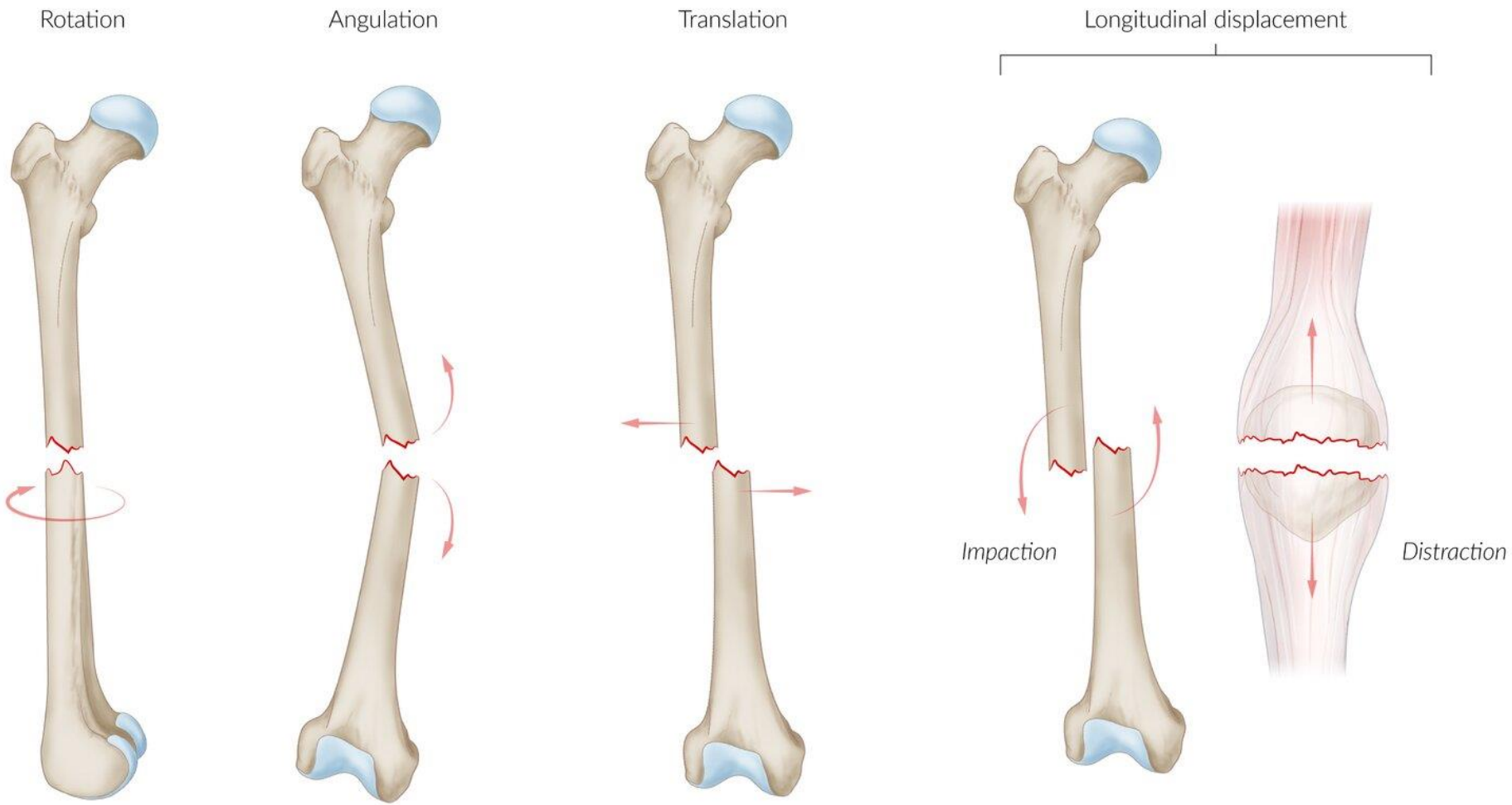
Direct trauma

4 points bend

Fracture classification – 5.Displacement

- Undisplaced
- Displaced
  - **Rotated**: rotation around the longitudinal axis
  - **Angulated**: angulation of the axis
  - **Translated**: lateral movement of the bone fragments
  - Longitudinal displacement of bone fragments
    - **Distraction**: elongation
    - **Impaction**: shortening

Fracture classification – 5.Displacement



What is the most obvious deformity ?

Translation

Translation

Angulation

Translation

Translation

Fracture classification – 6.Soft tissue involvement

- **Closed fracture**: intact soft tissue; does not come into contact with the outside environment
- **Open fracture**: communicate between bone through traumatic wound to outer environment
  - **Management**: 4As
    1. Analgesia
    2. Anti-tetanus
    3. Adequate irrigation and debridement within 4-8 hrs
    4. Antibiotic prophylaxis: first or second generation cephalosporine + aminoglycoside (high energy) + penicillin (barnyard).

Open wound

This patient came to ER after RTA, vasculature is intact, according to the management of this type of injury all of the following are true except:

a. Anti-tetanus
b. Intravenous 1st & 2nd generation cephalosporine
c. Irrigation by normal saline
d. Acute suturing & repair
e. Analgesia

Case of RTA

- **What is your DDx ?**
  - Open fracture
- **What is your management in ER ?**
  - Anti-biotic, anti-tetanus, analgesia, adequate irrigation

Gustilo and Anderson classification

I : clean wound < 1 cm

II : 1-10 cm without extensive soft tissue damage, skin flaps, or avulsion

IIIA : >10 cm, extensive soft tissue damage or any high energy trauma, but maintains adequate coverage. No need for plastic or vascular surgeon

IIIB : Periosteal stripping and bony exposure. Plastic surgeon for flap

IIIC : vascular injury and vascular surgeon

Gustilo and Anderson classification

This patient came to ER after RTA, vasculature is intact, what is the stage of this case according to Gustilo Anderson ?

a. Grade I
b. Grade II
c. Grade IIIA
d. Grade IIIB
e. Grade IIIC

Clinical features

- Pain, redness, and swelling at the site of injury
  - Can be the only sign of fracture in x-ray free cases (e.g., Scaphoid fracture, Greenstick, Salter-hares type 1)
- Attitude (the position taken by the patient)
- Deformity and axis deviation
- Bone fragments penetrating the skin
- Palpable step-off or gap
- Bone crepitus
- Concomitant soft tissue injuries
- Neurovascular compromise below the site of injury
- X-ray findings

Approach to fracture (Stable patient (2ry survey))

- Clinical assessment
  1. **Pain management**: Support (Splint the patient) + Analgesia
  2. **Brief history**: Profile, Chief complain, Mechanism of injury, Past medical & surgical
  3. **Physical exam**: Lazy Fat Mice Suck
     - **A. Look**: Attitude
     - **B. Feel**: Assess for neurovascular compromise and compartment syndrome with the **6Ps**: pain, pallor, pulselessness, paresthesia, paralysis, and poikilothermia
     - **C. Move**: Decreased range of motion
     - **D. Special tests**
- Imaging
- Management: Reduction ⟶ Fixation ⟶ Early rehabilitation

Notes

- In multi-traumatic unstable patient, we stabilize the patient first. (1ry survey (ABCs))
- Why do we ask about the mechanism of the trauma in the history ?
  - Looking for associated injuries
  - For medicolegal purposes
- Sensation exam to rule out nerve injury during physical assessment
  - Axillary: Over the deltoid
  - Musculocutaneous: Lateral forearm
  - Median: Tip of middle finger
  - Ulnar: Tip of little finger
  - Radial: Dorsum of the hand around the sniff box

Imaging

- **X-ray**:
  - Rule of 2:
    - 2 Absolute: 2 views, 2 Joints
    - 2 Relative: 2 Occasions (e.g., Scaphoid fracture), 2 Limbs (i.e., in pediatrics)
    - 2 Times: (pre-reduction and post-reduction)
  - Radiographic signs of a fracture include a radiolucent fracture line, cortical disruption and presence of abnormal fat pad or elevation of fat pad
  - Describe fracture based on the anatomic location, alignment, angulation, and articular involvement
  - X-ray imaging has a low sensitivity for detecting stress fractures.
- **CT/MRI (not routine)**:
  - Indicated in inconclusive x-ray findings, assessment of associated injuries, and preoperative planning for complicated fractures

Management

- Conservative fracture management
  - **Indications**:
    - Stable fractures
    - Mainstay management of pediatric fractures
  - **Procedure**: closed reduction and, if necessary, immobilization with a cast or splint of the fractured bone and adjacent joints
- Surgical fracture management
  - **Indications**:
    - Open fractures
    - Unstable fractures (e.g., intraarticular fractures, pelvic fractures)
    - Severe displacements (e.g., rotational deformities) and displaced fragments
    - Inadequate manual reduction and fixation
  - **Procedure**: anatomic reduction of the fracture and subsequent fixation and immobilization using external fixation (pins or screws outside the skin), internal fixation (implants e.g., plates, screws, wires) or open reduction with internal fixation

Terminology

- **Reduction**:
  - **Anatomical reduction**: involves positioning and aligning the fragments of the broken bone to reconstruct the fractured bone as precisely as possible, so that the bone recovers to a form as close as possible to its original form as it heals.
  - **Functional reduction**: restoring the fragments into such a position that normal function will occur following fracture union
  - **Closed reduction** is the manipulation of the bone fragments without surgical exposure of the fragments.
  - **Open reduction** is where the fracture fragments are exposed surgically by dissecting the tissues.
- **Fixation**:
  - **Absolute fixation**: minimal callous formation ⟶ used in intra-articular fractures
  - **Relative fixation**: callous formation ⟶ used in diaphysis fractures

Healing calendar

Upper limb + Child : 3 weeks

Lower limb + Child : 3x2=6

Upper limb + Adult : 3x2=6

Lower limb + Adult : 3x2x2=12

Complications

- **Early (Acute) complications**:
  - Neurologic and vascular injury (e.g., bleeding, hematoma, seroma)
  - **Compartment syndrome** (most common in the anterior compartment of the leg)
  - Wound infection, osteomyelitis
  - Secondary dislocation
  - DVT, PE
- **Late (Long-term) complications**:
  - Delayed union (Epiphyseal Fx), Nonunion (Diaph. Fx), Malunion (Metaph. Fx)
  - Avascular necrosis
  - Chronic regional pain syndrome
  - Stiffness
  - Osteoarthritis
  - Infection

Special demographic fractures

❖ Elderly

- Increased age is associated with osteoporosis, rendering elderly persons more susceptible to fractures (**Fragility fractures**)
- **Fragility fractures**: pathological fractures that are caused by everyday activities or minor trauma
- Common locations of major osteoporotic fractures:
  - Vertebral (most common) > femoral neck > distal radius (Colles fracture) > other long bones (e.g., proximal humerus)

❖ Pediatrics

- Elastic bone ⟶ Bones tend to BOW rather than BREAK
- Thicker periosteum ⟶ functioning in reduction of fracture and fasten healing
- Presence of the growth plate ⟶ Salter-Harris fractures (physis fracture)
- Pediatric Ligament stronger than bone ⟶ Avulsion of the bone rather ran ligament tear

Complication of physis fracture

- The majority of physeal injuries heal quickly and recover fully.
- In a minority, growth disturbance or arrest may occur, and can result in deformity and impaired function.
- Growth disturbance factors
  - Involvement of growth plate with highest rate of growth: distal femur (50%) more than distal tibia 25%
  - Late reduction
  - Significant displacement
  - Type of salter fracture
  - Younger age (more time for growth so more shortening and deformity)

Pediatric fractures

MCQ (3)

❖ **Type of fracture:**

- Buckle fracture

MCQ (2)

❖ **Management:**

- Cast only (for 2-3 wks)

Not the same picture

Pediatric fractures

سنوات (3)

❖ **Name of the defect**:

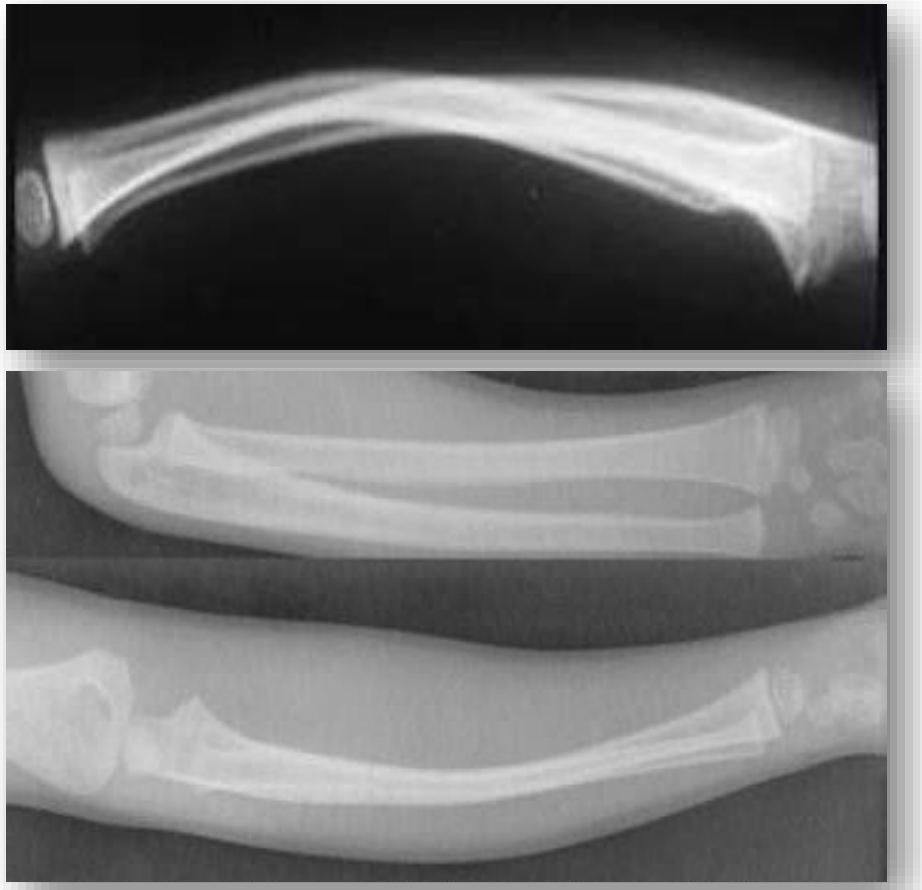
- Plastic deformation

سنوات (2)

❖ **Management**:

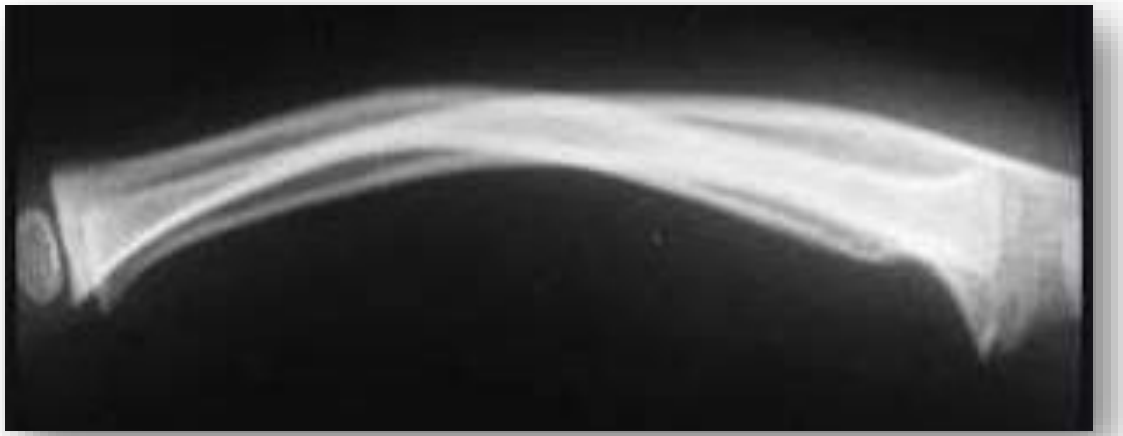
- Acceptable angulation: immobilization with a cast
- Greater than acceptable angulation: closed reduction followed by immobilization with a cast

Same management as greenstick



What is the first step in management ?

a. Open reduction
b. Closed reduction
c. Cast only
d. Cast and X-ray after 10 days



Nerve injuries principles

Nerve injuries principles

❖Mechanism

- Ischemia
- Compression
- Stretching (Traction)
- Laceration
- Crush : worst
- Burning

❖Negative Prognosis

- Older age
- Proximal level of injury
- Crush injuries
- Repair delay

❖Types of injury

- **Transient ischemia**
  - These changes are due to transient anoxia and leave no trace of nerve damage
- **Neurapraxia**
  - Nerve contusion or stretch leading to reversible conduction block
- **Axonotmesis**
  - Incomplete nerve injury more severe than neurapraxia
- **Neurotmesis**
  - complete nerve division with disruption of endoneurium

Nerve injuries principles

	Neurapraxia	Axonotmesis	Neurotmesis
Pathophysiology	focal temporary demyelination of the axon	Axon and myelin sheath disruption leads to focal conduction block	All connective tissues disrupted
Wallerian degeneration	No Wallerian degeneration	Wallerian degeneration	Wallerian degeneration
	Axon remains intact	Endoneurium disrupted	All three layers disrupted
NCS	No fibrillation	Fibrillations and positive sharp waves on EMG	
Tinel's sign	Negative	Positive	Positive
Prognosis	recovery is excellent	Unpredictable recover	No recovery unless surgical repair performed
Examples	Saturday night palsy	After closed fractures and dislocations	Occurs in open wounds
Energy	Low energy injuries	High energy injuries	

Principles of treatment

- **Exploration surgery is indicated in**
  - if the nerve was seen to be divided and needs to be repaired;
  - if the type of injury (e.g., a knife wound or a high energy injury) suggests that the nerve has been divided or severely damaged;
  - if recovery is inappropriately delayed and the diagnosis is in doubt.
- **Treatment of open injuries**
  1. If the nerve is cleanly divided, end to end suture may be possible
  2. Paring of the stumps with a sharp blade, and if this leaves too large gap, nerve mobilizing can be done to prevent tension
  3. Nerve grafts can be used
- **It may be best to leave the injured nerve alone in case of**
  - If the patient has adapted to the functional loss.
  - If it is high lesion, and re-innervation is unlikely to occur within the critical 2 years.
  - If there is pure motor loss which can be treated by tendon transfer

The Spine


Vertebral fractures

Vertebral fractures

- **Epidemiology**
  - Common in elderly women (osteoporotic fractures) and young men (traumatic injuries)
  - Location: ~ 50% in the cervical spine and ~ 50% in the thoracic, lumbar, and sacral spine
- **Etiology**: Osteoporosis (most common), Traumatic
- **Clinical features**
  - Local pain on pressure, percussion, and compression
  - Palpable unevenness or disruption of the vertebral process alignment
  - Paravertebral hematoma
  - Weakness or numbness/tingling
  - Neurogenic shock
  - Depending on complications and any accompanying injuries, further symptoms, potentially as severe as paralysis, are possible

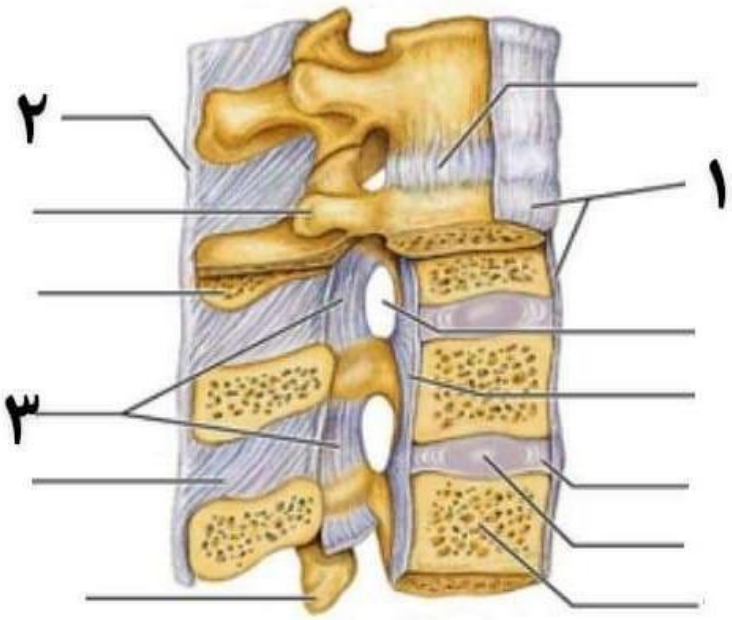
مهم

Stability of vertebral fractures

- **Stability depends on:**
  - Integrity of vertebral bodies
  - Ligaments
- **Stable vertebral fracture**
  - The structural stability of the spine remains intact.
  - No neurologic deficits
  - Fractures of the anterior column of the spine
- **Unstable vertebral fracture**
  - The structural stability of the spine is compromised.
  - The spine can move as two or more independent units, which may cause spinal cord injury.
  - Mid-column and posterior column fractures
- A dorsal spine injury (vertebral arches, processes, and their ligaments) is always unstable and has a high probability of spinal cord injury.

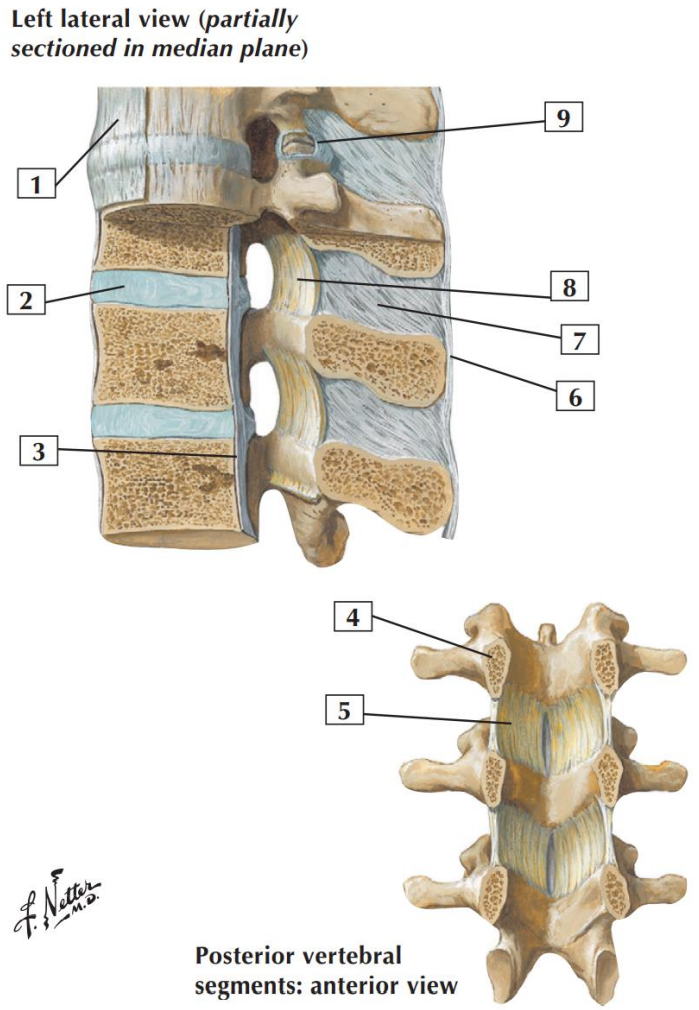
Identify these tendons

1. Anterior longitudinal ligament
2. Supraspinous ligament
3. Ligamentum flavum



Vertebral Ligaments: Lumbar Region

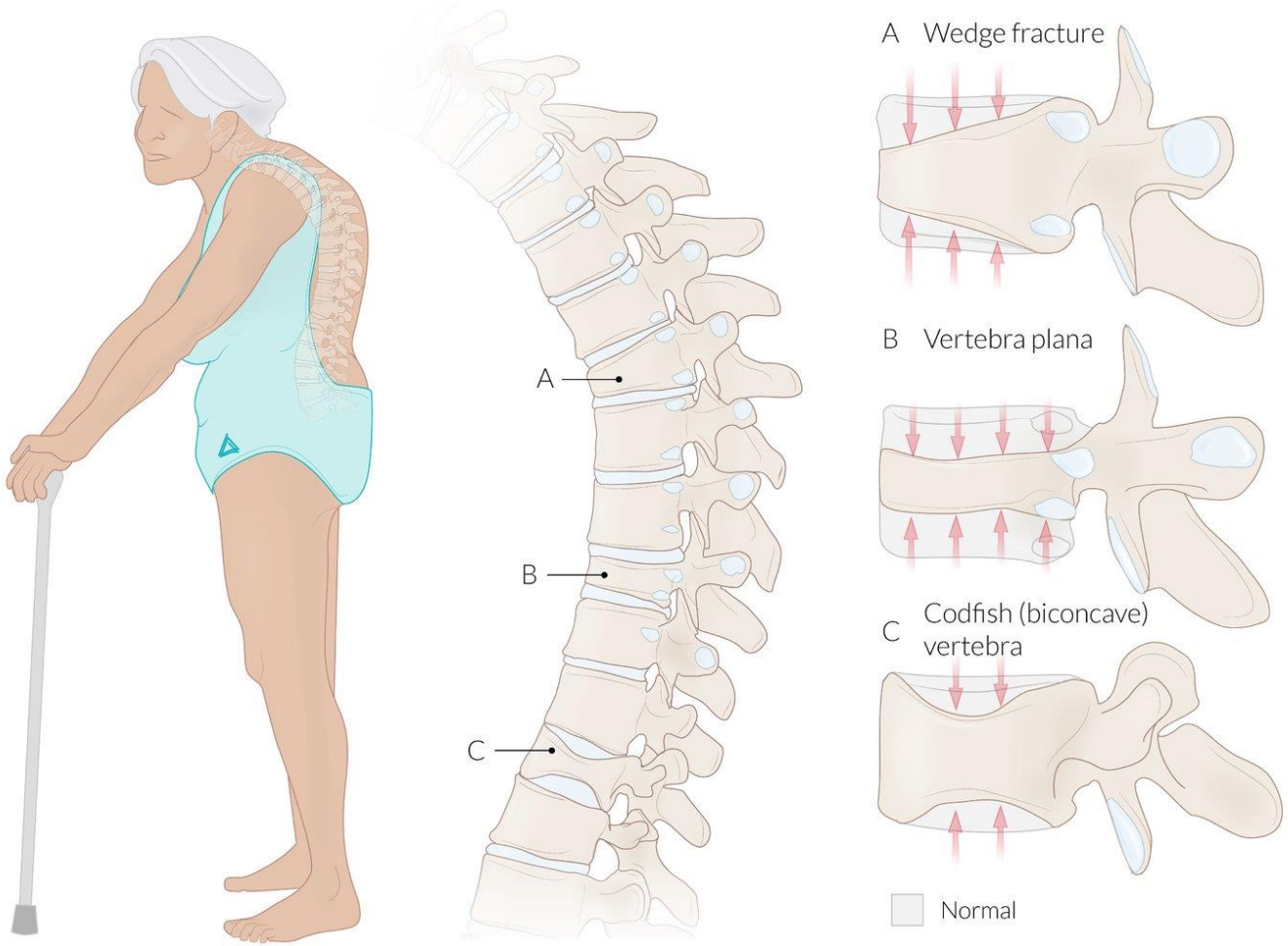
1. Anterior longitudinal ligament
2. Intervertebral disc
3. Posterior longitudinal ligament
4. Pedicle (cut surface)
5. Ligamentum flavum
6. Supraspinous ligament
7. Interspinous ligament
8. Ligamentum flavum
9. Capsule of zygapophysial joint (partially opened



Types of vertebral fractures

- **Vertebral compression fracture** (most common type)
  - **Causes**: Pathological fractures, Trauma
  - **Clinical features**
    - Usually, stable
    - Often asymptomatic, but may cause acute back pain and point tenderness
    - Long-term findings after multiple vertebral compression fractures:
      - Progressive thoracic kyphosis, Decreased height
- **Burst fracture**: fracture of the vertebra in multiple locations
  - Result of compression trauma with severe axial loading
  - Possible displacement of bone fragments into the spinal canal; except atlas
- **Fracture-dislocation**: fractured vertebra and disrupted ligaments; instability may cause spinal cord compression

Compression fracture subtypes



A. Wedge fracture: characterized by a loss of height, predominantly of the anterior part of the vertebral body. Wedge fractures are common in individuals with osteoporosis, and they can lead to a kyphotic deformity of the spine (gibbus) if multiple vertebrae are involved.

B. Vertebra plana: an advanced compression fracture where there is a loss of height of the entire vertebral body, both anteriorly and posteriorly. Vertebra plana is also referred to as a pancake or coin-on-edge vertebra.

C. Codfish vertebra: characterized by loss of height of the central part of the vertebral body, resulting in a biconcave vertebral body that resembles fish vertebrae.

Diagnostics

- **Physical exam**
  - Detailed neurologic exam (cranial nerves, motor and sensory components, coordination, and reflexes)
  - Rectal exam to assess sphincter activation
  - In trauma scenarios, a secondary survey to assess for associated injuries should be done.
- **Imaging**
  - Used to assess the stability of the fracture, spinal cord lesions
  - Anterior-posterior and lateral x-ray
    - Discontinued cortex, bone fragments
    - Loss of height in the vertebral bodies
  - CT: The axial image in particular helps localize the fracture and allows for an assessment of (posterior edge) stability.
  - MRI: most sensitive tool for detecting spinal cord lesions

Treatment

- **Conservative treatment**
  - **Indication**: stable fractures
  - **Procedures**: Pain medication, Physical therapy, External bracing
- **Surgical treatment**
  - Spondylodesis
    - **Indications**: unstable fractures and/or neurological symptoms
    - **Approach**: fusion of two or more vertebral bodies via internal fixation
  - Minimally invasive procedures
    - **Indication**: stable vertebral compression fractures with progressive pain or kyphosis despite conservative treatment
    - **Procedures**: Vertebroplasty, Kyphoplasty

Patient presented with low back pain

❖ **What is the type of fracture ?**

- Compression

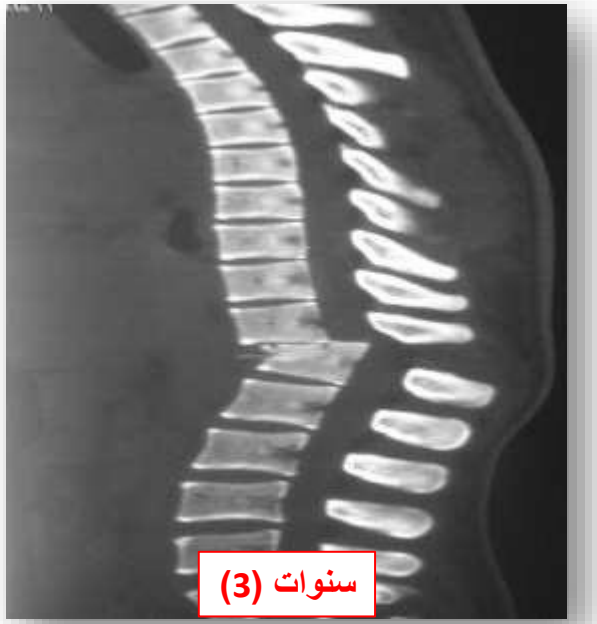
What does the pointer resemble

a. L1 burst fracture
b. L5 vertebral compressive fracture
c. L1 vertebral compressive fracture
d. Spondylolysis
e. L1 disc prolapse

Patient presented with bradycardia and hypotension

❖**What type of shock is this ?**

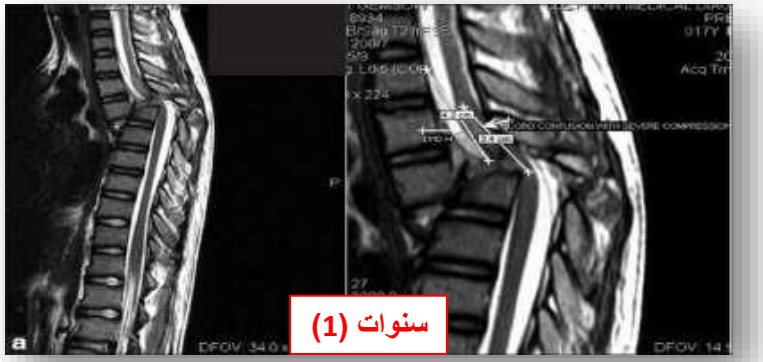
- Neurogenic shock



Insult → Spinal shock → Neurogenic shock

❖**Spinal shock**: flaccid paralysis, anesthesia, absent bowel and bladder control, and loss of reflex activity

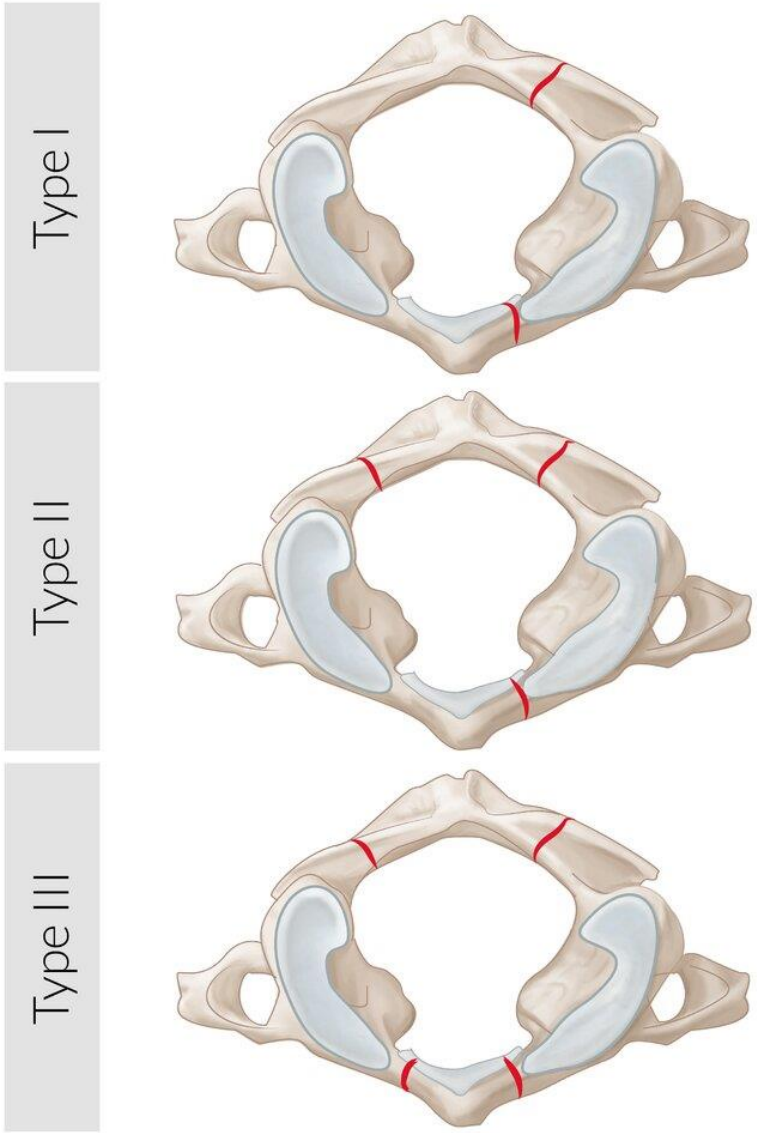
❖**Neurogenic shock**: ↓Sympathetic → hypotension, bradycardia, vasodilation

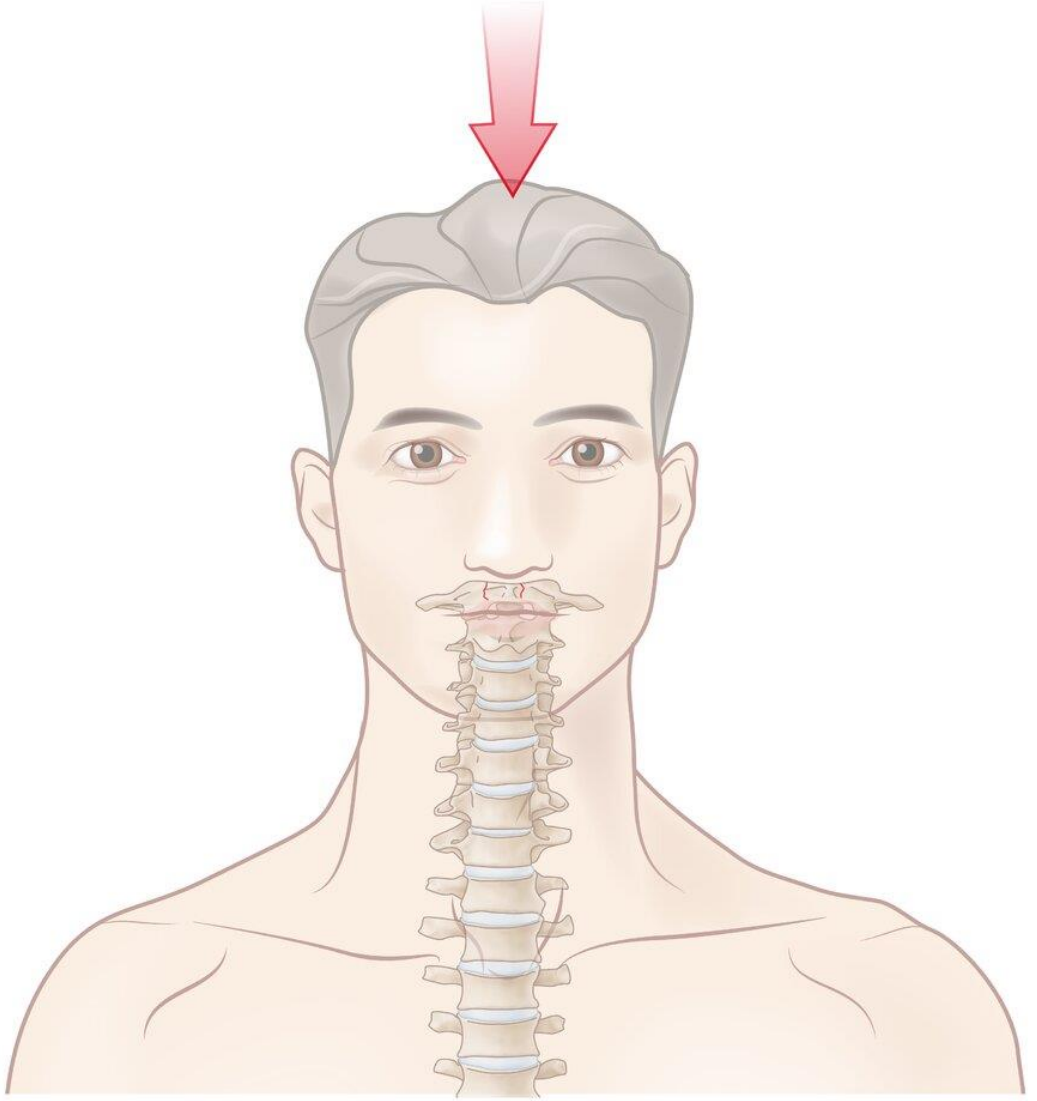


Vertebral fractures variants – Atlas fracture

- **Definition**: fracture of the atlas (first cervical vertebra)
  - Injury mode: axial force (e.g., swimming accident caused by jumping head-first into shallow water)
  - Jefferson fracture: combined fracture of the anterior and posterior arches
- **Symptoms**
  - Painful restriction of movement
  - Neck ache, paravertebral hematoma with dysphagia
  - Neurologic deficits, such as Horner syndrome
  - An asymptomatic course is also possible.
- **Diagnostics**
  - Cervical spine x-ray: fractures and dislocations
  - CT: best for Jefferson fractures
  - Arteriography: in cases of vascular compromise
- **Treatment**: immobilization for stable fractures; surgery for dislocations

Jefferson fracture

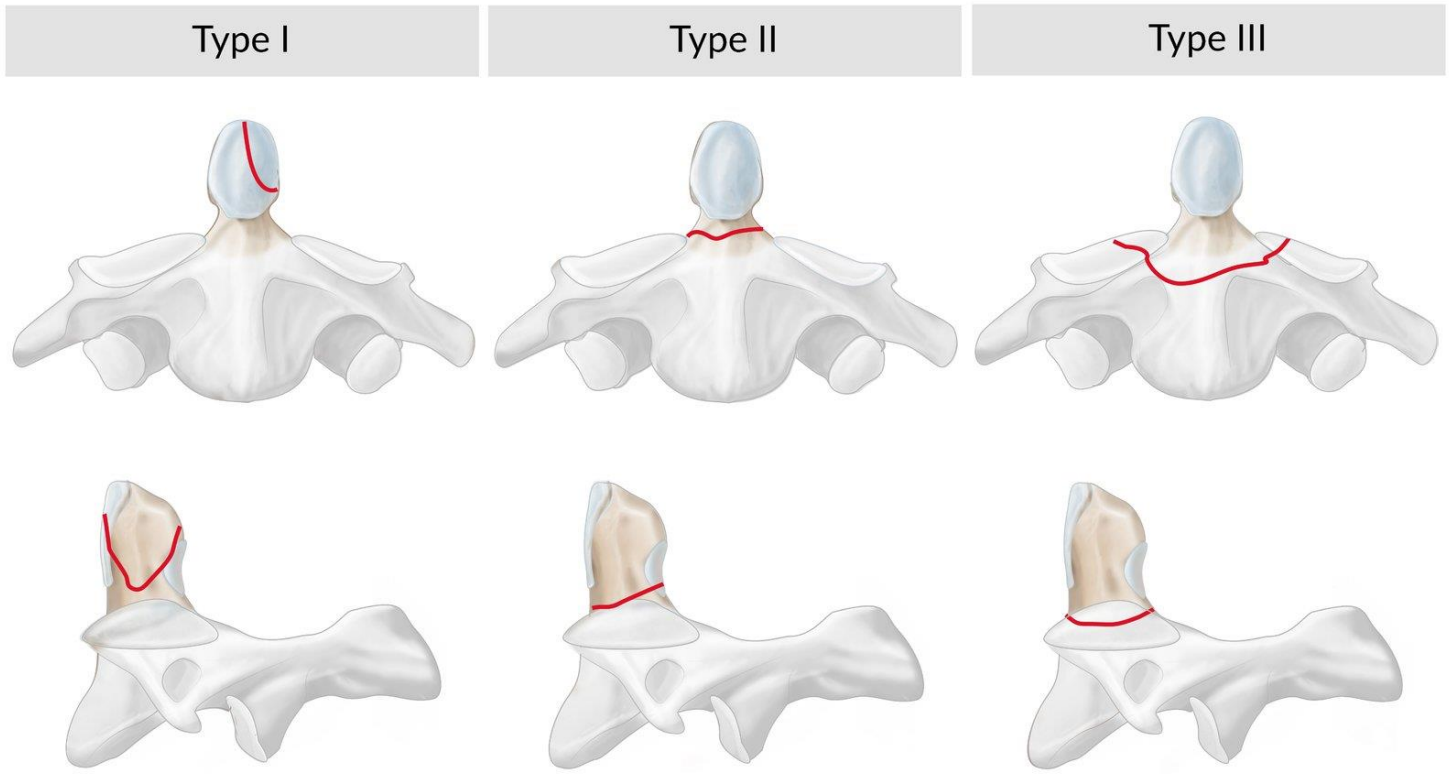




Vertebral fractures variants – Dens fracture

- **Definition**: fracture of the dens axis (second cervical vertebral body)
- **Epidemiology**: 10–15% of all cervical fractures
- **Etiology**
  - Head or neck injury as a result of a fall or blunt trauma
  - A contributing factor is loss of bone substance as a result of osteoporosis (mostly seen in elderly patients).
- **Symptoms**
  - Movement-induced pain
  - Neurological problems ranging from local sensory loss to paralysis due to complete spinal cord injury
- **Specific forms**: hangman's fracture
  - Definition: bilateral fracture of the axis arch
  - Etiology: trauma with hyperextension and distraction (e.g., car accident)
- **Diagnostics**: x-ray of the spinal cord to discern an atlantoaxial dislocation , CT, or MRI
- **Treatment**: immobilization for stable fractures, surgery for dislocations

Anderson's dens fracture classification



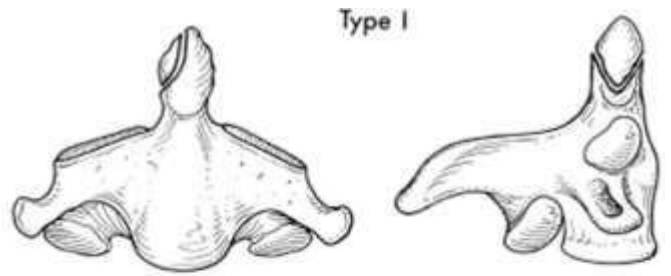
Type I: oblique fracture through the cranial part of the dens (stable)

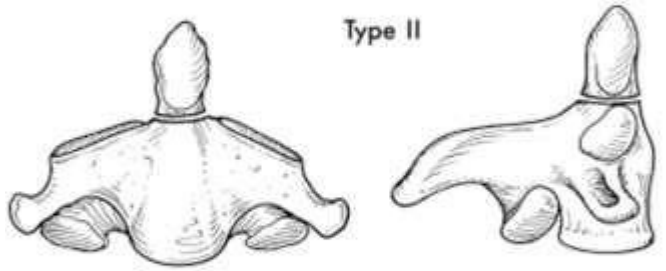
Type II: fracture at the base of the dens (frequently unstable)

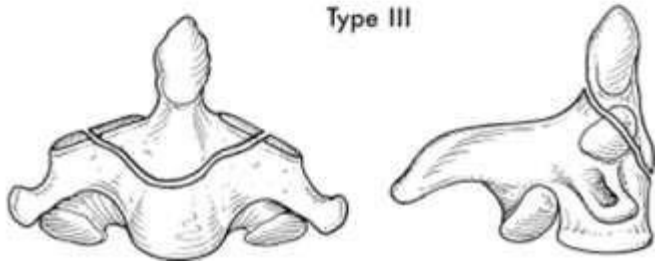
Type III: dens fracture and affected corpus axis (unstable)

Which type is more associated with non-union ?

a. Type 1
b. Type 2
c. Type 3
d. Type 4
e. Type 5





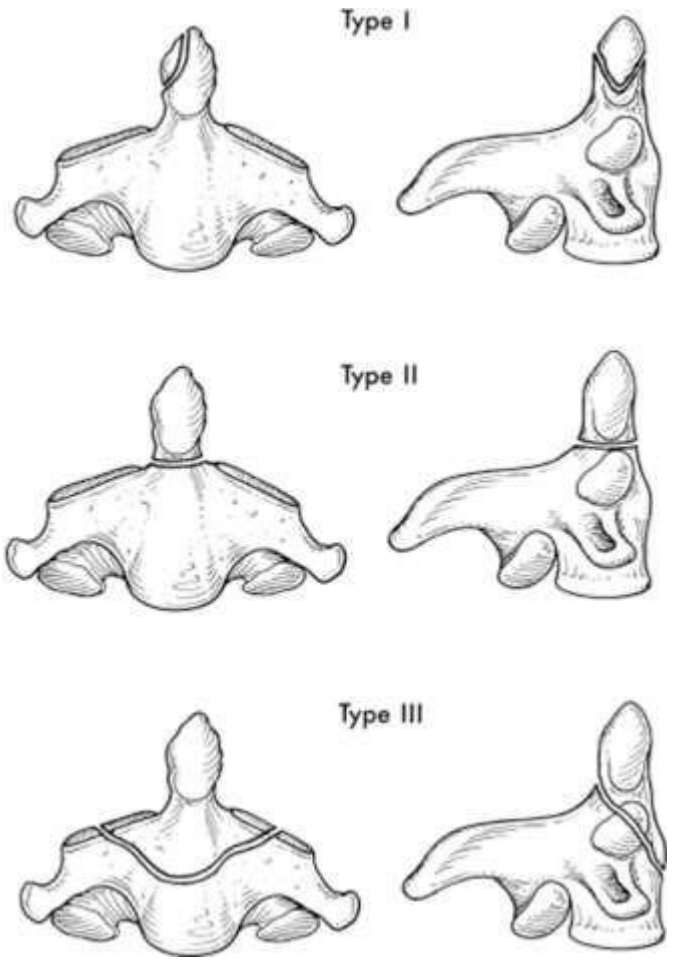


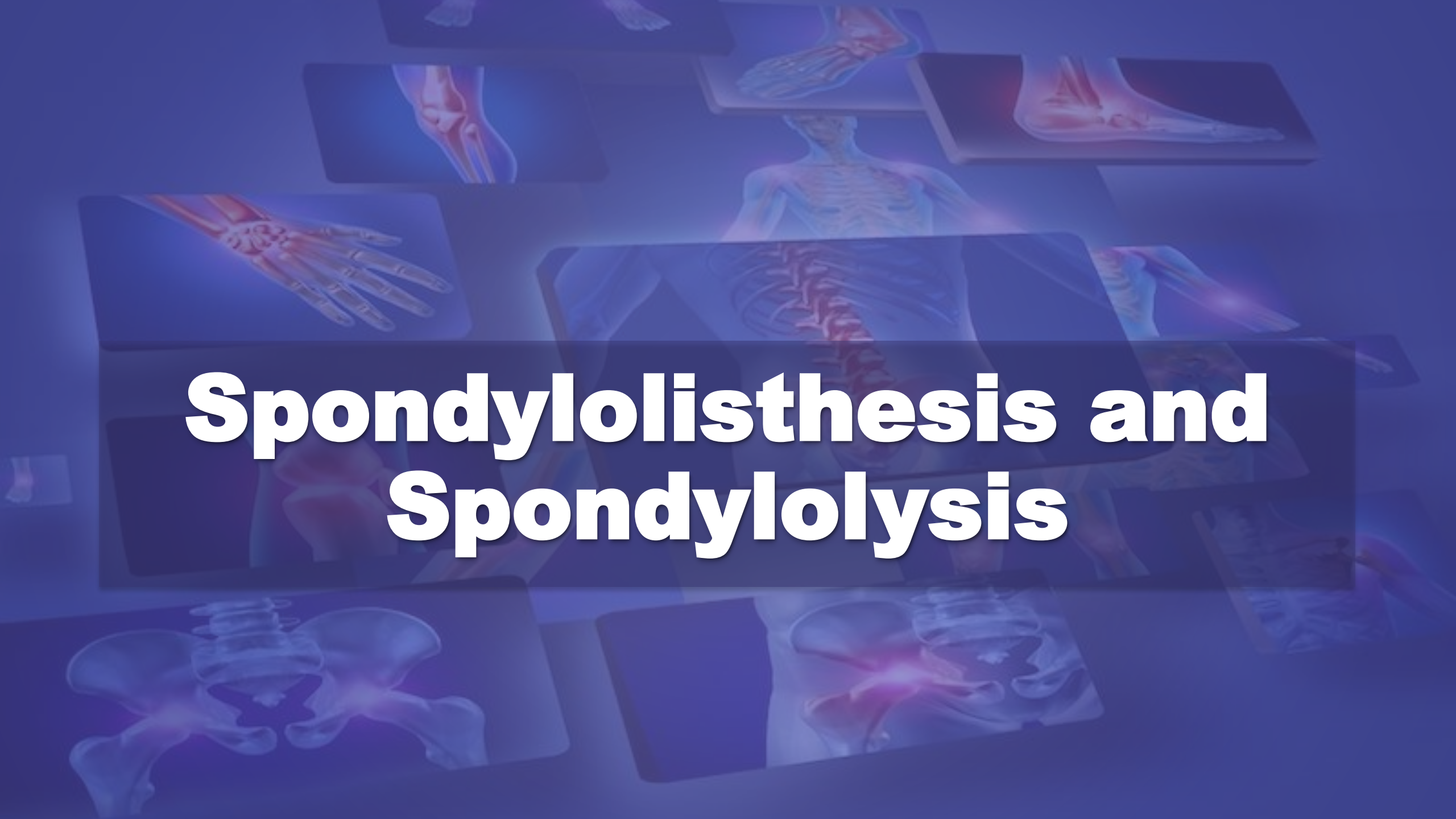
- Non-union increases risk of AVN

Which type is more associated with AVN ?

a. Type 1
b. Type 2
c. Type 3
d. Type 4
e. Type 5

- Non-union increases risk of AVN





Spondylolisthesis and Spondylolysis

Definitions

- **Spondylolisthesis**: anterior slippage of a vertebral body over the subjacent vertebra
- **Isthmic spondylolisthesis (spondylolytic form)**: spondylolisthesis resulting from an abnormality in the pars interarticularis
- **Degenerative spondylolisthesis**: spondylolisthesis resulting from degenerative changes, without an associated disruption or defect in the vertebral ring
- **Congenital spondylolisthesis**: spondylolisthesis secondary to congenital anomalies (e.g., hypoplastic facets, sacral deficits, poorly developed pars interarticularis).

Spondylolisthesis

❖Epidemiology

- Most common in children and adolescents < 18 years (congenital and isthmic spondylolisthesis) and adults aged > 50 years (degenerative spondylolisthesis)
- Sex: ♂ > ♀ (congenital and isthmic spondylolisthesis); ♀ > ♂ (degenerative spondylolisthesis)
- Defect most commonly occurs in the lumbar spine (typically L5-S1 in isthmic spondylolisthesis, L4-L5 in degenerative spondylolisthesis)

❖Risk factors include:

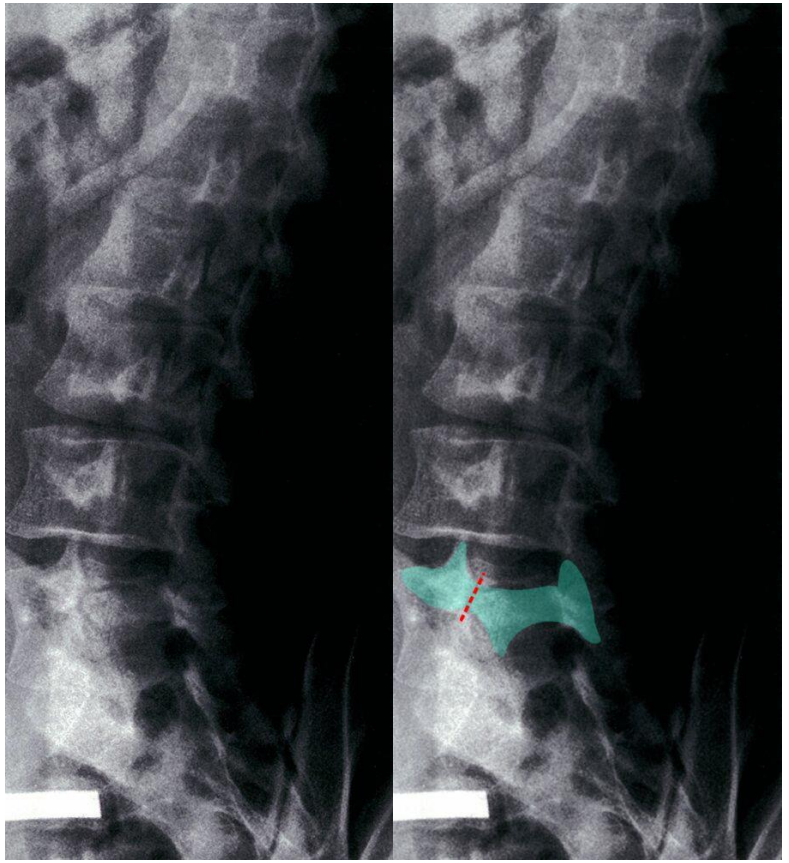
- Congenital malformation (dysplasia or hypoplasia) of the lumbosacral joints in L5–S1
  - Repetitive hyperextension and rotation movements at L5–S1
  - Commonly associated with gymnastics, swimming, and weightlifting
- **Spondylolysis**: lytic defect in the pars interarticularis, permitting forward slippage of the superjacent vertebra
  - Leads to isthmic spondylolisthesis if spondylolysis is bilateral
  - Scheuermann disease can be the underlying cause of spondylolysis or spondylolisthesis
- Degenerative disease: most commonly in the elderly at L4–L5
- Trauma
- Local or systemic pathology (e.g., tumor, Paget's disease, osteogenesis imperfecta, TB)

Spondylolisthesis – Clinical features

- Asymptomatic (majority of patients)
- Acute or chronic lumbar pain that worsens with activity and/or with spine extension
- Gait problems (e.g., waddling gait)
- Possible physical examination findings
  - Spine
    - Reduced lumbar range of motion and reduced lumbar lordosis
    - Step-off sign (seen in advanced stages)
    - Procedure: Observe and palpate the spinous processes to identify any slippage of the vertebrae.
    - Positive sign: visible or palpable step-off sign at the lumbosacral area
  - Lower limbs
    - Tight, contracted hamstring muscles
    - Weakness and atrophy in lower legs; reduced sensation and reflexes
    - Straight leg raise test: A positive test indicates lumbar radiculopathy.

Spondylolisthesis – X-ray lumbosacral spine

- **Indications**: initial test for all patients in whom spondylolisthesis is suspected
- **Views**
  - Lateral, PA, and oblique
  - Dynamic flexion-extension (lateral view): Consider performing to assess for spinal instability.
- **Supportive findings**: anterior vertebral displacement (anterolisthesis)
  - L4 over L5: most common in degenerative spondylolisthesis
  - L5 over S1: most common in isthmic spondylolisthesis
- **Additional findings**
  - Degenerative changes, e.g., disk space narrowing, vacuum phenomenon, endplate sclerosis
  - Spondylolysis: in the isthmic form
    - Scottie dog with a collar sign
    - High-grade spondylolisthesis of L5 over S1 due to bilateral spondylolysis (inverted Napoleon hat sign)
  - Spinal instability



Scottie dog with a collar sign

Spondylolisthesis – Additional imaging studies

Order to assess for spinal stenosis and impingement of nerve roots in patients with signs of neurological involvement.

❖Indications

- Clinical features of radiculopathy or myelopathy
- Suspected underlying condition (e.g., metastatic disease)
- Suspected cauda equina syndrome (i.e., bladder or bowel complaints)

❖Options

- First-line: MRI lumbosacral spine
- Second-line
  - CT myelography or CT lumbosacral spine
  - For patients with contraindications to MRI; can also be used as a guide to surgical treatment

Spondylolisthesis – Treatment

❖Conservative treatment

- Indications
  - Initial treatment for patients with low-grade slippage and no significant neurological involvement
  - Consider as initial treatment for high-grade degenerative spondylolisthesis with no significant neurological involvement
- General recommendations
  - Physical therapy, Physical activity restriction, Management of comorbidities
- Pain management

❖Surgical treatment

- Common indications
  - High-grade spondylolisthesis (Meyerding classification grades ≥ III)
  - Significant neurogenic claudication or radiculopathy
  - Progressive or persistent symptoms (e.g., after 3–6 months) despite conservative treatment
  - Traumatic spondylolisthesis and spinal instability
  - Bladder or bowel symptoms
- Treatment options: Vertebral fusion: standard procedure

Spondylolysis

- **What is your diagnosis ?**
  - Spondylolysis
- **What test should we do?**
  - 1-Leg hyperextension test

Scottie dog with a collar sign

Female has lower back pain 1 month duration

X Ray was done, what type of spondylolisthesis she is at risk to have ?

a. Post-trumatic spondylolisthesis

b. Isthmic spondylolisthesis

c. Degenerative spondylolisthesis

d. Pathological spondylolisthesis

e. Post–Surgical spondylolisthesis

Scottie dog with a collar sign

- Spondylolysis leads to isthmic spondylolisthesis if spondylolysis is bilateral

Spondylolisthesis

- **What is your diagnosis**
  - Spondylolisthesis

Female has history of Spondylolysis

What is your diagnosis ?

a. Post-trumatic spondylolisthesis
b. Isthmic spondylolisthesis
c. Degenerative spondylolisthesis
d. Pathological spondylolisthesis
e. Post–Surgical spondylolisthesis

- Spondylolysis leads to isthmic spondylolisthesis if spondylolysis is bilateral

What is your diagnosis

a. L4-L5 spondylolisthesis
b. L5-S1 spondylolisthesis
c. L5-S1 spondylolysis
d. S1-S2 spondylolisthesis
e. S1-S2 spondylolysis

What is your diagnosis

a. L4-L5 spondylolisthesis
b. L5-S1 spondylolisthesis
c. L5-S1 spondylolysis
d. S1-S2 spondylolisthesis
e. S1-S2 spondylolysis

Degenerative disk disease

Degenerative disk disease

❖Classifications Of Herniations

- **Disk protrusion**: protrusion of the vertebral disk nucleus pulposus through the annulus fibrosus (intact)
- **Disk herniation** (disk extrusion or disk prolapse): complete extrusion of the nucleus pulposus through a tear in the annulus fibrosus
- **Disk sequestration**: extrusion of the nucleus pulposus and separation of a fragment of the disk

Degenerative disk disease

- **Epidemiology**
  - Age: most common at 30–50 years
  - Sex: ♂ > ♀
  - Cervical and thoracic disk herniations: rare
  - Lumbosacral disk herniation
    - L5–S1 (most common site)
    - L4–L5 (second most common site)
- Intervertebral disks usually protrude/herniate posterolaterally, as the posterior longitudinal ligament is thinner than the anterior longitudinal ligament.

Degenerative disk disease – Clinical features

- Asymptomatic and detected incidentally
- Acute onset of severe neck or back pain
  - Radicular pain: pain that radiates to the legs (sciatic pain) or arms
  - The pain is either stabbing in nature or resembles an electric shock
- Features of radiculopathy: lower motor neuron signs of the affected nerve root (typically unilateral)
  - Paresthesia of the affected dermatome
  - Muscle weakness and atrophy of the related myotome
  - Absent or diminished deep tendon reflexes
- Features of compressive myelopathy (typically bilateral) or cauda equina syndrome
  - Paresthesia below the level of compression
  - Motor deficits

Overview of cervical radiculopathies

Overview of cervical radiculopathies [9]

Radiculopathy	Causative disk	Sensory deficits	Motor deficits	Reduction of reflexes
C3/4 radiculopathy	• C2–C4	• Shoulder and neck area	• Scapular winging	• None
C5 radiculopathy	• C4–C5	• Anterior shoulder	• Biceps and deltoid	• Biceps reflex
C6 radiculopathy	• C5–C6	• From the upper lateral elbow over the radial forearm up to the thumb and radial side of index finger	• Biceps and wrist extensors	• Biceps reflex • Brachioradialis reflex
C7 radiculopathy	• C6–C7	• Palmar: fingers II–IV (II ulnar half, III entirely, IV radial half) • Dorsal: medial forearm up to fingers II–IV	• Triceps, wrist flexors, and finger extensors	• Triceps reflex
C8 radiculopathy	• C7–T1	• Fingers IV (ulnar half) and V, hypothenar eminence, and ulnar aspect of the distal forearm	• Finger flexors	• None

Overview of lumbosacral radiculopathies

Overview of lumbosacral radiculopathies [9]

Radiculopathy	Causative disk	Sensory deficits	Motor deficits	Reduction of reflexes
L3 radiculopathy	• L2–L3	• Anterolateral area of the thigh	• Hip flexion • Knee extension • Hip adduction	• Adductor reflex • Patellar reflex
L4 radiculopathy	• L3–L4	• Anterolateral thigh, area over the patella, medial aspect of the leg, medial malleolus	• Knee extension • Hip adduction	• Patellar reflex
L5 radiculopathy	• L4–L5	• Lateral aspect of the thigh and knee, anterolateral aspect of the leg, dorsum of the foot, and the big toe	• Tibialis anterior muscle (foot dorsiflexion): difficulty heel walking (foot drop) • Extensor hallucis longus muscle (first toe dorsiflexion)	• Posterior tibial reflex (medial hamstring)
S1 radiculopathy	• L5–S1	• Dorsolateral aspect of thigh and leg, and the lateral aspect of the foot	• Peroneus longus and brevis muscle (foot eversion) and gastrocnemius muscle (foot plantarflexion): difficulty toe walking	• Achilles reflex • Lateral hamstring reflex
S2 radiculopathy, S3 radiculopathy, S4 radiculopathy	• S1–S4	• Posterior aspect of the thigh and leg (S2), perineum (S3–S4), perianal (S4)	• None	• Bulbocavernosus reflex • Perineal reflex

Diagnostics

1. **Perform clinical evaluation focusing on red flags for acute back pain**
   - **Patient characteristics**: Age < 18 or > 50 years, Immunosuppression
   - **History of** cancer, unexplained weight loss, abdominal aortic aneurysm, bacterial infection, spinal anesthesia, spinal surgery, or significant trauma
   - **Medications**: Long-term steroids, Anticoagulants, IV drugs
   - **Signs of cord compression syndromes**: (Motor weakness, Paresthesia or anesthesia (including saddle anesthesia), Bladder, bowel, or sexual dysfunction)

بسألوا عنها بالراوندات

2. **Determine the need for imaging**
   - Red flags for acute back pain: MRI spine without IV contrast is preferred
   - No red flags for acute back pain: Urgent imaging is typically not required

MRI spine without IV contrast

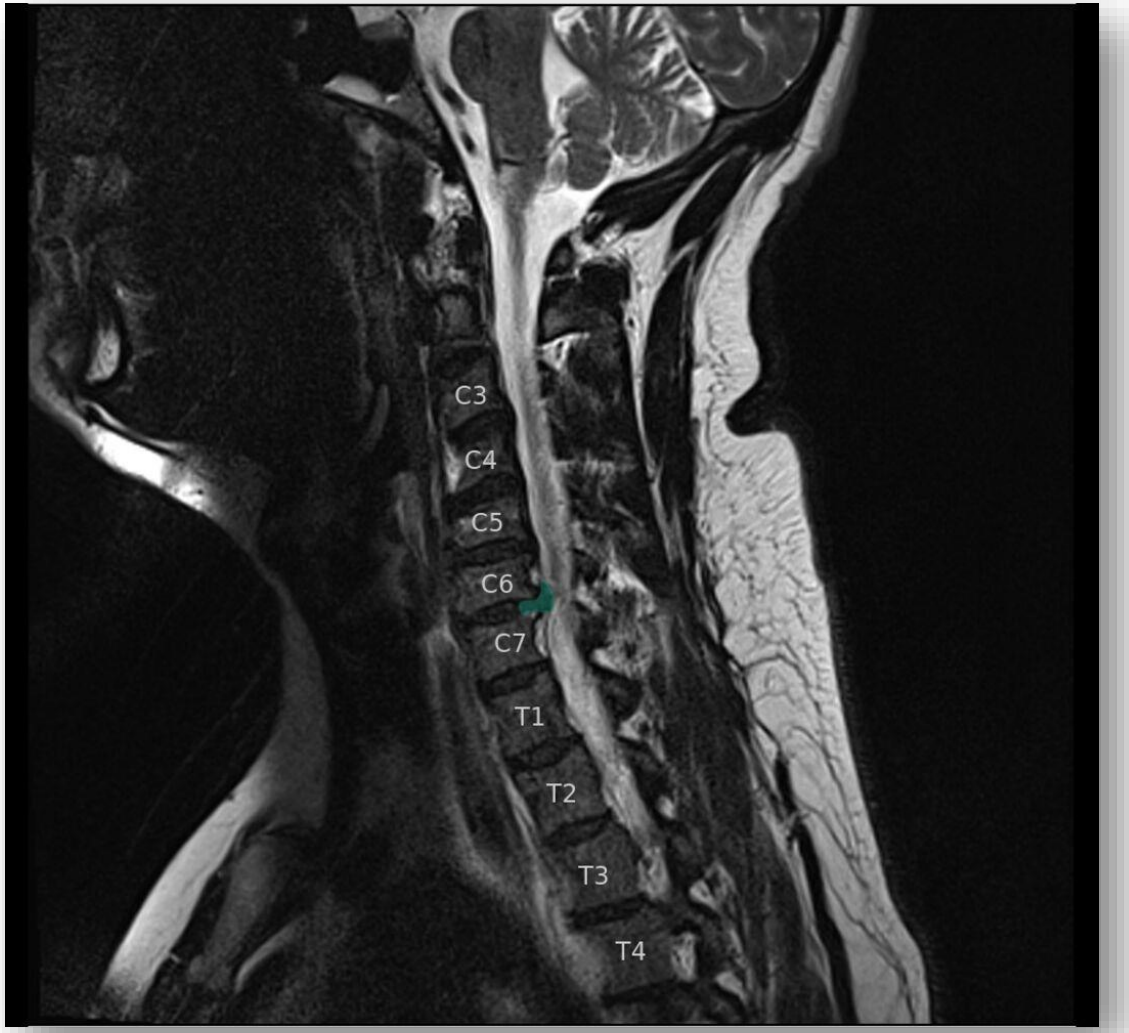
❖Indications

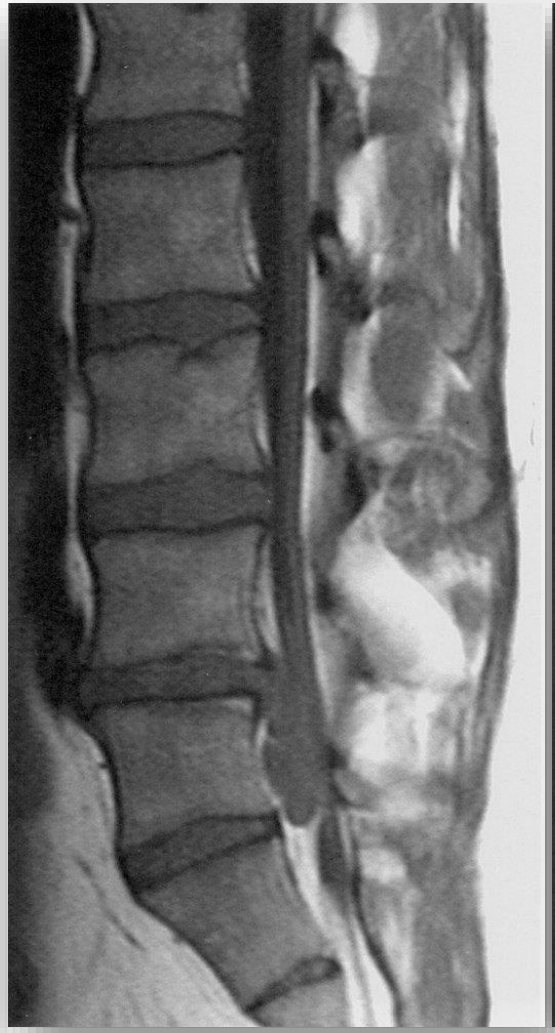
- preferred initial imaging modality for suspected radiculopathy, myelopathy, or cauda equina syndrome

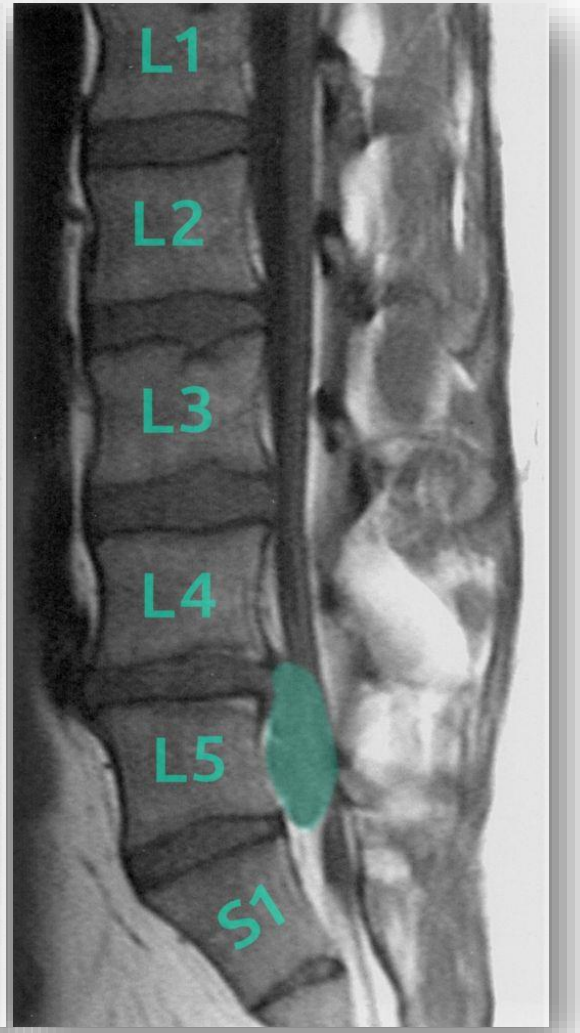
❖Supportive findings

- Disk degeneration: sclerosed, dehydrated disk that appears hypointense on T2-weighted images
- Disk prolapse/herniation: herniation of disk tissue with surrounding edema
- Evidence of impingement/compression of a spinal nerve or the spinal cord may be visible, e.g.:
  - Focal narrowing of the spinal canal
  - Compression of the thecal sac
  - Edema of the spinal cord (appears hyperintense on T2-weighted images)

MRI spine without IV contrast







Treatment

❖Approach

- Identify and treat compressive spinal emergencies immediately, if present
- For isolated radiculopathy without any red flags for acute back pain:
  - Initiate conservative management
  - Urgent imaging is typically not required

❖Conservative management

- Physiotherapy, Continuation of daily activities (minimize bed rest), Analgesics

❖Surgery

- **Indications**
  - **Urgent**: significant or progressive neurological deficits, bowel or bladder incontinence, compressive spinal emergencies
  - **Elective**: persistent or progressive radiculopathy despite conservative management
- **Procedure**: diskectomy (Surgical removal of the herniated portion of the intervertebral disk)

Spinal canal stenosis

Spinal canal stenosis

- **Definition**: Narrowing of the spinal canal due to hypertrophy at the posterior disc margin and the facet joints
- **Epidemiology**
  - Lumbar stenosis is the most common form of spinal stenosis
  - Cervical stenosis affects 1–2 individuals per 100,000 population.
  - Thoracic stenosis is rare.
  - Age range: middle-aged and elderly population
- **Etiology**
  - Degenerative joint disease (most common)
    - Spondylolisthesis, Disk space narrowing, Facet joint hypertrophy
  - Iatrogenic: following spinal surgery such as laminectomy
  - Systemic disease: Paget disease, ankylosing spondylitis, tumors
  - Others: e.g., trauma, calcification of the ligamentum flavum

Spinal canal stenosis – Clinical features

- **Lumbar spinal stenosis**
  - Load-dependent lower back pain that worsens with walking
  - **Neuropathic claudication**: a group of neuropathic symptoms affected by postural changes
    - Unilateral or bilateral gluteal, thigh, and calf pain
    - Worsens with lumbar extension (e.g., walking, prolonged standing)
    - Relieved by lumbar flexion (e.g., sitting, laying down, cycling)
  - Unsteady wide-based gait
  - Reduced lower extremity reflexes
  - Mild motor weakness and sensory changes may be present.
  - Abnormal Romberg test

Spinal canal stenosis – Clinical features

- **Cervical spinal stenosis**
  - Neck pain
  - Gait and balance disturbances
  - Increased urinary frequency or incontinence
  - Upper motor neuron signs below the level of stenosis
  - Lower motor neuron signs at the level of stenosis
  - Sensory abnormalities: pain, paresthesia, and/or anesthesia at or below the level of stenosis; Lhermitte sign
- **Thoracic spinal stenosis**
  - Unilateral or bilateral lower limb paresthesia and pain
  - Bladder, bowel, and/or sexual dysfunction
  - Radicular pain around the chest or abdomen
  - Upper motor neuron signs in the lower limbs

Spinal canal stenosis – Imaging

❖MRI spine without IV contrast

- Preferred modality in symptomatic patients
- Findings
  - Evidence of spinal stenosis: Narrowing of the spinal canal, compression of the spinal cord and/or nerve root impingement
  - Evidence of the underlying etiology (e.g., degenerative disk disease, facet joint hypertrophy, ligamentous hypertrophy)

❖X-ray spine

- **Indications**
  - Routine first-line modality for acute back pain in individuals with no neurological abnormalities
  - Suspected vertebral fracture
- **Findings**: evidence of the underlying etiology (e.g., degenerative joint changes)

Spinal canal stenosis – Treatment

- **Lumbar spinal stenosis**
  - **Conservative management**
    - Indication: Mild or moderate symptoms: conservative management with analgesia and physiotherapy
    - First-line: NSAIDS, Physiotherapy
    - Second-line: image-guided epidural steroid injection
  - **Surgery**
    - Indications: Severe lumbar stenosis, moderate lumbar stenosis with insufficient response to conservative therapy or patients who elect to undergo surgery
    - Surgical options: Laminectomy, Laminotomy
- **Cervical and thoracic spinal stenosis**
  - **Surgery** (decompression with or without vertebral fusion) is preferred in most cases because of the risk of severe neurological symptoms without surgical treatment
  - **Conservative management** (NSAIDs and/or physiotherapy) may be considered in patients with mild stenosis

Lumbar canal stenosis

A case of patient had lumbar canal stenosis (this information was not written in the question), according to difference between vascular and neurological claudication choose the true answer

a. Downhill more painful

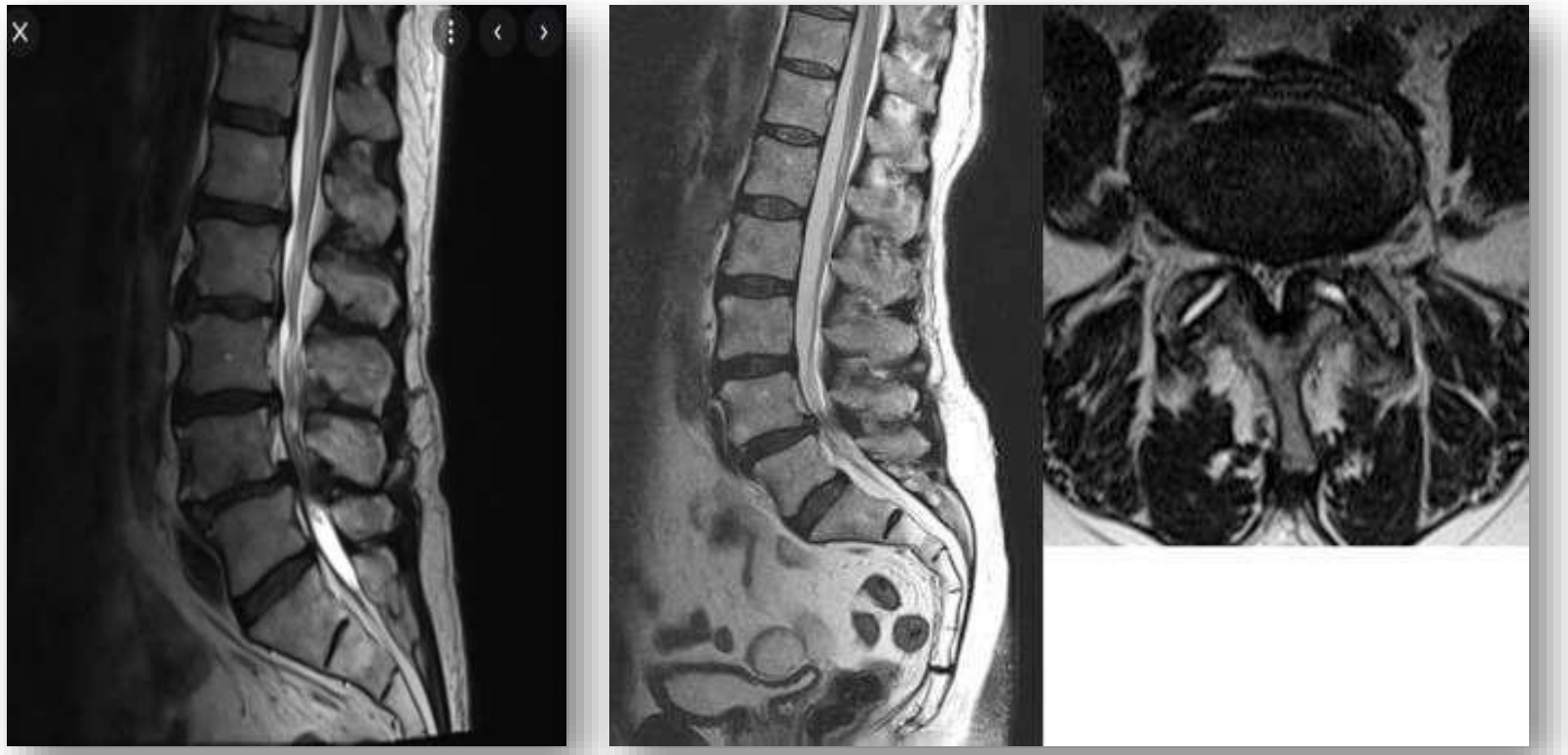
(the other choices were the features of vascular claudication)

Neurogenic Vs Vascular claudication

Symptoms	**Neurogenic**	**Vascular**
Back Pain	Common	Uncommon
Pain Relief	Sitting or flexed posture Standing and resting usually insufficient Often slow (>5 mins)	Not positional Pain relief while standing Almost immediate
Ambulatory tolerance	Variable	Fixed
Uphill vs. Downhill	Downhill more painful (extended posture)	Uphill more painful
Bicycle ride	No pain	Pain

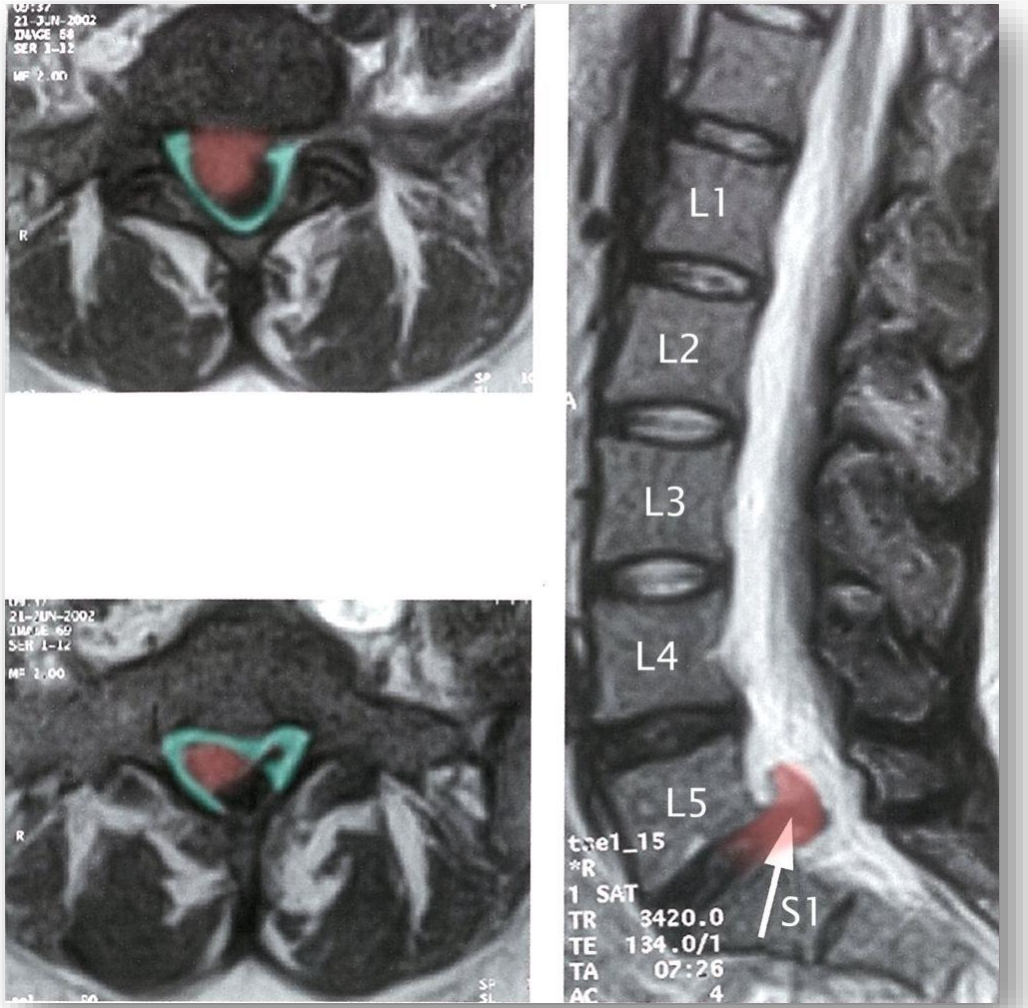
What is your diagnosis ?

a. Lumbar canal stenosis

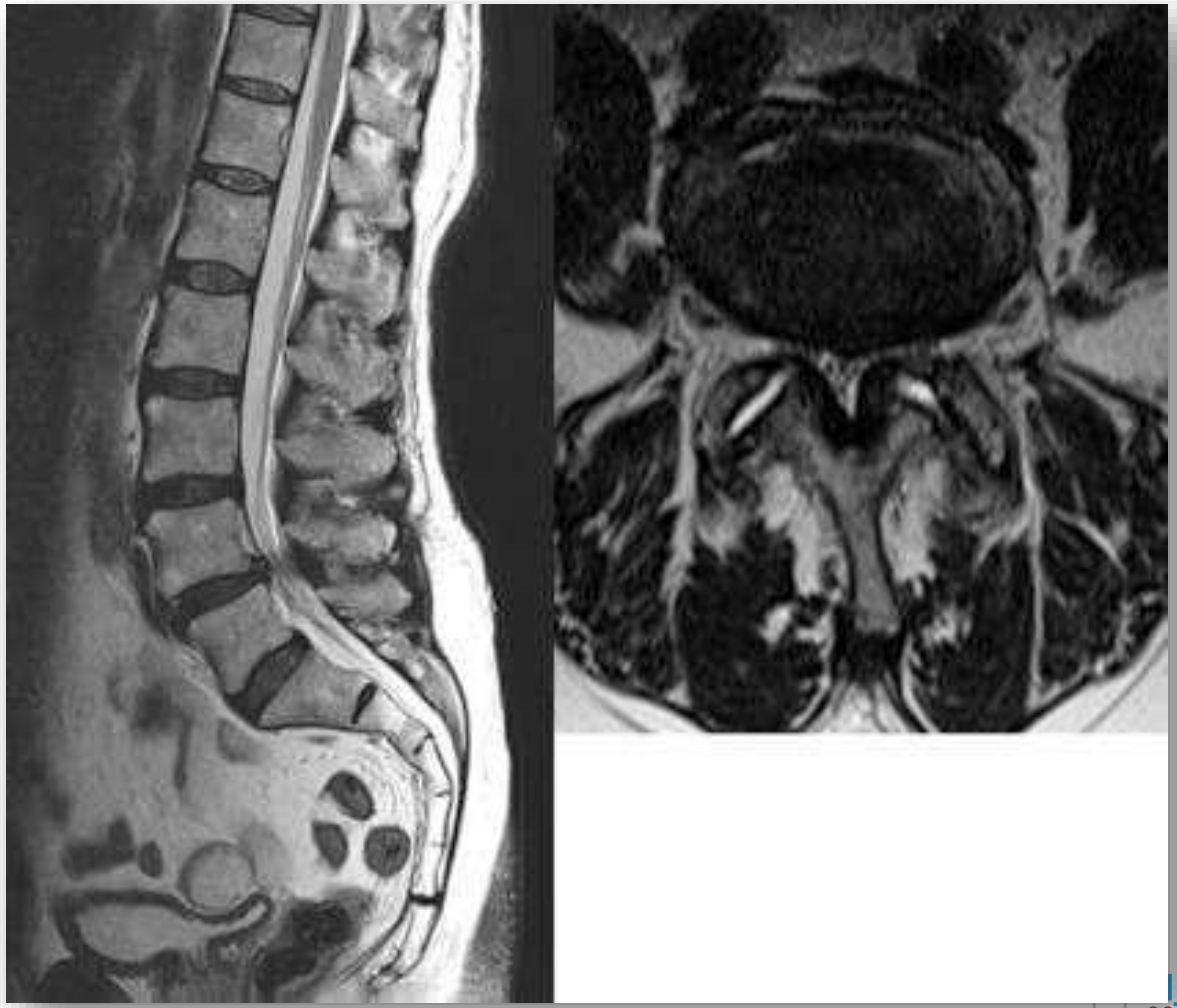


Disk herniation Vs Canal stenosis

Spinal disc herniation



Spinal canal stenosis

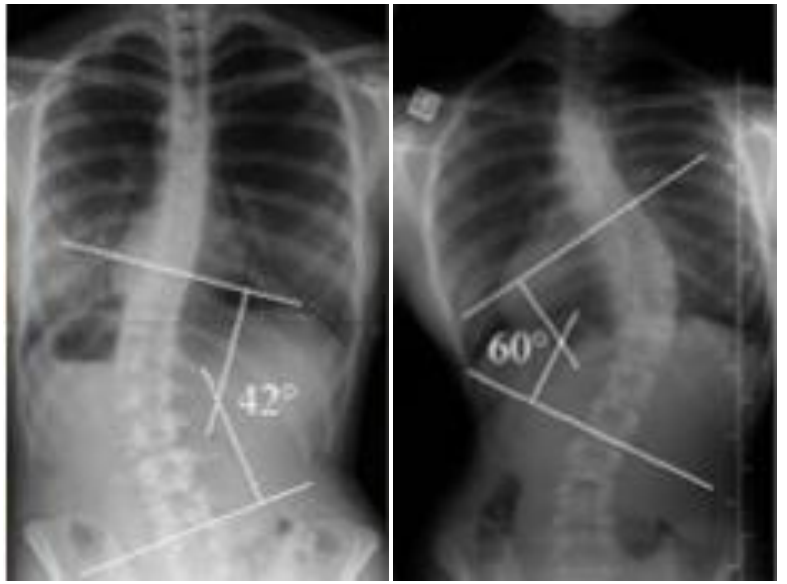


Scoliosis

Scoliosis

❖Definitions

- Lateral curvature (Cobb angle > 10°) and simultaneous rotation of the vertebrae
- It is a triplanar deformity with lateral, anteroposterior and rotational components
- **Levoscoliosis**: Describes a spinal curve to the left; Common in lumbar spine
- **Dextroscoliosis**: Describes a spinal curve to the right
  - Usually in the thoracic spine
  - This is the most common type of curve
  - Forming either c shape or s shape



Levoscoliosis **Dextroscoliosis**

- The vertebrae that make up the curve are always rotated around the vertebral axis
- the bodies point to the convexity. And the spinous processes to the concavity of the curve

❖Epidemiology

- Patients usually present between the age of 10 and 15
- Mostly occur in female

Scoliosis types

Postural type

- Secondary or compensatory to some condition outside the spine, such as a short leg or a pelvic tilt due to contracture of the hip.
- Local muscle spasm associated with a prolapsed lumbar disc may also cause a skew back.
- When the patient sits (thereby cancelling leg length asymmetry) or bend forward (adam's test) the curve disappears.
- It can become structural if it exceed a certain point
- 2 dimensional "Diplaner" (AP only)

Structural type

- Non-correctable deformity of the affected spinal segment
- Rib hump on bending forward
- The deformity is liable to increase throughout the growth period. curves greater than 50 degrees may go on increasing by 1 degree per year
- Very severe curves (angle >70-80 degree) accompanied with chest deformity and cardiopulmonary dysfunction

Types of structural scoliosis

- Idiopathic scoliosis (80%)
  - Infantile (0-3 years old)
  - Juvenile (4-9 years old)
  - Adolescent (10 years to maturity)
- Osteopathic scoliosis: due to congenital vertebral anomalies
- Neuropathic scoliosis: due to asymmetrical muscle weakness (e.g., In poliomyelitis or cerebral palsy).
- Myopathic scoliosis: in muscular dystrophies.
- Neurofibromatosis.

Types of structural scoliosis – Idiopathic scoliosis

- **Infantile idiopathic scoliosis**
  - Only type whose most common curve pattern is left thoracic
  - Only type that is more common in males
  - Only type to resolve spontaneously (90%)
- **Juvenile idiopathic scoliosis**
  - Most common curve pattern is a right thoracic curve
  - More common in female. 50% resolve spontaneously
  - High rate of progression, and need for surgery
- **Adolescent idiopathic scoliosis**
  - The most common type of scoliosis overall
  - Present before puberty and progresses until skeletal growth ceases

Types of structural scoliosis cont.

- **Osteopathic (congenital) scoliosis**
  - The commonest bony cause is some type of vertebral anomaly:
    - Hemivertebra, wedged vertebra (failure of formation), fused vertebrae, fractures, bone softening (rickets or osteogenesis imperfecta)
  - More aggressive and need early surgery
- **Neuropathic and myopathic scoliosis**
  - **Causes**: Poliomyelitis, cerebral palsy, Syringomyelia, Friedreich's ataxia
  - Also aggressive and bracing may fail, need surgery
- **Scoliosis and neurofibromatosis**
  - 1/3 of patients with neurofibromatosis develop spinal deformity
  - Accompanied by skin lesions, multiple neurofibromata and bony dystrophy affecting the vertebrae and ribs

In a 23 years old this was an incidental finding

- What is the underlying etiology ?
  a. Idiopathic
  b. Infantile
  c. Syndromic
  d. Congenital
  e. Neuropathic

Diagnostics

❖Screening

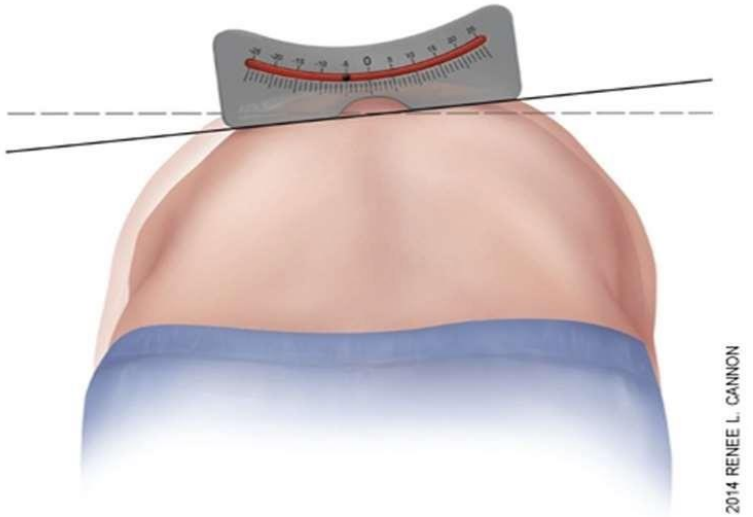
- **Adams test**: deviation when the patient bends forward, used as a screening test in schools along with scoliometer
- **Scoliometer**: if the angle below 7 normal, above 7 need further investigations

❖Plain X-ray

- Full-length PA and lateral x-rays of the spine and iliac crests must be taken with the patient erect
- PA x-ray shows asymmetry in vertebra at the apex of the curve or vertebral rotation

❖CT and MRI needed in

- Pain, Big curves > 50, Rt thoracic curve, Abnormal neurological examination



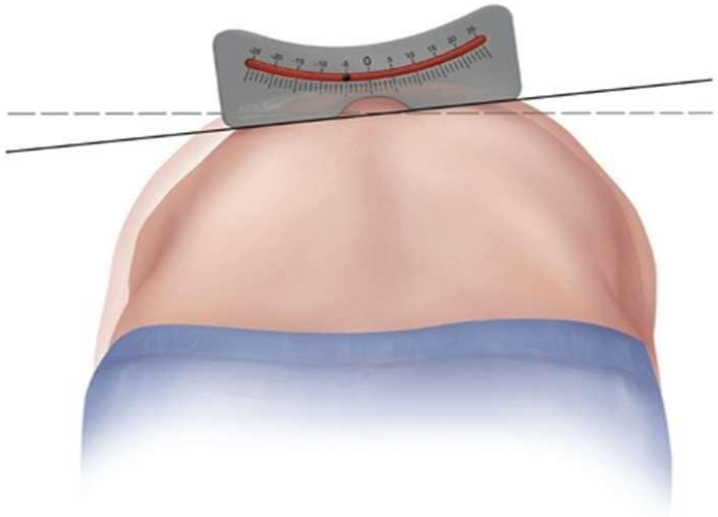
Scoliosis Screening

- **What is this deformity ?**
  - Scoliosis
- **What is the name of this test ?**
  - Bending forward test (Adams test)

سنوات (2)

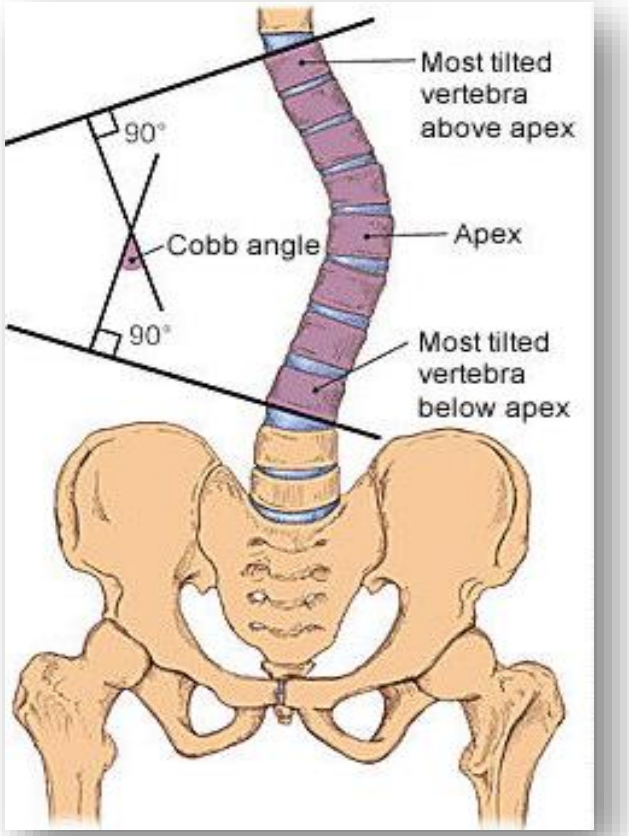
- **What is the name of this test ?**
  - Scoliometer
- **This test is used for**
  - Screening

سنوات (4)

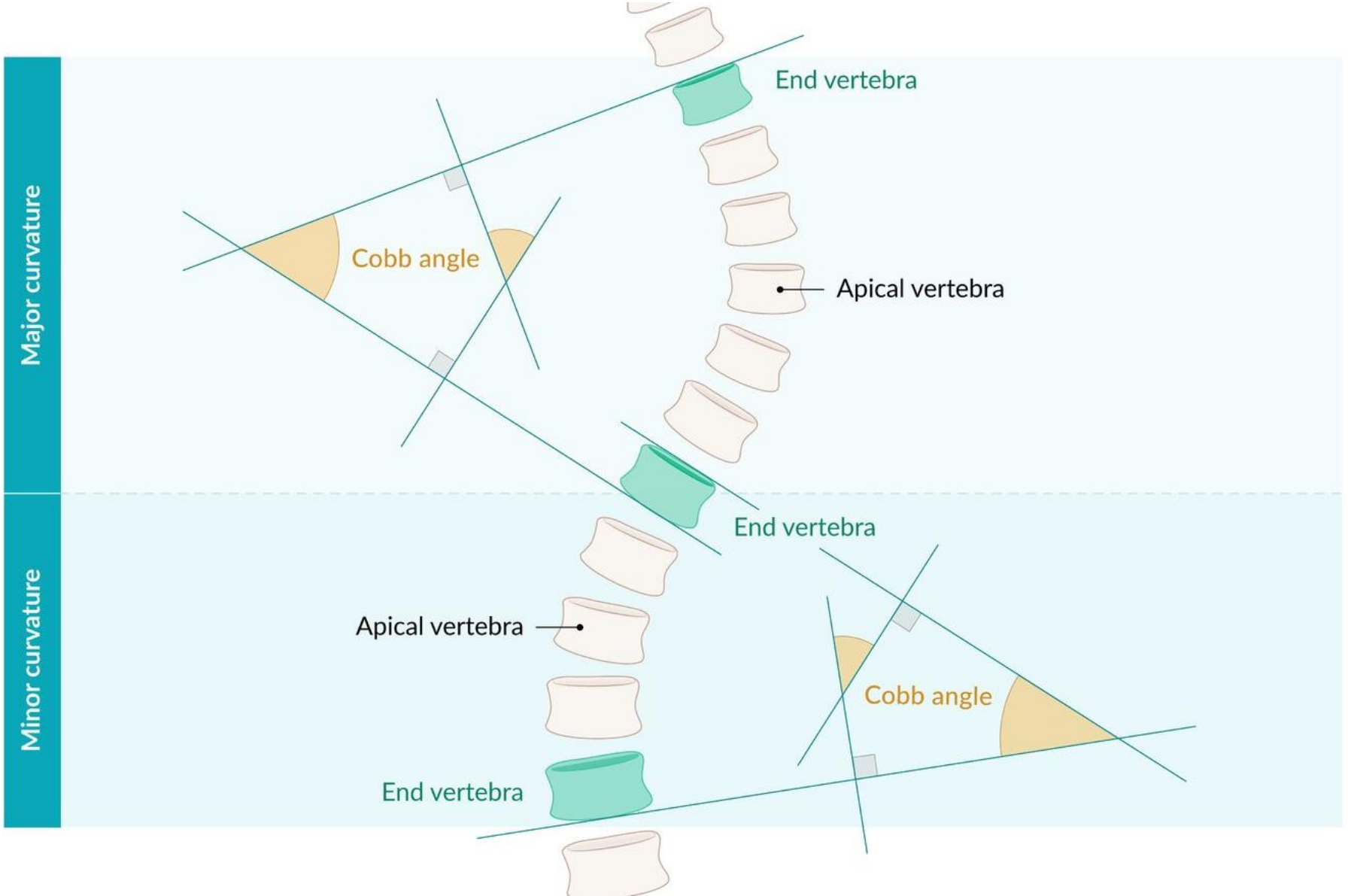


Cobb angle

- Cobb angle for measuring the spinal curvature
  - Choose the most tilted vertebrae above & below apex of the curve.
  - Angle between intersecting lines drawn perpendicular to the top of the superior vertebrae and bottom of the inferior vertebrae is the Cobb angle
- **Interpretation**
  - Secondary curve (compensatory): <25 degree
  - Primary curve: >25 degree
- **Treatment**:
  - <25 degree: conservative/ follow up
  - 25-45 degree: bracing and also depend on Risser's sign



Cobb angle


Major curvature
Minor curvature
End vertebra
Cobb angle
Apical vertebra
End vertebra
Apical vertebra
Cobb angle
End vertebra

Risser's sign

- Ossification of iliac crest starts laterally and proceeds medially toward sacrum
- Risser staging is based on iliac crest apophysis ossification
  - Type 1 = ossification of lateral 25%
  - Type 2 = lateral 50%
  - Type 3 = lateral 75%
  - Type 4 = lateral 100%
  - Type 5 = fusion of ilium
- This is important because the curve often progresses most during the period of rapid skeletal growth and maturation
- Once the iliac crests are completely ossified (14-16 year) further progression of the scoliosis is minimal

- **What is the name of this classification ?** سنوات (5)
  - Risser's staging

Prognostic factors

- **Mention 2 prognostic factors**:
  - Cobb's angle
  - Risser's staging
- **What is the most important prognostic factor ?**
  - Risser's staging (Ossification of iliac apophysis)

Treatment

- **Treatment based on the Cobb angle**
  - Cobb angle < 10°: per definition not scoliosis, and therefore not monitored
  - Cobb angle 10–19°: continual monitoring for progression
  - Cobb angle 20–29°: monitoring or bracing
  - Cobb angle 30–39°: bracing
  - Cobb angle > 40° or rapidly progressing scoliosis: surgery
- **Bracing**
  - 18 hours/day, if possible
  - Bracing is usually able to halt progression but cannot cure the underlying condition.
- **Surgery**
  - Goal: correct spinal arching and rotation
  - Various surgical techniques and approaches exist (ventral, lateral, dorsal, or combined approach).
  - Spondylodesis: fusion of the vertebrae by bridge plating or by internal fixation
  - Risks: paraplegia (< 1% of cases), development of pseudarthroses, infection of surgical material

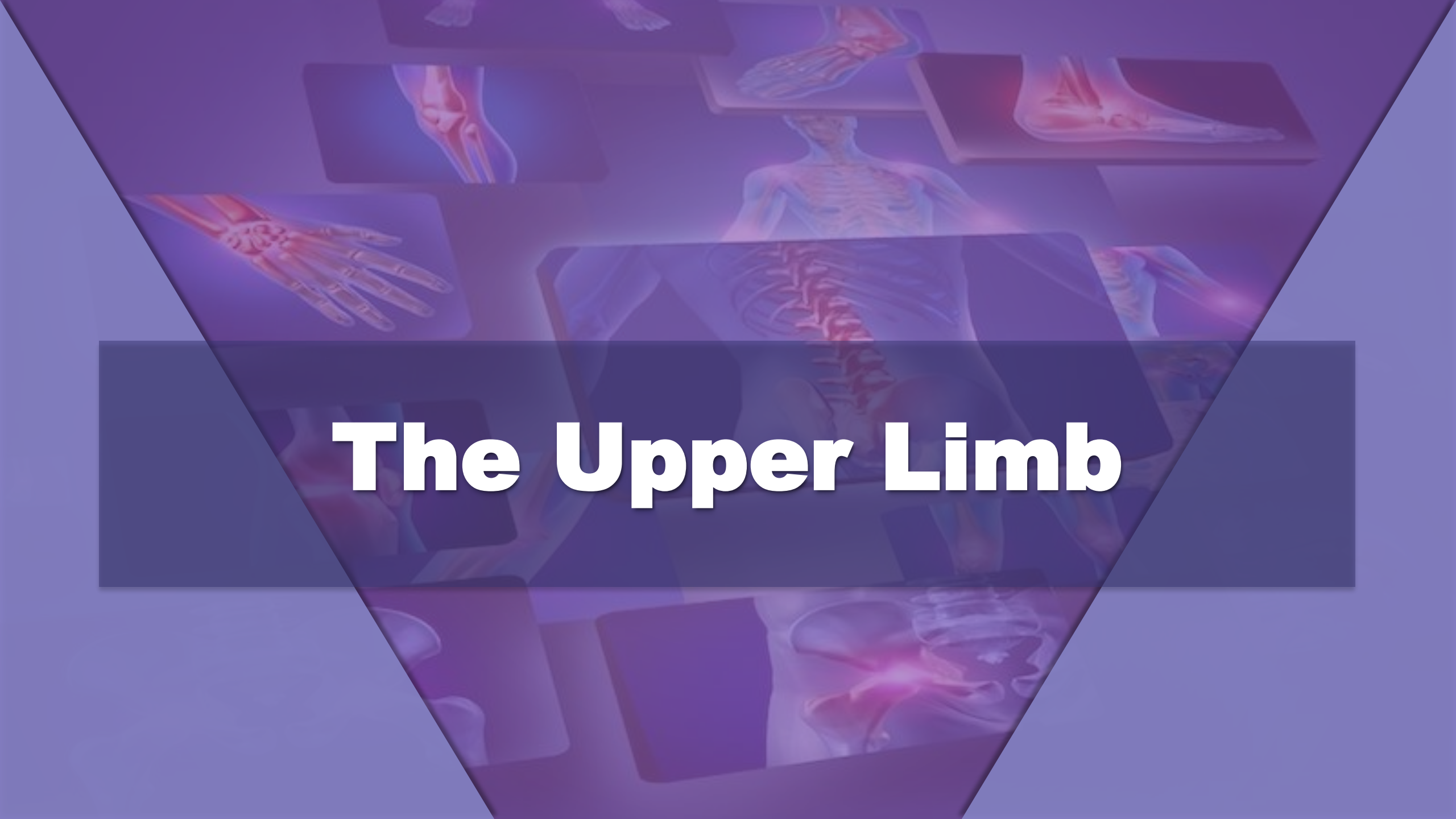
Scoliosis MCQ

- In a 19 years old female patient this was an incidental finding, she was diagnosed with idiopathic scoliosis, and she is complaining only of deformity

❖ **How is it managed ?**

a. Conservative without follow up
b. Bracing
c. Arthrodesis
d. Complete spine MRI
e. Conservative + follow up every 6 months for the second two years

As the patient is 19Y/O and there is no complications there is no need for surgery, BUT she must be followed up until the complete ossification of the iliac crest apophysis (Risser's staging) which occur at age of 21 and thus we follow her for the following 2 years every 6 months



The Upper Limb

Brachial plexus

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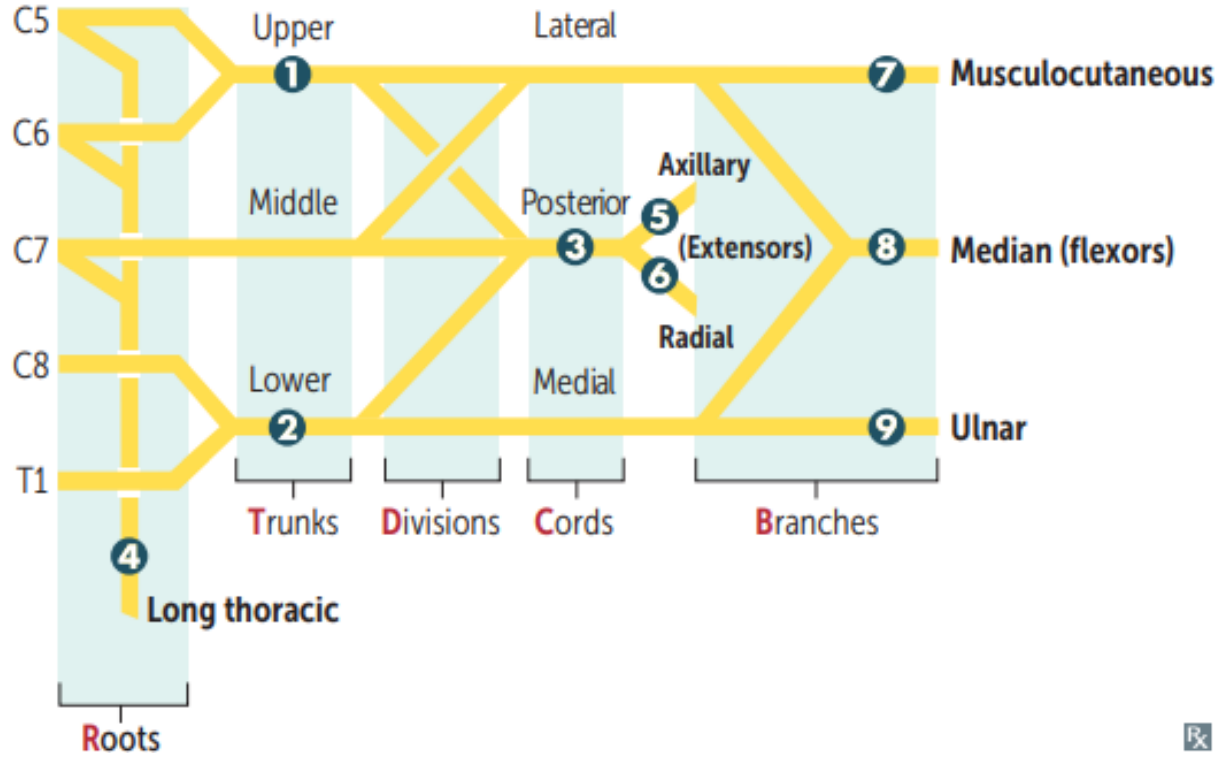
Brachial plexus

Brachial plexus lesions

1. Erb palsy ("waiter's tip")
2. Klumpke palsy (claw hand)
3. Wrist drop
4. Winged scapula
5. Deltoid paralysis
6. "Saturday night palsy" (wrist drop)
7. Difficulty flexing elbow, variable sensory loss
8. Decreased thumb function, "hand of benediction"
9. Intrinsic muscles of hand, claw hand



Divisions of brachial plexus:

Remember
To
Drink
Cold
Beer

Trunks of brachial plexus and the subclavian artery pass between anterior and middle scalene muscles. Subclavian vein passes anteromedial to the scalene triangle.

Nerves of the upper limb:

- Axillary, Musculocutaneous, Radial, Median, Ulnar

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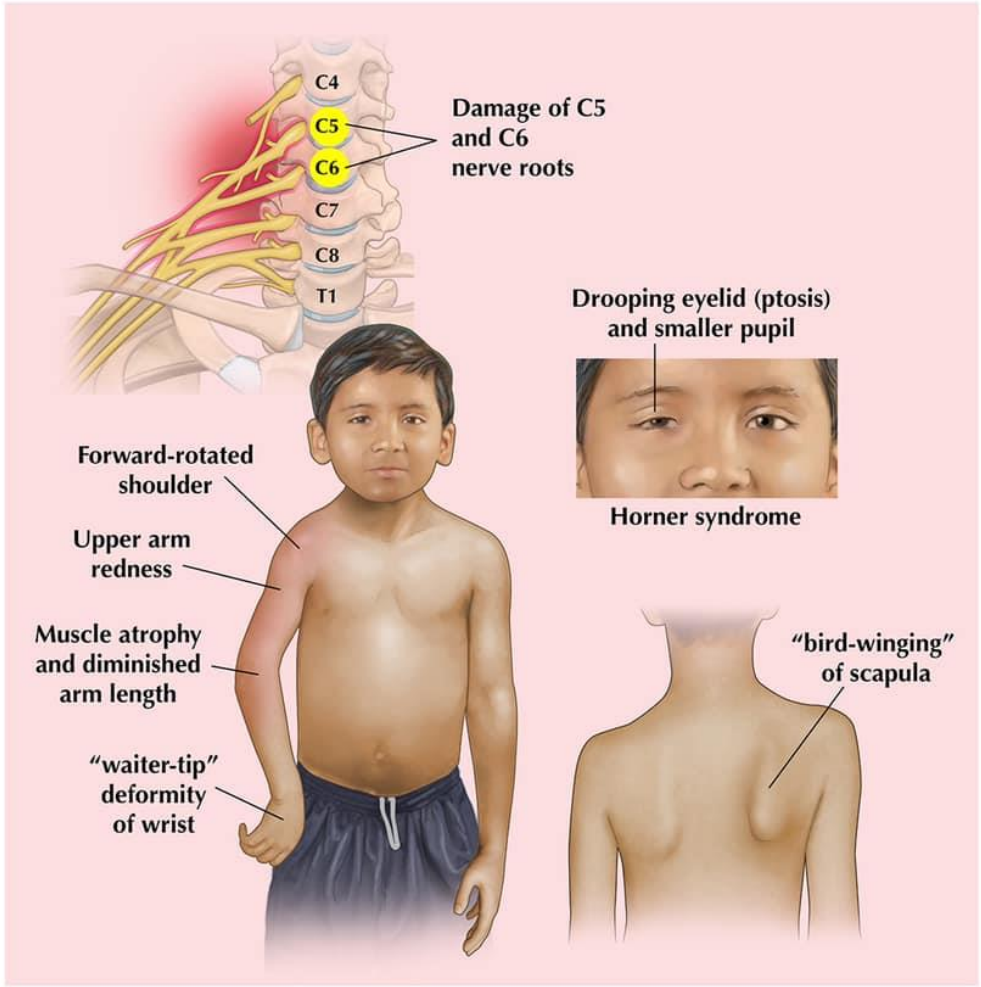
Brachial Plexus Lesion

CONDITION	INJURY	CAUSES	MUSCLE DEFICIT	FUNCTIONAL DEFICIT	PRESENTATION
Erb palsy ("waiter's tip")	Traction or tear of **upper** trunk: C5-C6 roots	Infants—lateral traction on neck during delivery Adults—trauma leading to neck traction (eg, falling on head and shoulder in motorcycle accident)	Deltoid, supraspinatus Infraspinatus, supraspinatus Biceps brachii Herb gets DIBs on tips	Abduction (arm hangs by side) Lateral rotation (arm medially rotated) Flexion, supination (arm extended and pronated)	
Klumpke palsy	Traction or tear of **lower** trunk: C8-T1 roots	Infants—upward force on arm during delivery Adults—trauma (eg, grabbing a tree branch to break a fall)	Intrinsic hand muscles: lumbricals, interossei, thenar, hypothenar	Claw hand: lumbricals normally flex MCP joints and extend DIP and PIP joints	
Thoracic outlet syndrome	Compression of **lower** trunk and subclavian vessels, most commonly within the scalene triangle	Cervical/ anomalous first ribs (arrows in A), Pancoast tumor	Same as Klumpke palsy	Atrophy of intrinsic hand muscles; ischemia, pain, and edema due to vascular compression	
Winged scapula	Lesion of long thoracic nerve, roots C5-C7 ("wings of heaven")	Axillary node dissection after mastectomy, stab wounds	Serratus anterior	Inability to anchor scapula to thoracic cage → cannot abduct arm above horizontal position B	

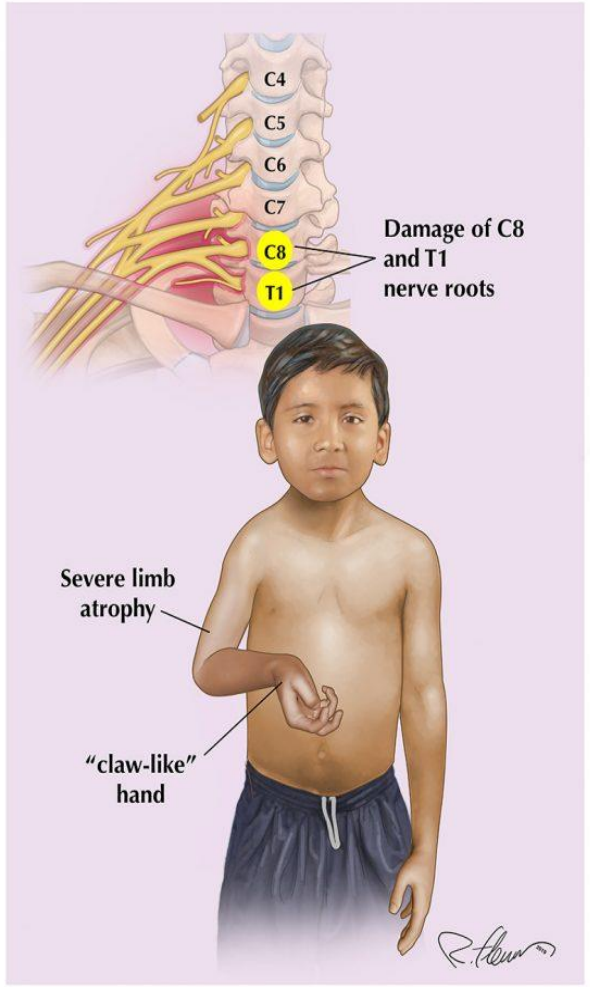
Obstetric brachial plexus injuries

- Caused by excessive traction on the brachial plexus (C5+C6+C7+C8+T1) during childbirth
- **Clinical features**:
  - Difficult delivery
  - Flail arm
- **Further examination reveals one of the following**:
  - Erb's palsy C5 and C6
  - Klumpke's palsy C8 and T1

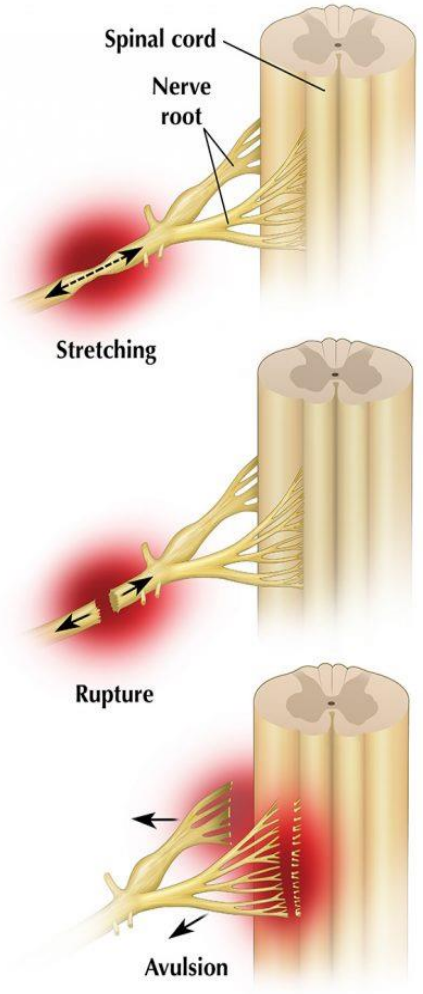
Obstetric brachial plexus injuries



Erb's palsy



Klumpke's palsy



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Upper extremity nerves

NERVE	CAUSES OF INJURY	PRESENTATION
Axillary (C5-C6)	Fractured surgical neck of humerus Anterior dislocation of humerus	Flattened deltoid Loss of arm abduction at shoulder (> 15°) Loss of sensation over deltoid and lateral arm
Musculocutaneous (C5-C7)	Upper trunk compression	↓ biceps (C5-6) reflex Loss of forearm flexion and supination Loss of sensation over radial and dorsal forearm
Radial (C5-T1)	Compression of axilla, eg, due to crutches or sleeping with arm over chair ("Saturday night palsy") Midshaft fracture of humerus Repetitive pronation/supination of forearm, eg, due to screwdriver use ("finger drop")	Injuries above the elbow cause loss of sensation over posterior arm/forearm and dorsal hand, wrist drop (loss of elbow, wrist, and finger extension) with ↓ grip strength (wrist extension necessary for maximal action of flexors) Injuries below the elbow cause distal paresthesias without wrist drop Tricep function and posterior arm sensation spared in midshaft fracture
Humerus fractures, proximally to distally, follow the **ARM** (**A**xillary → **R**adial → **M**edian) nerves		

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Upper extremity nerves

NERVE	CAUSES OF INJURY	PRESENTATION
Median (C5-T1)	Supracondylar fracture of humerus → proximal lesion of the nerve Carpal tunnel syndrome and wrist laceration → distal lesion of the nerve	"Ape hand" and "Hand of benediction" Loss of wrist flexion and function of the lateral two Lumbricals, Opponens pollicis, Abductor pollicis brevis, Flexor pollicis brevis (LOAF) Loss of sensation over thenar eminence and dorsal and palmar aspects of lateral 3 1/2 fingers with proximal lesion
Ulnar (C8-T1)	Fracture of medial epicondyle of humerus (proximal lesion) Fractured hook of hamate (distal lesion) from fall on outstretched hand Compression of nerve against hamate as the wrist rests on handlebar during cycling	"Ulnar claw" on digit extension Radial deviation of wrist upon flexion (proximal lesion) ↓ flexion of ulnar fingers, abduction and adduction of fingers (interossei), thumb adduction, actions of ulnar 2 lumbrical muscles Loss of sensation over ulnar 1 1/2 fingers including hypothenar eminence
Recurrent branch of median nerve (C5-T1)	Superficial laceration of palm	"Ape hand" Loss of thenar muscle group: opposition, abduction, and flexion of thumb No loss of sensation

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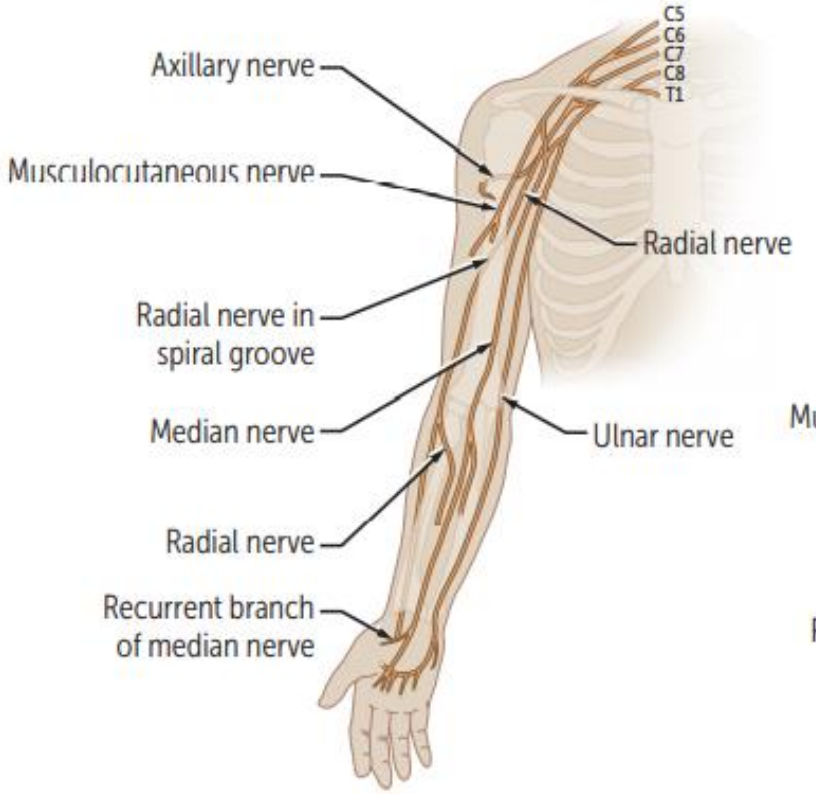
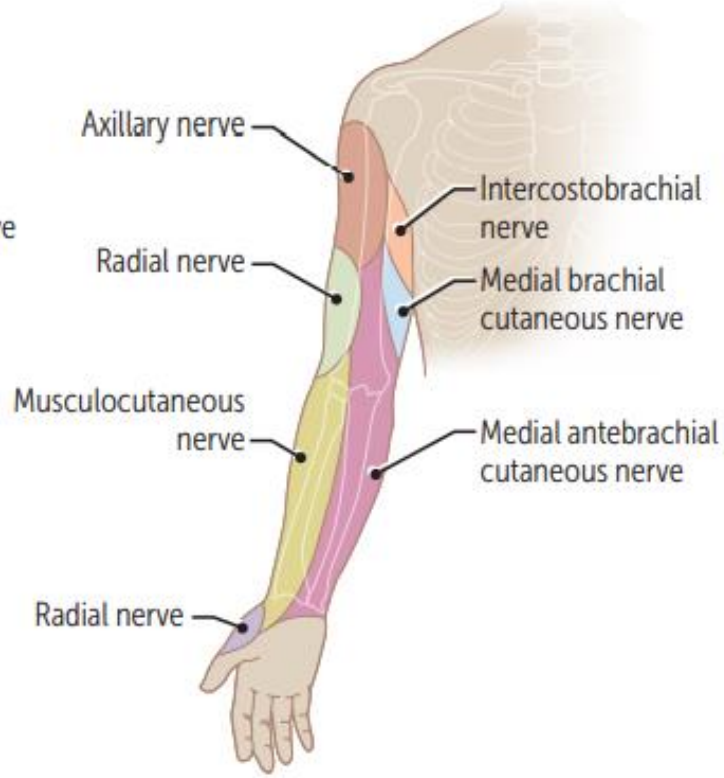
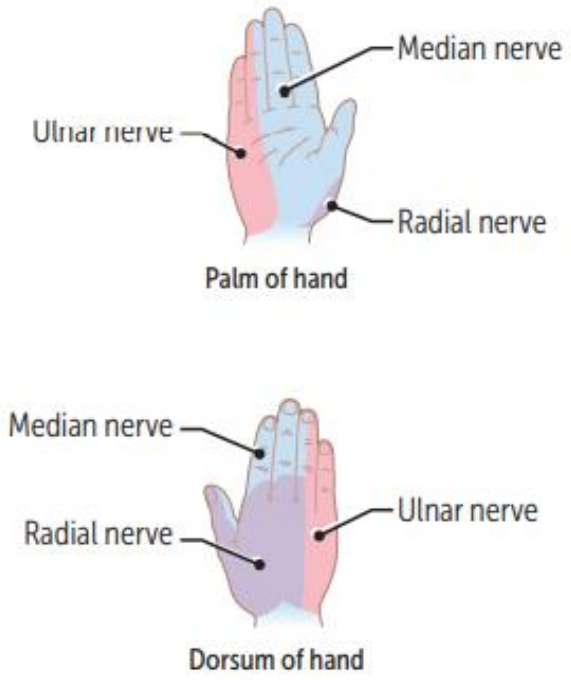
Upper extremity nerves







Musculocutaneous (C5-C7) nerve

❖**Which of the following is true about musculocutaneous nerve injury ?**

a. Loss of sensation on lateral arm
b. Loss of sensation on lateral forearm
c. Loss the ability to extend the elbow
d. Loss the ability to extend the wrist
e. Flattened deltoid

Radial (C5-T1) nerve

Site of lesion	Sensory symptoms	Motor symptoms
Axilla	• All below	• All below • Paralysis of the triceps muscle may occur if the radial nerve is injured in the axilla.

Mid-arm	• All below
	• Numbness, paresthesia, pain along lateral posterior arm (does not occur in midshaft humerus fracture)
		• All below
		• **Wrist drop**
		  ◦ Paralysis or weakness of the hand and finger extensors, which results in decreased grip strength (wrist extension ensures the optimal action of finger flexors)
		  ◦ The patient cannot extend their hand at the wrist joint.

Elbow (radial tunnel)	• Pain and tenderness following extension or repetitive pronation/supination [1]	• Sometimes weakness of extension and supination, secondary to pain (not to missing innervation!)
Deep forearm (proximal posterior interosseous nerve)	• None [2]	• Paralysis of the finger extensors (no true wrist drop)
Superficial forearm and wrist (superficial radial nerve)	• Deficits on the radial side of the dorsum of the hand (thumb, index finger, and the radial half of the middle finger) [3]	• None

Radial (C5-T1) nerve

What is the injured nerve ?

a. Axillary nerve
b. Musculocutaneous nerve
c. Radial nerve
d. Median nerve
e. Ulnar nerve

- Radial nerve injury → Wrist drop + Fingers drop
- Anterior interosseous nerve injury → Fingers drop

Radial (C5-T1) nerve

- **This area is supplied by which nerve ?**
  a. Median nerve
  b. Lateral cutaneous nerve of the hand
  c. Superficial radial nerve
  d. Ulnar nerve
  e. Musculocutaneous nerve

Radial (C5-T1) nerve

❖**What is the injured nerve ?**

a. Anterior interosseus nerve
b. Posterior interosseus nerve
c. Lateral cutaneous nerve of the hand
d. Superficial radial nerve
e. Musculocutaneous nerve

A 58-year-old man with absence of independent extension of right index finger and thumb prior to surgical decompression of the posterior interosseous nerve from lipoma

Median (C5-T1) nerve

Clinical features of median nerve lesions

Location of lesion	Motor deficit	Sensory deficit

Proximal (above anterior interosseous nerve origin)	• Hand of benediction: when asked to make a fist, the patient can only flex the ring finger and the little finger due to
	  ◦ Loss of thumb **opposition** and **abduction**
	  ◦ Loss of index and middle finger **flexion**
	• Impaired wrist **pronation** and **flexion**
	• Thenar muscle atrophy (**chronic injury**)
		• Thumb
		• Index and middle finger
		• Radial side of ring finger

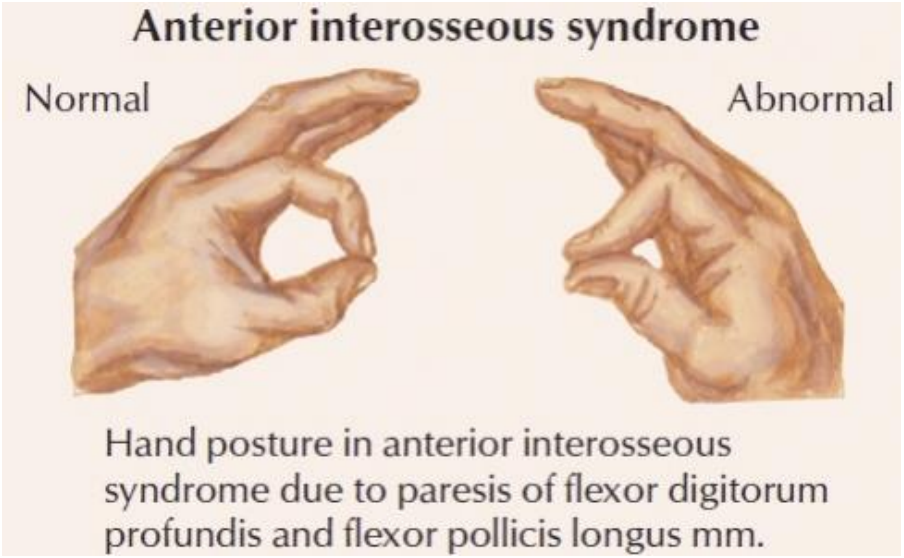
Distal (affecting anterior interosseous nerve)	• **Anterior interosseous nerve syndrome**: loss of flexion in distal joints of the thumb and index finger, leading to an inability to pinch small objects (**pinch sign**) or form the "OK sign"	• None

Distal (below anterior interosseous nerve origin)	• **Recurrent branch of median nerve**
	  ◦ Innervates muscles of the thenar eminence
	  ◦ Damaged with lacerations of the radial-sided wrist and proximal palm
	  ◦ Results in loss of thumb flexion, opposition, and abduction without sensory or other motor deficits
	• **Median claw**: Distal median nerve injury causes palsy of the lumbricals I and II with preserved function of extrinsic flexors. This imbalance leads to permanent flexion of the index finger and the middle finger (aggravated when trying to extend the fingers).
	• **Ape hand**: inability to oppose and abduct the thumb due to injury of the proximal or distal median nerves impairing the thenar muscles' functions
	• **Palmar cutaneous nerve**
	  ◦ Purely sensory nerve arising from median nerve proximal to the carpal tunnel
	  ◦ Provides sensation to the palm
		• Thumb
		• Index and middle finger
		• Radial side of ring finger

Distal (within wrist)	• **Carpal tunnel syndrome**
	  ◦ Mild impairment of flexion of index finger, long finger, and thumb (less severe than in other median nerve lesions)
	  ◦ Thenar muscle atrophy (in **chronic injury**)	

Median (C5-T1) nerve

- **To examine what nerve ?**
  - Anterior interosseous nerve
- **In which fracture it could be injured ?**
  - Medial supracondylar



Hand posture in anterior interosseous syndrome due to paresis of flexor digitorum profundis and flexor pollicis longus mm.

Median (C5-T1) nerve

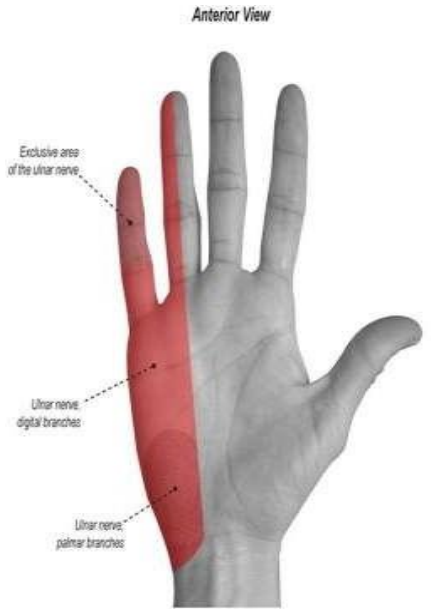
- **Describe what you see**
  - Ape hand
- **What is the affected nerve ?**
  - Distal median nerve injury

- **Ape hand**: inability to oppose and abduct the thumb due to injury of the proximal or distal median nerves impairing the thenar muscles' functions

Ulnar (C8-T1) nerve

This area is supplied by which nerve ?

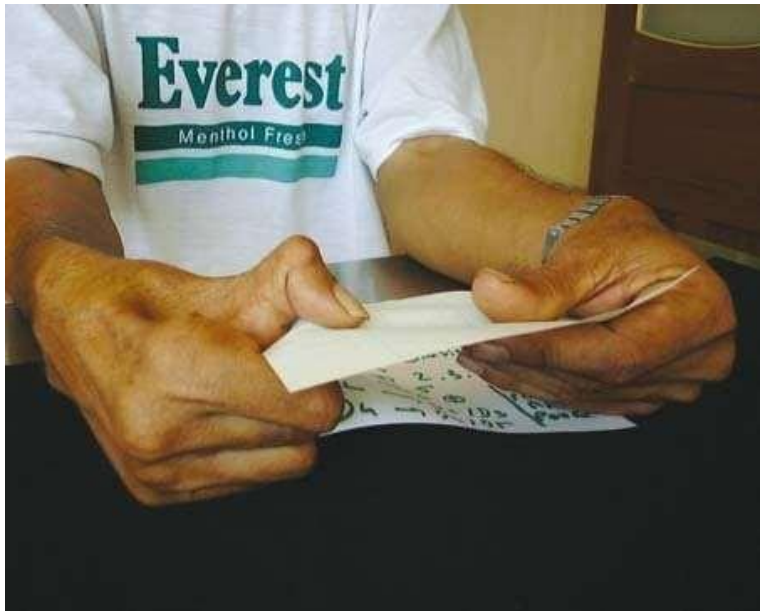
a. Median nerve
b. Lateral cutaneous nerve of the hand
c. Superficial radial nerve
d. Ulnar nerve
e. Musculocutaneous nerve

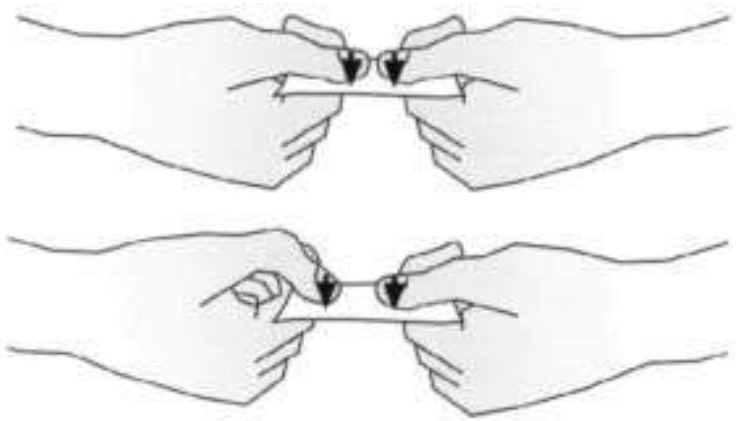


Ulnar (C8-T1) nerve

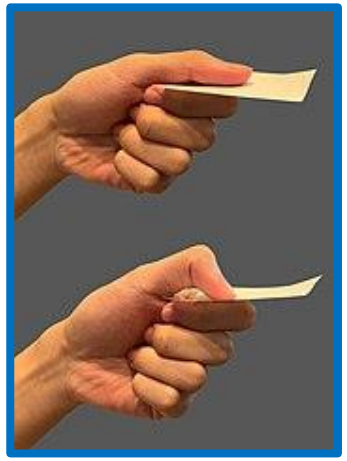
❖**This test used to test what muscle ?**

a. Median nerve
b. Ulnar nerve
c. Radial nerve
d. Lateral cutaneous nerve of the hand
e. Superficial radial nerve





- Positive Froment's sign (a special test of the wrist for palsy of the ulnar nerve, specifically, the action of adductor pollicis)



Claw hand

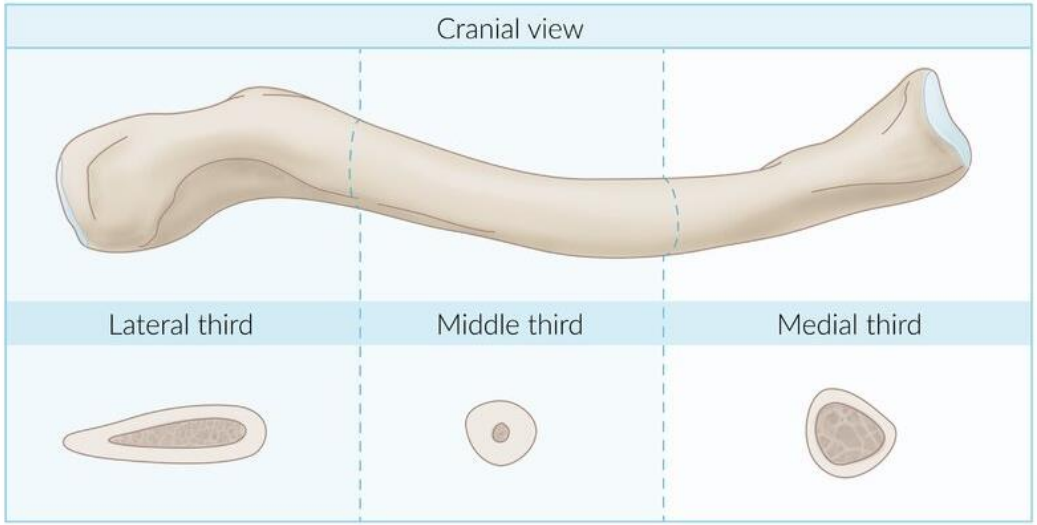
- **What is the name of this deformity ?**
  - Ulnar claw hand
- **What is the nerve affected ?**
  - Ulnar nerve

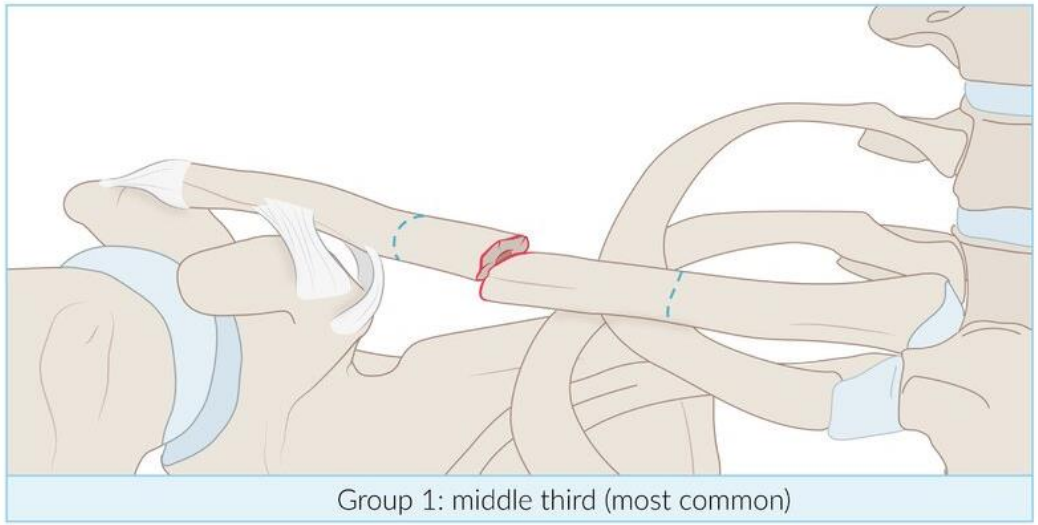
Clavicle & Scapula

Clavicle fracture

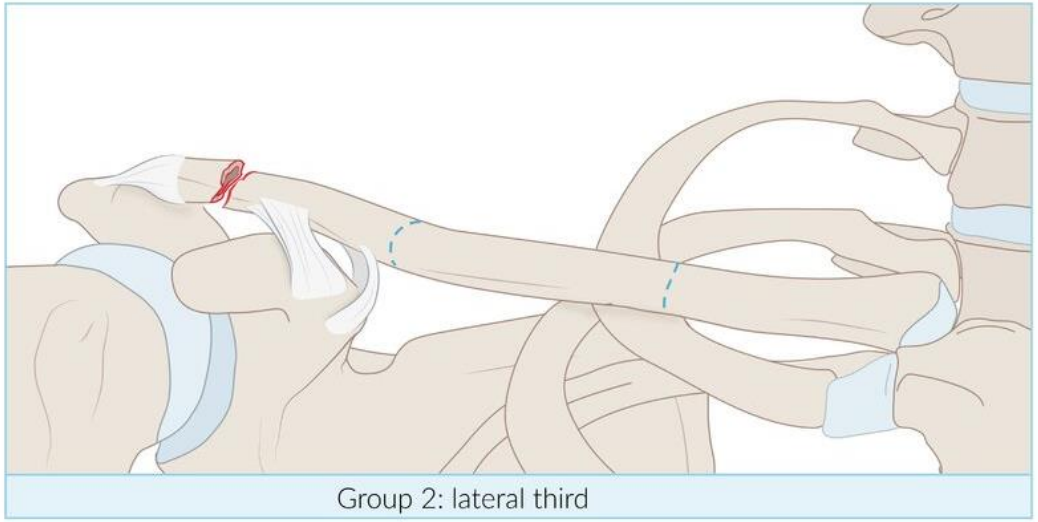
- **Epidemiology**: Most commonly occurs in children and adolescents
- **Mechanism of injury**:
  - **Direct trauma (95%)**
    - Fall onto the shoulder, lateral compression; most common cause
    - Direct blow to the clavicle; comminuted fracture
  - **Indirect trauma (5%)**: mainly falls onto an outstretched hand
- **Classification**: Allman classification system
  - **Group I**: Midshaft fracture/middle third (Most common site of fracture)
    - because it's the weakest point; not protected by muscles and thin bone cortex
  - **Group II**: Lateral/distal third
  - **Group III**: Medial/proximal third (Rare)
    - Fractures in this area occur infrequently because of surrounding muscles and ligaments that protect the clavicle. Thus, this fracture raise suspicion of accompanying injuries

Allman classification system

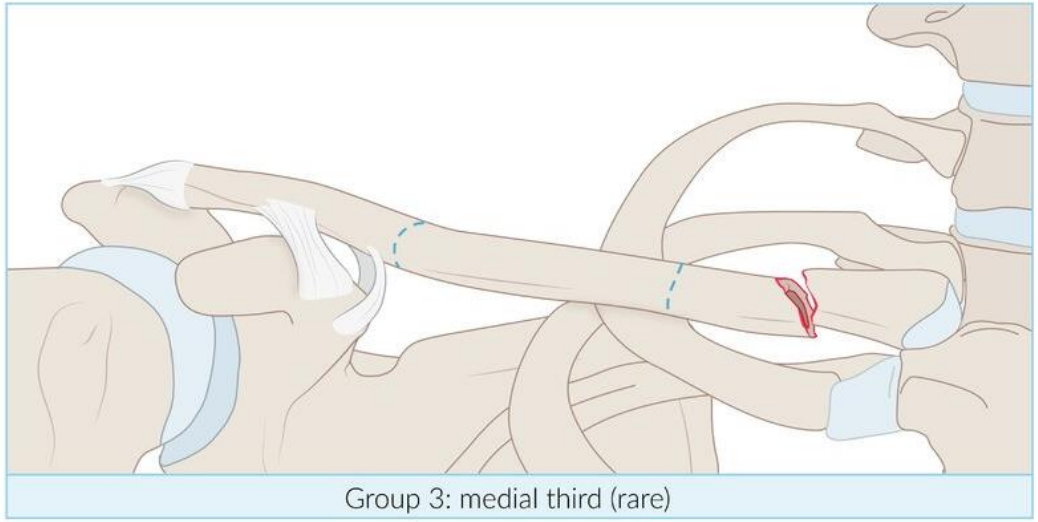




Group 1: middle third (most common)



Group 2: lateral third



Group 3: medial third (rare)

Diagnostics

❖ Physical examination

- Assess for neurovascular compromise and compartment syndrome
  - Weak pulses: possible injury of the subclavian artery
  - Dysfunction of a distal nerve: possible injury of the brachial plexus
  - Massive swelling and discoloration: possible injury of the subclavian vein

❖ Imaging

- **Best initial test**: x-ray in 2 views (Upright anteroposterior view, 45° cephalic tilt view)
  - Why upright AP ? Gravity effect will lead to better view of deformity
- CT/MRI when associated injuries are suspected or x-ray findings are inconclusive

Physical examination

Management

- **Midshaft (group I) fractures**
  - Mostly conservative treatment (e.g., simple shoulder sling) for 4–6 weeks
  - Exception: excessively shortened or displaced fractures (require surgery)
- **Lateral (group II) fractures**
  - Stable fractures: conservative treatment (e.g., simple shoulder sling)
  - Unstable fractures
    - Surgical fixation (e.g., tension banding, clavicular plate) is typically indicated
    - If needed, ligament repair
- **Medial (group III) fractures**
  - Conservative treatment (similar to group I fractures)
  - Displacement is uncommon due to strong ligamentous attachments.

Why do we use shoulder sling in clavicle fractures ?

- To override the upper limb weight from the clavicle to the cervical spine

Hx: Falling on outstretched hand (FOOSH)

سنوات (1)

❖ Diagnosis

- Clavicle fracture

سنوات (1)

❖ What is the muscle that exerts action on the medial side of the fractured bone?

a. Sternocleidomastoid
b. Trapezius
c. Deltoid muscles

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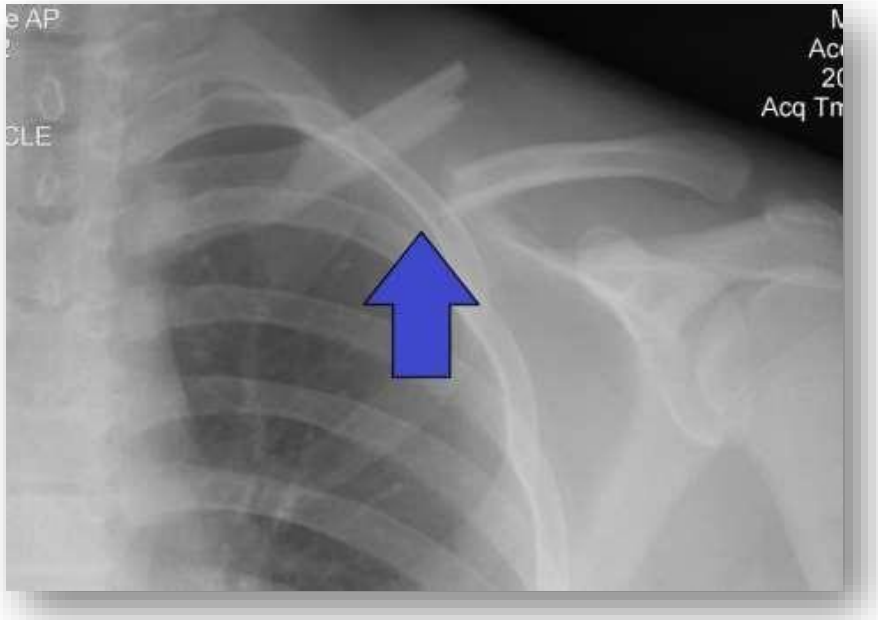


Muscle attachments

Lateral one-third: trapezius and deltoid muscles

Medial two-thirds: sternocleidomastoid, pectoralis major, and subclavius muscles

What is your diagnosis ?

a. Sternoclavicular joint dislocation
b. Medial fracture
c. Midshaft fracture
d. Lateral fracture
e. Acromioclavicular joint dislocation

Scapula pathologies

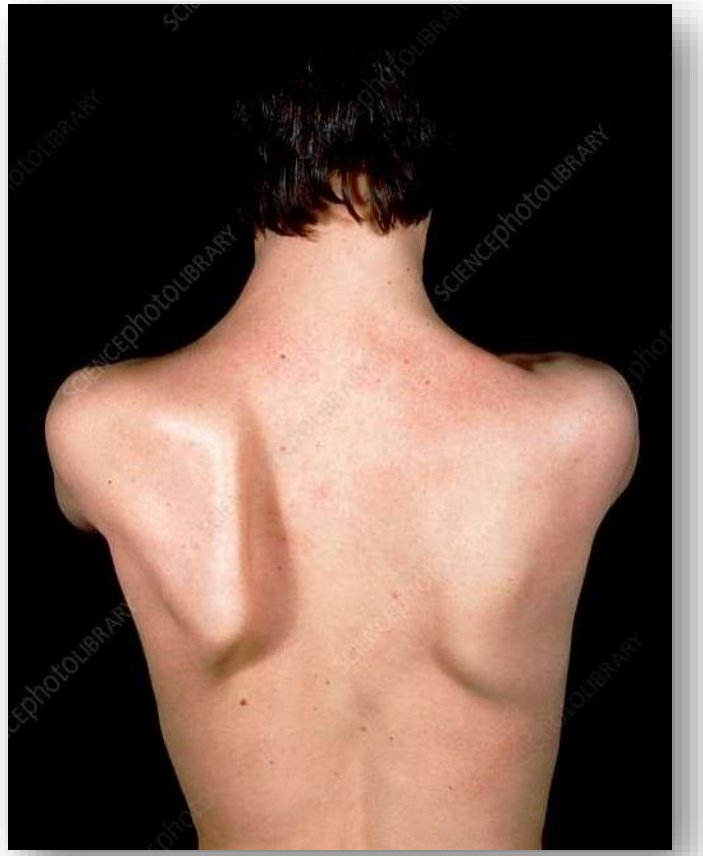
1. **Winged scapula**
   - Medial winging from disruption to Long thoracic nerve ⟶ Serratus anterior
   - Lateral winging from disruption to
     - Spinal accessory ⟶ Trapezius
     - Dorsal scapular ⟶ Rhomboids
2. **Scapula fractures**
   - Uncommon; the scapula is protected by muscles and thoracic cage
   - Scapular fracture indicates major trauma (multi-traumatic patients)

Winged Scapula

- **What is this deformity ?**
  - Lateral winging of scapula
- **What is the name of the affected muscle ?**
  - Trapezius muscle
- **What is the name of the affected nerve ?**
  - Spinal accessory

Winged Scapula

- **What is this deformity ?**
  - Medial winging of scapula
- **What is the name of the affected muscle ?**
  - Serratus anterior
- **What is the name of the affected nerve ?**
  - Long thoracic nerve



Shoulder

Shoulder motion

- **The shoulder consist of 4 joints**
  - Scapulothoracic
  - Acromioclavicular
  - Sternoclavicular
  - Glenohumeral
- **Normal shoulder motion**
  - 2/3 of normal shoulder abduction comes from the glenohumeral joint
  - 1/3 of shoulder abduction comes from scapulothoracic joint
- **Problems of motion**: Active Vs Passive
  - If passive = active
    - The problem is usually of the static components if the joint
    - E.g., Arthritis, Adhesive capsulitis, Locked joint
  - If passive > active
    - The problem is dynamic or patient is in pain

Shoulder's x-ray of a rheumatoid arthritis patient

a. Passive motion is greater than active
b. Passive motion is equal to active
c. Active motion is greater than passive

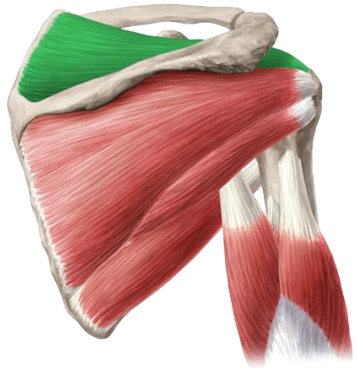
Shoulder stability

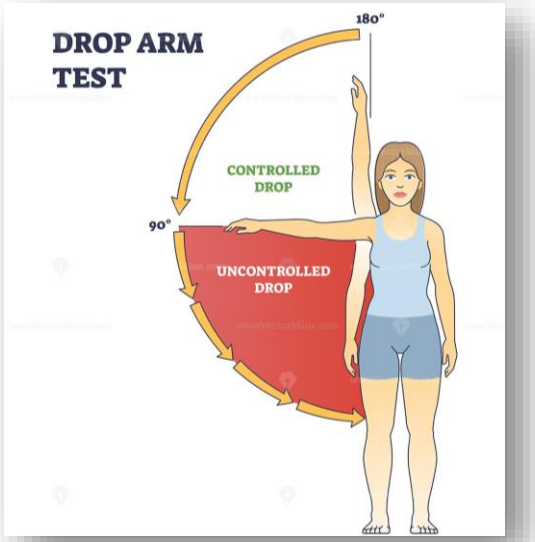
- **Static Stabilizers (Non-Contractile)**
  - Bone
  - Labrum (Deepen the joint, Muslces and ligaments attachment)
  - Capsule (Negative pressure)
  - Ligaments
- **Dynamic Stabilizers (Contractile)**
  - Rotator cuffs (Supraspinatus, Infraspinatus, Subscapularis, Teres minor)
  - Superficial muscles (Deltoid, Pectoralis Major, Latissmus dorsi, Biceps, Serratous anterior, Trapezius)

Supraspinatus

❖Anatomy

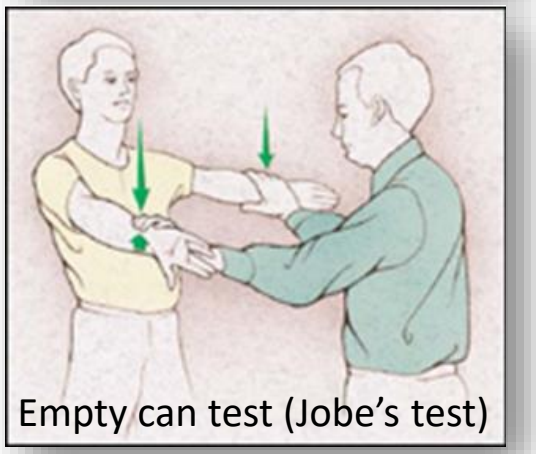
- Origin: Supraspinous fossa of scapula
- Insertion: Greater tuberosity of humerus; capsule of shoulder joint
- Nerve Supply: Suprascapular nerve
- Action: Abducts arm and stabilizes shoulder joint





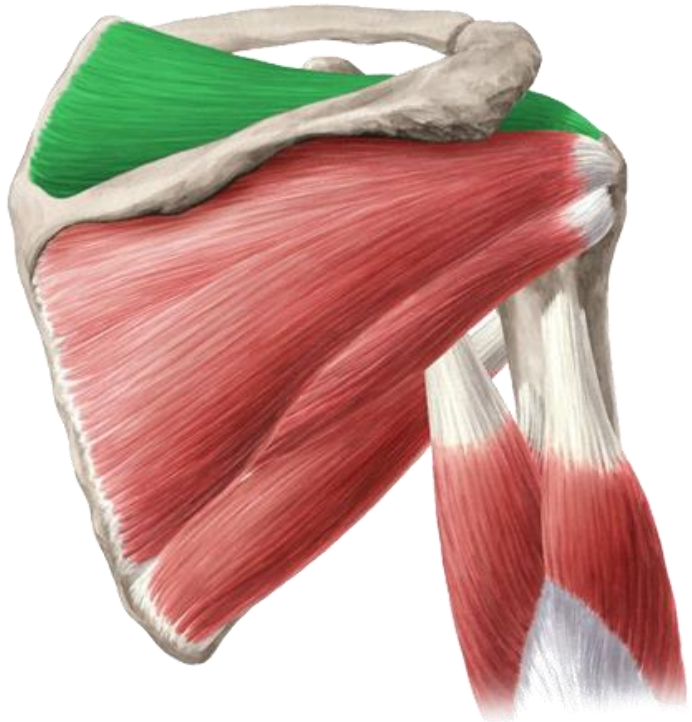
❖Examination

- Subacromial space tenderness
- Drop arm test; indicates complete tear
- Empty can test (Jobe's test); positive if there was shoulder pain or muscle weakness


Empty can test (Jobe's test)

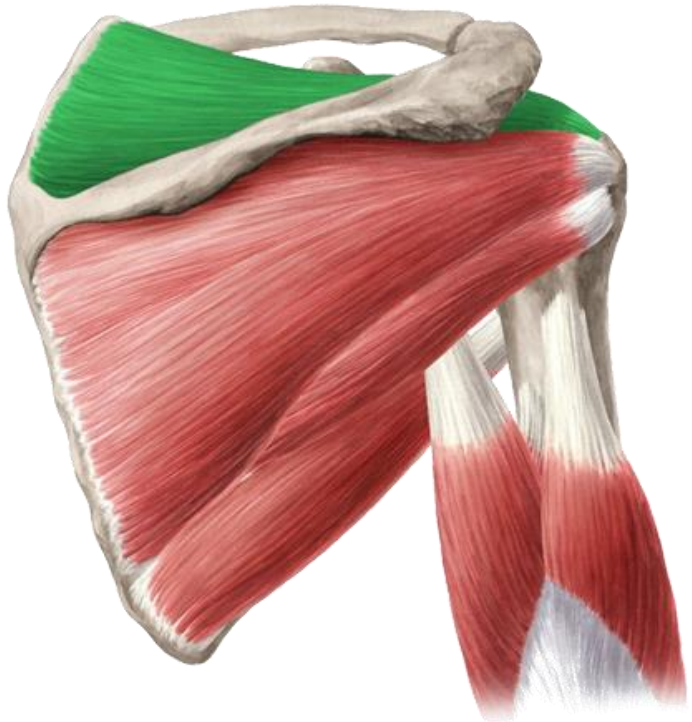
Supraspinatus

- **Name of the muscle**:
  - Supraspinatus muscle
- **Insertion**:
  - Greater tubercle
- **Action**:
  - Abduction 0-30



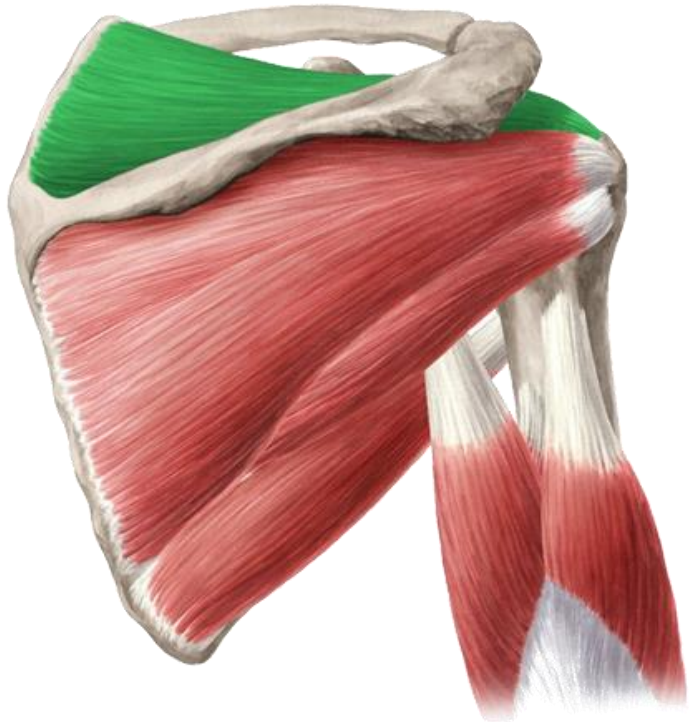
Special Test used for this muscle

a. Empty bear can test , Drop arm test
b. Lift-off Test , Drop arm test
c. Yergason's Test , Speed's Test



The main function of this muscle

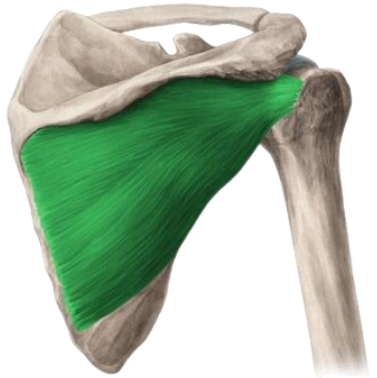
a. Flexion
b. Extension
c. Initiate Adduction
d. Initiate Abduction
e. Initiate Rotation



Infraspinatus

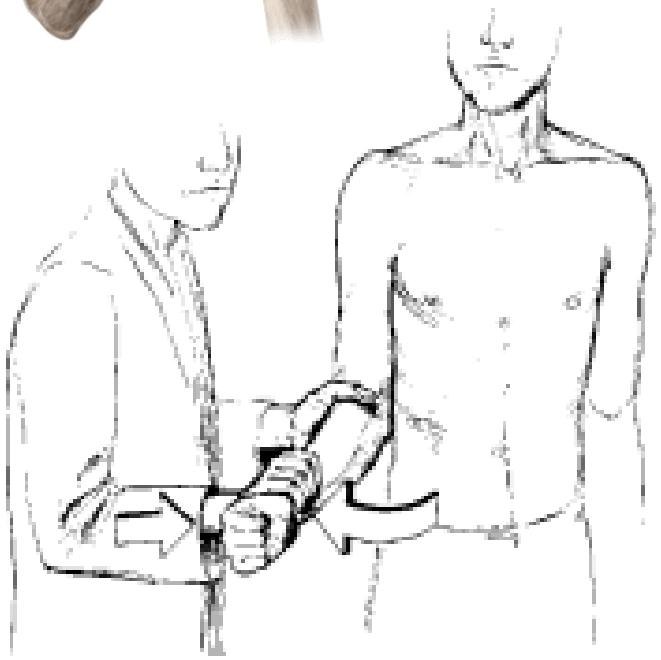
❖Anatomy

- Origin: Infraspinous fossa of scapula
- Insertion: Greater tuberosity of humerus; capsule of shoulder joint
- Nerve Supply: Suprascapular nerve
- Action: Laterally rotates arm during arm adduction



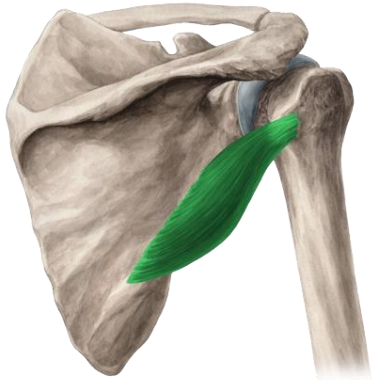
❖Examination

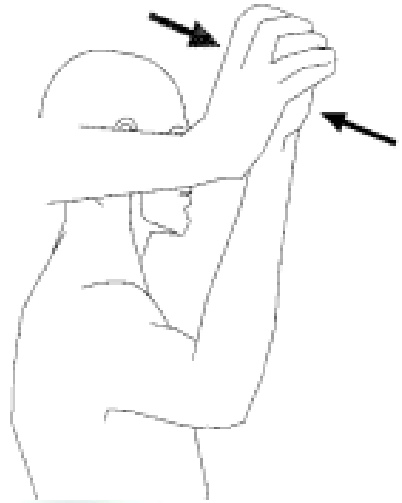
- Infraspinatus test
  - Decreased in angle between the arm and the abdomen indicates complete tear
  - Pain on resistance indicates incomplete tear or tendinitis



Teres Minor

- **Anatomy**
  - Origin: Upper two thirds of lateral border of scapula
  - Insertion: Greater tuberosity of humerus; capsule of shoulder joint
  - Nerve Supply: Axillary nerve
  - Action: Laterally rotates arm during abduction and stabilizes shoulder joint
- **Examination**
  - Hornblower sign; positive if pain or weakness





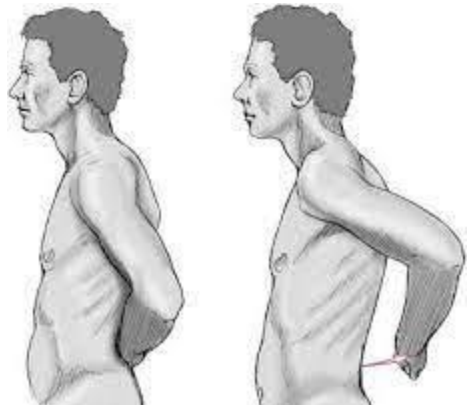
Subscapularis

❖Anatomy

- Origin: Subscapular fossa
- Insertion: Lesser tuberosity of humerus
- Nerve Supply: Upper and lower subscapular nerves
- Action: Medially rotates arm and stabilizes shoulder joint

❖Examination

- Lift off test
- Bear hug test
- Belly press test



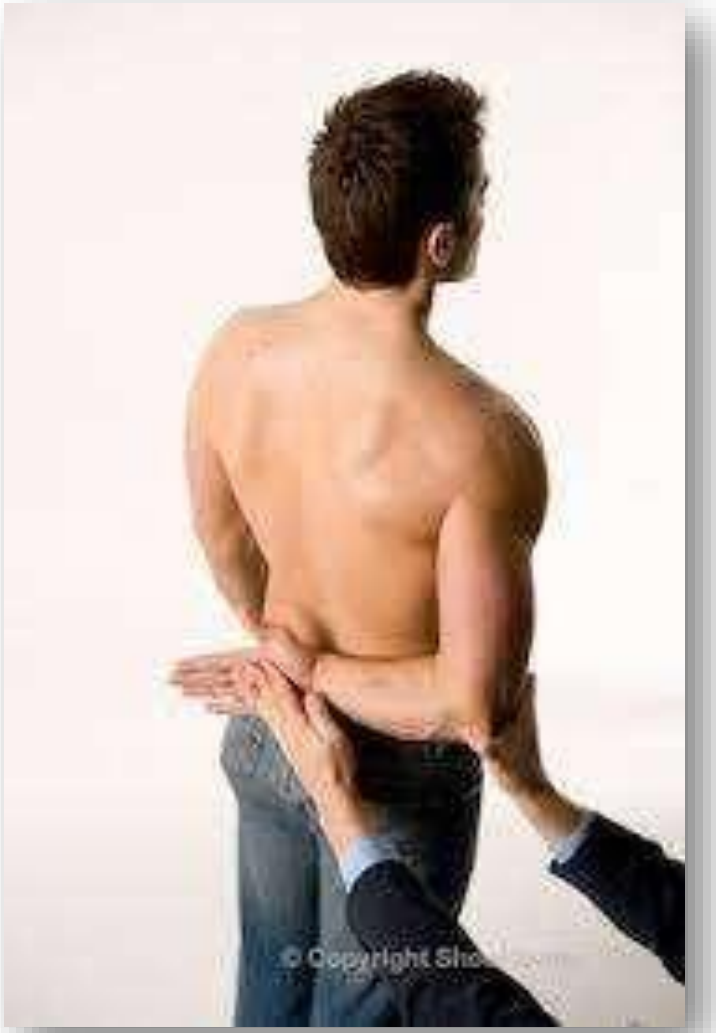
Lift off test

Bear hug test

Belly press test

Subscapularis

- **What is the name of this test ?**
  - Lift off test used for subscapularis muscle
- **Where is the insertion of the muscle doing this movement ?**
  - lesser tubercle
- **What is the action of this muscle ?**
  - internal rotation with adduction



The examined muscle

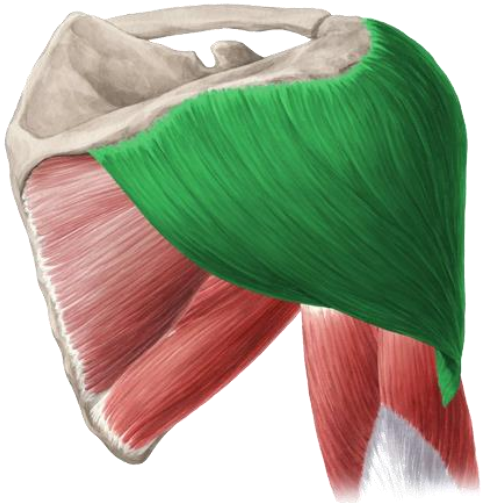
a. Supraspinatus
b. Infraspinatus
c. Subscapularis
d. Teres minor
e. Teres major

Function of the muscle which is examined by this test

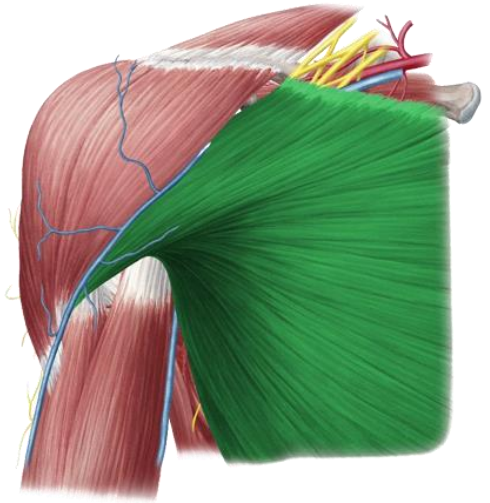
a. Internal rotation of the shoulder
b. External rotation of the shoulder
c. Abduction of the shoulder
d. Adduction of the shoulder
e. Flexion of the shoulder

Superficial Muscles

1. **Deltoid**
   - Origin: Lateral third of clavicle, acromion, spine of scapula
   - Insertion: Middle of lateral surface of shaft of humerus
   - Nerve Supply: Axillary nerve
   - Action: Abducts arm; anterior fibers flex and medially rotate
   - arm; posterior fibers extend and laterally rotate arm

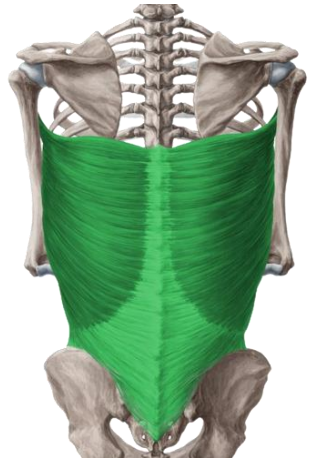


2. **Pectoralis major**
   - Origin: Clavicle, sternum, and upper six costal cartilages
   - Insertion: Lateral lip of bicipital groove of humerus
   - N. Supply: Medial and lateral pectoral nerves from brachial plexus
   - Action: Adducts arm and rotates it medially; clavicular fibers also flex arm



Superficial Muscles

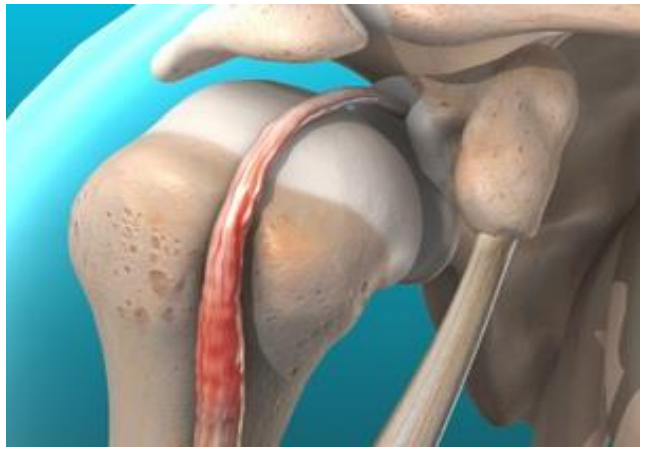
3. **Latissimus dorsi**
   - Origin: Iliac crest, lumbar fascia, spines of lower six thoracic vertebrae, lower three or four ribs, and inferior angle of scapula
   - Insertion: Floor of bicipital groove of humerus
   - N Supply: Thoracodorsal nerve
   - Action: Extends, adducts, and medially rotates the arm



4. **Biceps brachii**
   - Long head: Origin: Supraglenoid tubercle of scapula
   - Short head: Origin: Coracoid process of scapula
   - Insertion: Tuberosity of radius and bicipital aponeurosis into deep fascia of forearm
   - Nerve Supply: Musculocutaneous nerve
   - Action: Supinator of forearm and flexor of elbow joint; weak flexor of shoulder joint

Biceps brachii

- **Examination**
  - Yergason's test: Positive if pain in the bicipital groove
  - Speed's test: Positive if pain in the bicipital groove; indicates long head tendinitis



These 2 tests are used to examine

a. Subscapularis
b. Supraspinatus
c. Deltoid
d. Brachialis
e. Biceps muscle

Nerve supply to the muscle which examined by these test

a. Axillary nerve
b. Musculocutaneous nerve
c. Median nerve
d. Radial nerve
e. Ulnar nerve

This test is done for

a. Biceps tendonitis
b. Tennis elbow
c. Golfers elbow

Biceps brachii examination

- **What are these tests used for ?**
  - Used for examination of biceps muscle
- **What is true about the muscle tested by this tests ?**
  a. It has the same nerve supply of brachialis
  b.
  c.
  d.
  e.

Biceps tendon Rupture

- **Proximal biceps rupture**
  - Popeye sign
  - Treatment: conservative
  - Consider surgery in young people and for cosmetic reasons
- **Distal biceps rupture**
  - Treatment: Tendon repair

Distal biceps rupture

Proximal biceps rupture

Why the proximal rupture can be managed conservatively while the distal rupture always require surgery ?

- Proximally the biceps has 2 heads thus the rupture of 1 tendon is compensated by the other

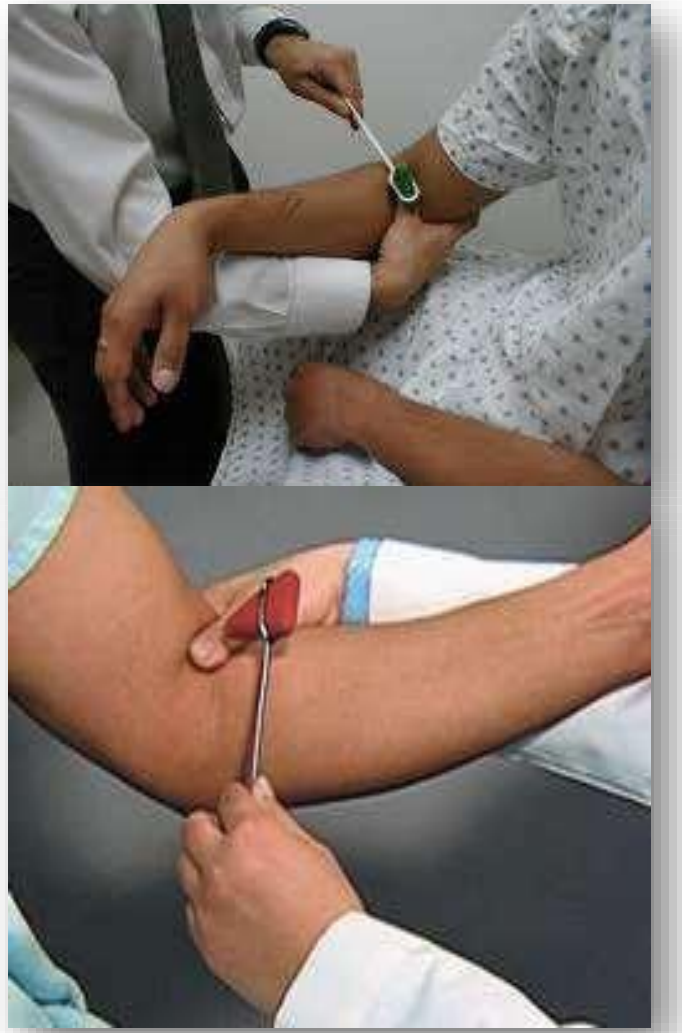
Function and nerve supply of this injured muscle

a. Extension of elbow, Axillary nerve
b. Extension of elbow, Musculocutaneous nerve
c. Flexion and supination of elbow, Musculocutaneous nerve
d. Flexion and supination of elbow, Axillary nerve
e. Extension of the wrist, Radial nerve

Biceps reflex

- **Herniation of which disc will cause this test to be negative ?**
  - C5-C6

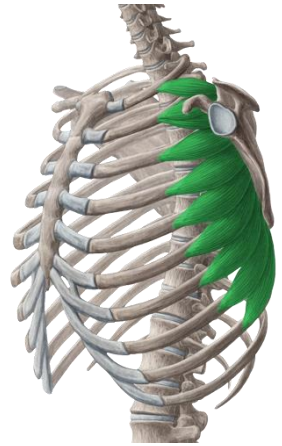
- **Note**: biceps reflex is controlled by C5 herniation of C5-C6 intervertebral disc would affect C5 (Any disc herniation affects the upper segment except for far lateral lumbar disc herniation affects the lower segment



Superficial Muscles

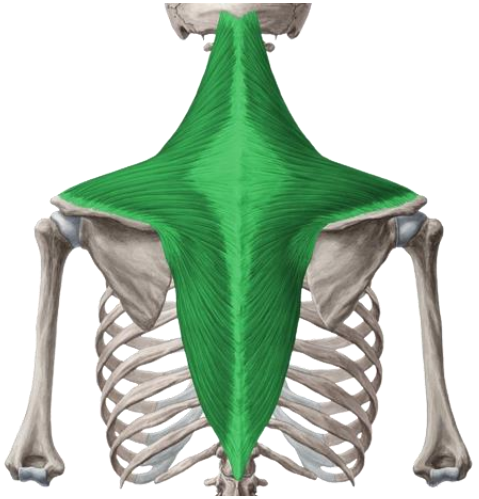
❖Serratus anterior

- Origin: Upper eight ribs
- Insertion: Medial border and inferior angle of scapula
- N Supply: Long thoracic nerve
- Action: Draws the forward anterior around the thoracic wall; rotates scapula



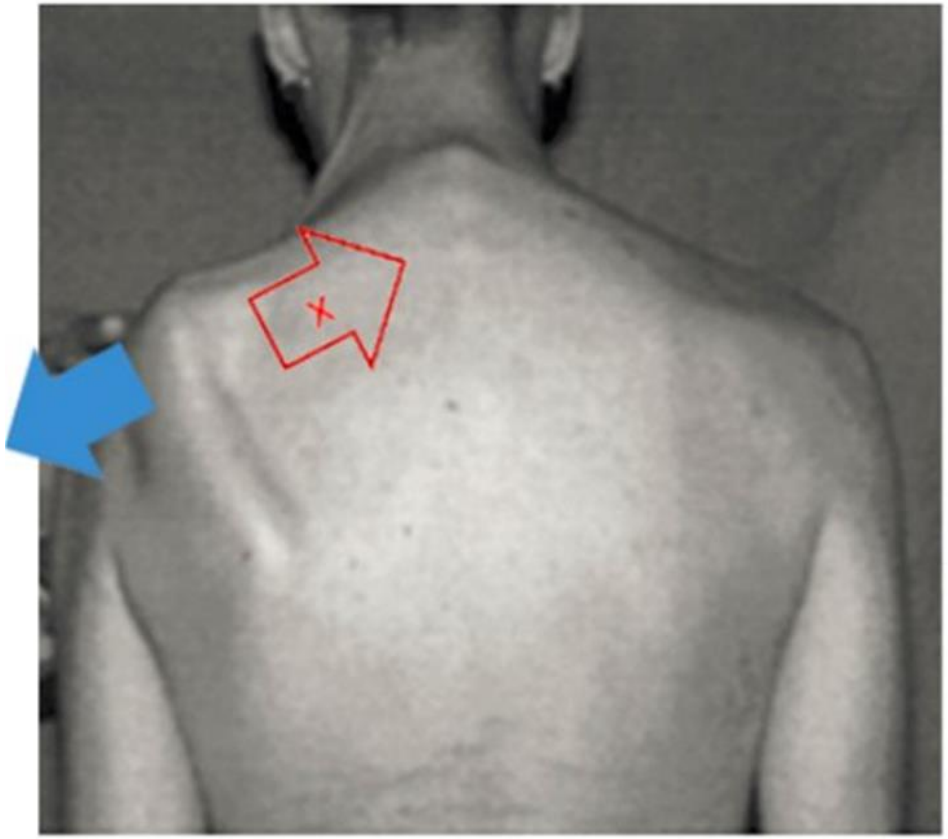
❖Trapezius

- Origin: Occipital bone, ligamentum nuchae, spine of 7th cervical vertebra, spines of all thoracic vertebrae
- Insertion: Upper fibers into lateral third of clavicle; middle and lower fibers into acromion and spine of scapula
- N Supply: Spinal part of accessory nerve (motor) and C3 and 4 (sensory)
- Action: Upper fibers elevate the scapula; middle fibers pull scapula medially; lower fibers pull medial border of scapula downward



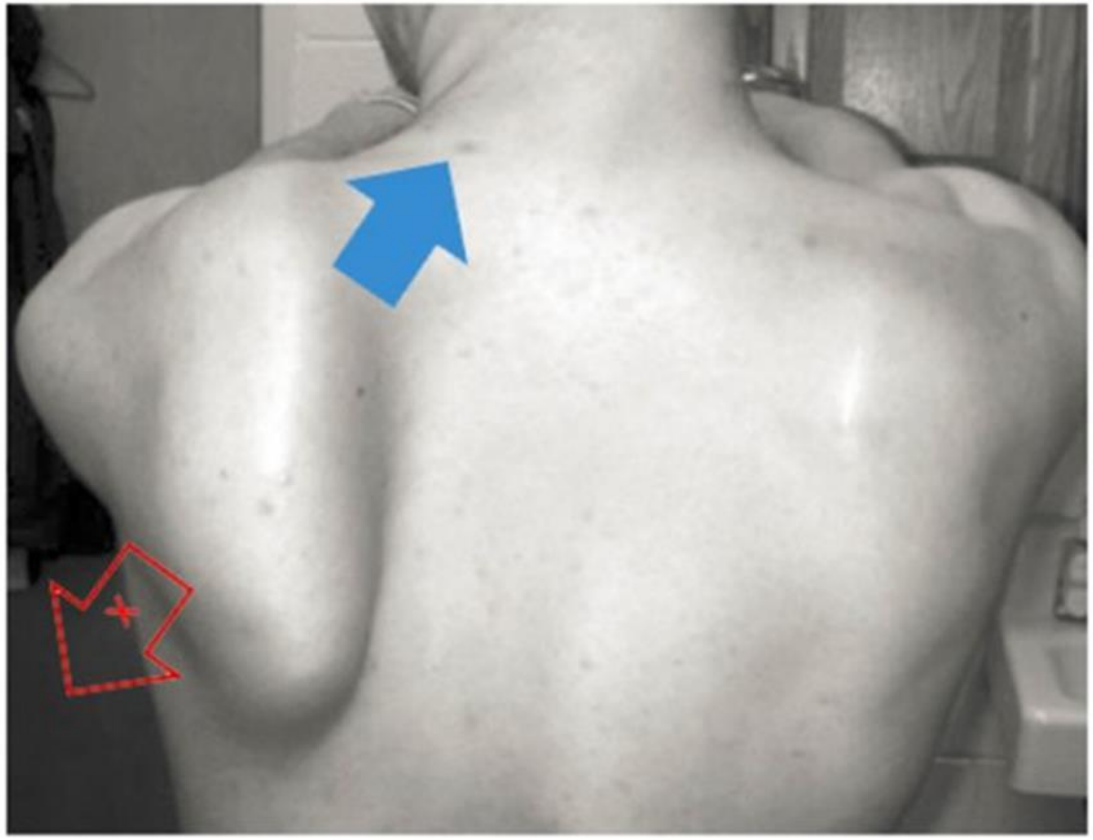
Scapula winging

Lateral Scapular Winging



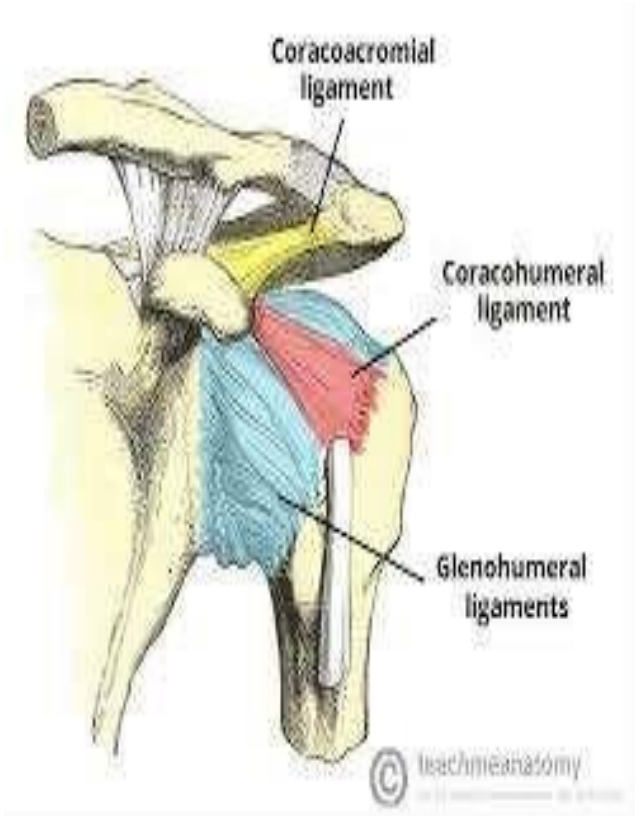
Absent pull of trapezius due to Spinal Assessory Nerve palsy

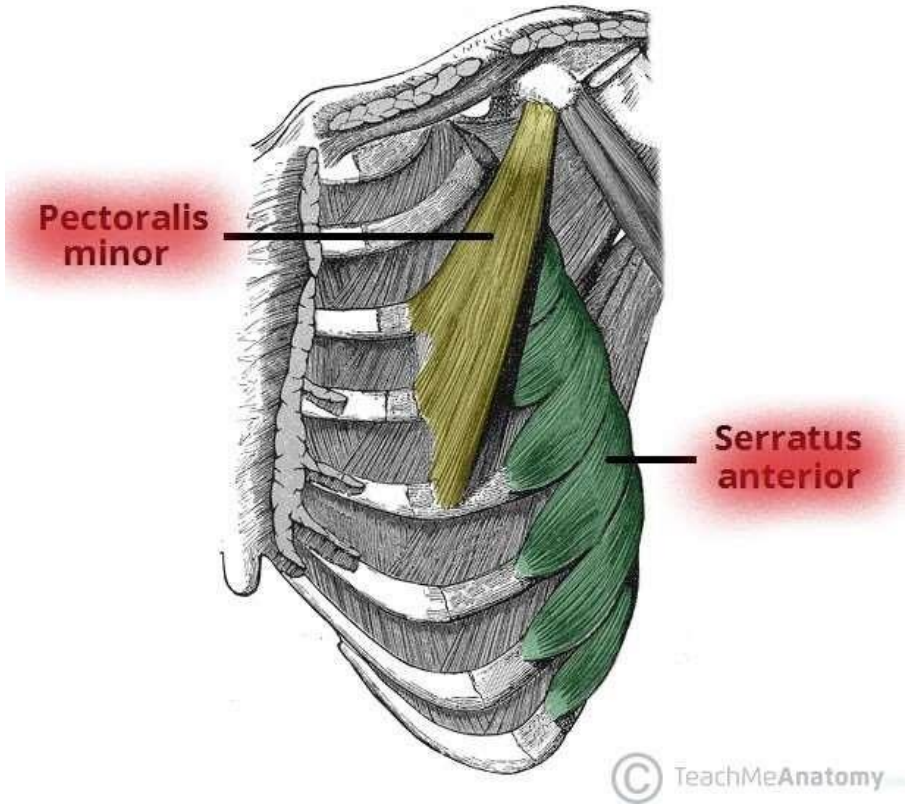
Medial Scapular Winging

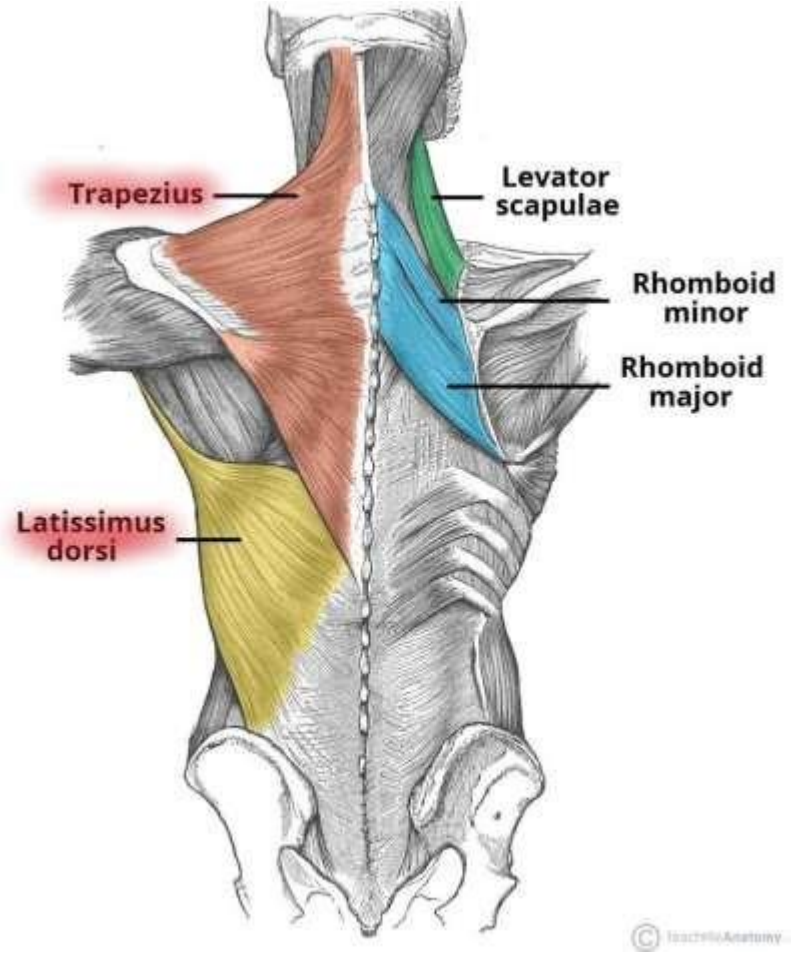


Absent pull of serratus anterior due to Long Thoracic Nerve palsy

Identify the marked muscles

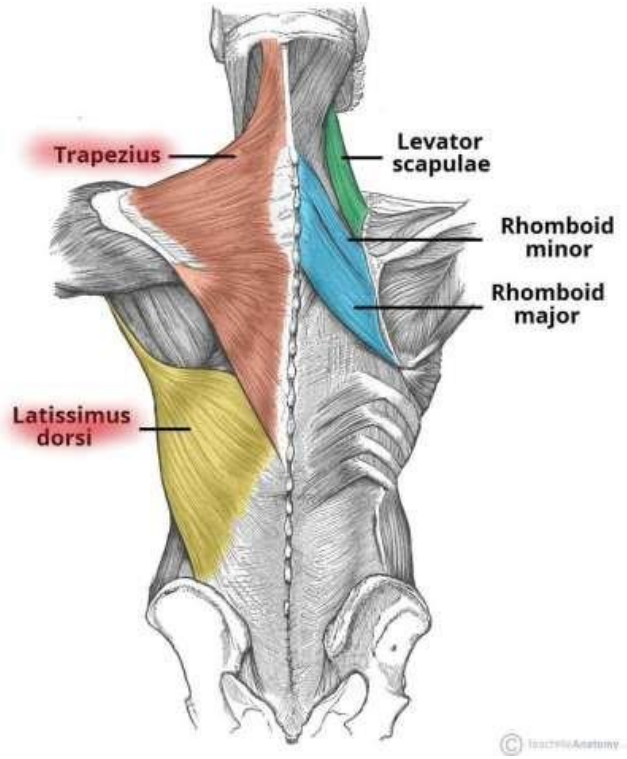






Which nerve supplies the blue muscle ?

a. Axillary nerve
b. Dorsal scapular nerve
c. Long thoracic nerve
d. Spinal accessory nerve
e. Suprascapular nerve

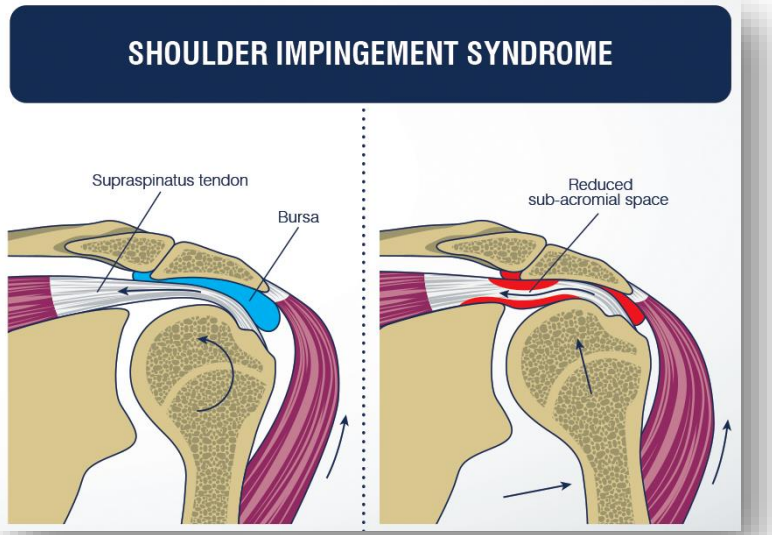


Calcific tendinitis

- **Pathophysiology**
  - Deposition of calcium hydroxyapatite crystals within the rotator cuff tendons esp. supraspinatus
- **Clinical features**
  - Disabling pain
  - Decrease in ROM
- **Management**
  - Activity modification
  - NSAID
  - ECSW
  - Steroid Injection
  - Surgery

Rotator Cuff Impingement

- **Pathophysiology**: structural narrowing in the subacromial space
- **Clinical features**
  - Patients often report painful elevation and depression of the arm between 70° and 120° (painful arch), pain on forced movement above the head, and pain when lying on the affected shoulder
- **Examination**
  - Neer's test
  - Hawkin's test
- **Management**
  - Rest and activity modification, NSAID, Physiotherapy, Injections, Surgery (Rare)



Neer's test

Hawkin's test

Rotator cuff tendinitis

- **Pathophysiology**: Tendinitis → Edema → Thickened tendon → Impingement → Tear → Edema → Impingement
- **Clinical features**
  - Pain over the anterolateral part of the shoulder that is exacerbated by overhead activities.
  - Night pain is a frequent symptom, especially when the patient lies on the affected shoulder
  - Weakness and loss of shoulder motion
- **Management**
  - Stop the activity, Ice, Anti-inflammatory drugs, Light exercise and physiotherapy, Injections, Surgery

Rotator cuff tear

❖ Etiology

- Chronic degenerative tear is seen in individuals aged > 50 years.
- Acute injury is seen mostly in athletes (e.g., infraspinatus tear in baseball pitchers).

❖ Clinical features

- Most commonly affects the supraspinatus tendon
- Acute rupture: acute severe pain and loss of strength
- Degenerative rupture: chronic pain; loss of strength is less pronounced
- Restricted range of motion

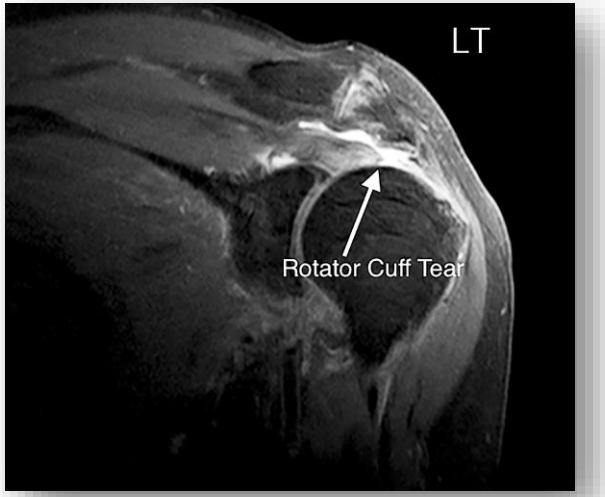
Rotator cuff tear

❖ Diagnostics

- X-ray: superior displacement of the humeral head (high-riding humeral head)
- MRI to determine the location and extent of the rupture

❖ Management

- **Traumatic rupture**
  - Surgical repair; especially those who are physically active
- **Degenerative**
  - Activity modification
  - Pain medication
  - Physiotherapy to strengthen the rotator cuff and scapular stabilizer



Complete vs Incomplete

- Complete: Tendon is shortened and doesn't reach its insertion
- Incomplete: Reach its insertion

Partial vs Full thickness

- Depends on the thickness of fluid

Rotator cuffs tear

❖Patient with subscapularis tendon complete tear which of the following describes the physical findings ?

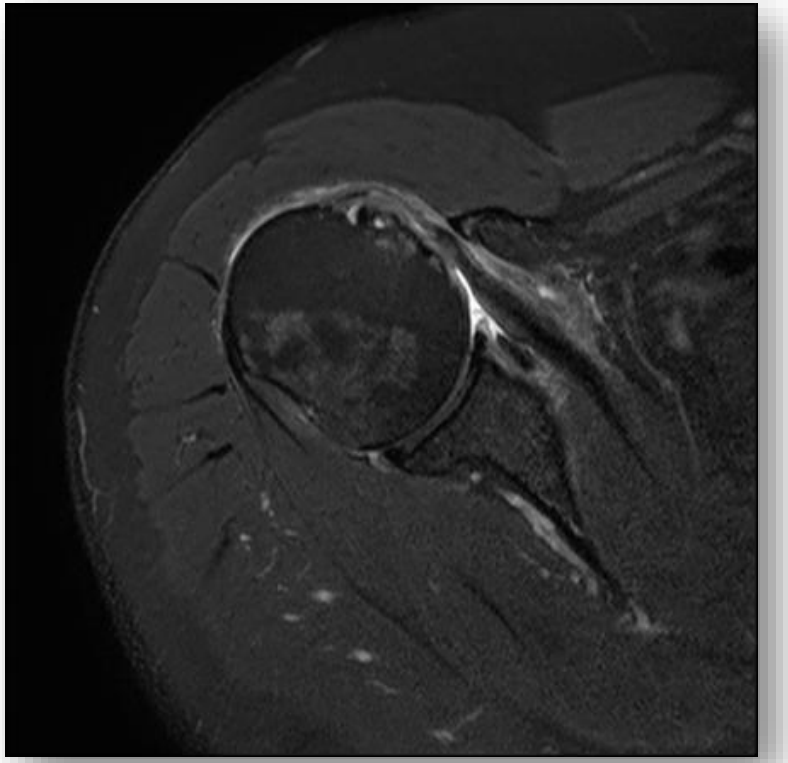
a. Passive flexion of the left arm is more than right arm

b. Passive extension of the left arm is more than right arm

c. Passive external rotation of the left arm is more than right arm

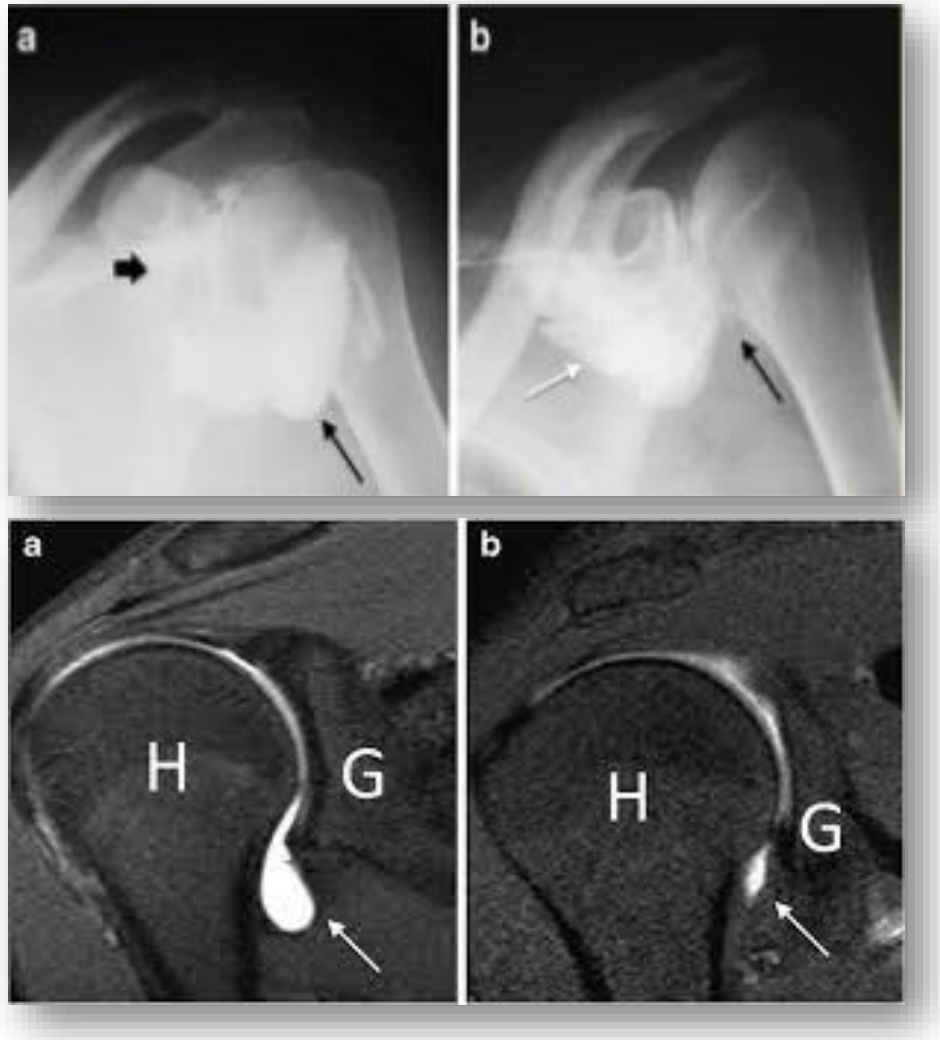
d. Active extension of the left arm is more than right arm

e. Passive extension of the right arm is more than left arm



Frozen shoulder

- **Epidemiology**: F>M
- **Etiology**
  - Idiopathic, usually associated with diabetes and Parkinson's
  - Secondary, most of the time due to prolonged immobilization
- **Clinical feature**:
  - Usually involves pain and stiffness that develops gradually, gets worse and then finally goes away
- **Diagnostics**
  - Arthrography (an X-ray with contrast dye injected into the shoulder joint to demonstrate the "shrunken shoulder capsule")
  - The tissues of the shoulder can also be evaluated with an MRI scan.



Frozen shoulder – Course

The normal course of a frozen shoulder has been described as having three stages:

1. The "freezing" or painful stage, (0 weeks to 6 months) As the pain worsens, the shoulder loses motion.

2. The "frozen" or adhesive stage (6-12months) Slow improvement in pain but the stiffness remains.

3. The "thawing" or recovery (12-18 months) when shoulder motion slowly returns toward normal.

Frozen shoulder – Management

- Medical Treatment (aggressive combination of anti-inflammatory medications, cortisone injection)
- Physical therapy (electric stimulation, range-of-motion exercise maneuvers, ice packs, and eventually strengthening exercises).
- Other treatments such as release of the scar tissue by arthroscopic surgery or manipulation of the scarred shoulder under anesthesia may be considered for patients with resistant frozen shoulders

Shoulder dislocation

❖Epidemiology

- Most common joint dislocation, Sex: ♂ > ♀, Peak incidence: 20–29 years

❖Etiology

- Trauma (e.g., falling on an outstretched arm)
- Predisposing factors for recurrent shoulder dislocation
  - Rotator cuff tear, Damage to the glenohumeral ligament, Bankart lesion and Hill-Sachs lesion, Loose joint capsule
- For posterior dislocation: uncoordinated muscle contraction (e.g., seizure, electrical shock)

❖Classification

- > 95 % anterior (subcoracoid) and/or anterior-inferior (subglenoid); fall on externally rotated, abducted and extended arm
- ~ 4% posterior
- ~ 1% inferior

Clinical features

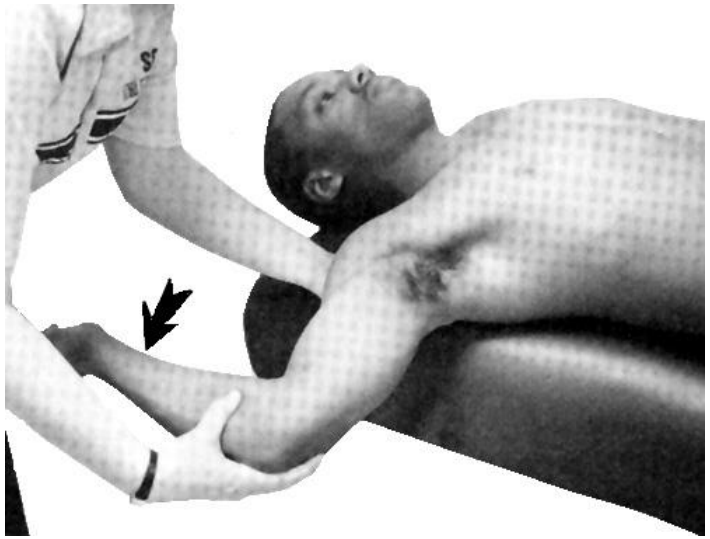
- **General symptoms**
  - Severe shoulder pain
  - Inability to move the shoulder
  - Empty glenoid fossa: A palpable dent may be present at the point where the head of the humerus is supposed to lie.
- **Anterior or anterior-inferior dislocation**
  - The humeral head can usually be palpated below the coracoid process.
  - The arm is typically held in external rotation and slight abduction.
- **Posterior dislocation**
  - Prominence of the posterior shoulder with anterior flattening
  - Prominent coracoid process
  - The arm is held in adduction and internal rotation, with the patient unable to actively rotate it in the outward direction.
- **Inferior dislocation**
  - The arm is held above the head, with the patient unable to actively adduct the arm.
  - Neurologic dysfunction, especially with involvement of the axillary nerve, is common.

Clinical features

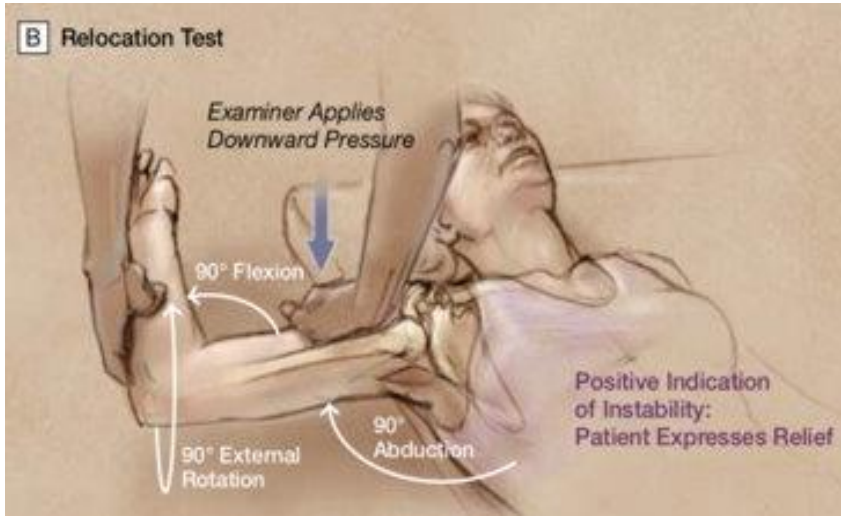
- **Multidirectional Instability (MDI)**
  - Can be from overuse (microtrauma)
  - Associated with connective-tissue disorders
    - Marfan's, Ehler-Danlos
  - Will possess patulous inferior capsule and deficient rotator interval
  - Primary treatment is always non-operative
    - Dynamic strengthening
  - Surgical treatment reserved for patients who failed prolonged conservative management
    - Focus on the capsule

Physical exam

- Check for neurovascular deficits pre and post reduction
- Special tests:
  - Apprehensive shoulder test
  - Relocation test
  - Sulcus sign



Apprehensive shoulder test



Relocation test

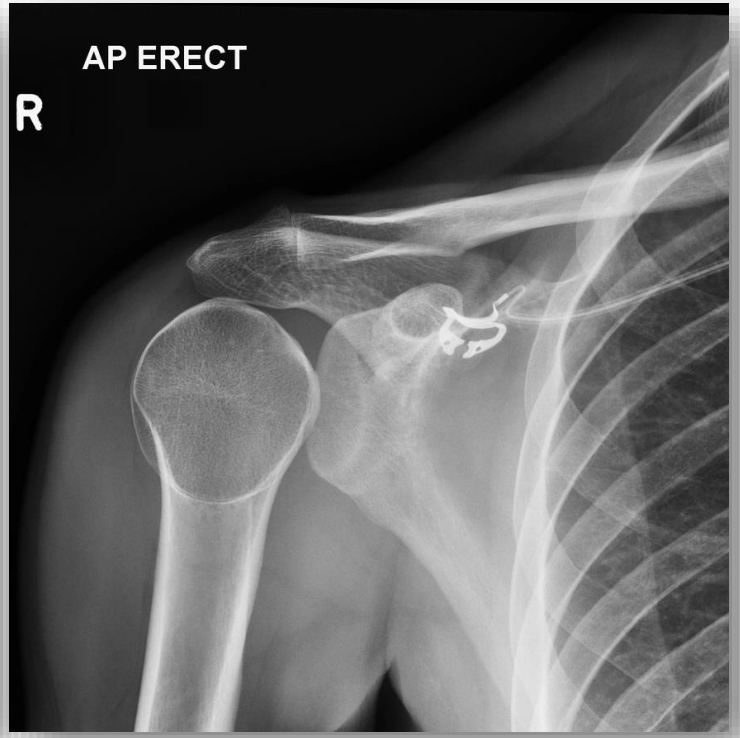
Sulcus sign

Imaging

- Shoulder X-ray
  - AP view and lateral view (Y view, an x-ray in which the body of the scapula forms the letter "Y" with the coracoid process and the acromion) to confirm dislocation and exclude fracture
    - For posterior shoulder dislocation: axillary and/or scapular lateral views (Y view)
    - The lightbulb sign is diagnostic of posterior shoulder dislocation.
  - **Hill-Sachs lesion**
    - Seen in 35–40 % of patients with an anterior dislocation
    - An indentation on the posterolateral surface of the humeral head caused by the glenoid rim
- MRI
  - Indicated to assess soft tissue damage or if a Hill-Sachs lesion is present
  - **Bankart lesion**: injury of the anterior inferior lip of the glenoid labrum due to traumatic anterior shoulder dislocation

Shoulder X-ray

Anterior dislocation



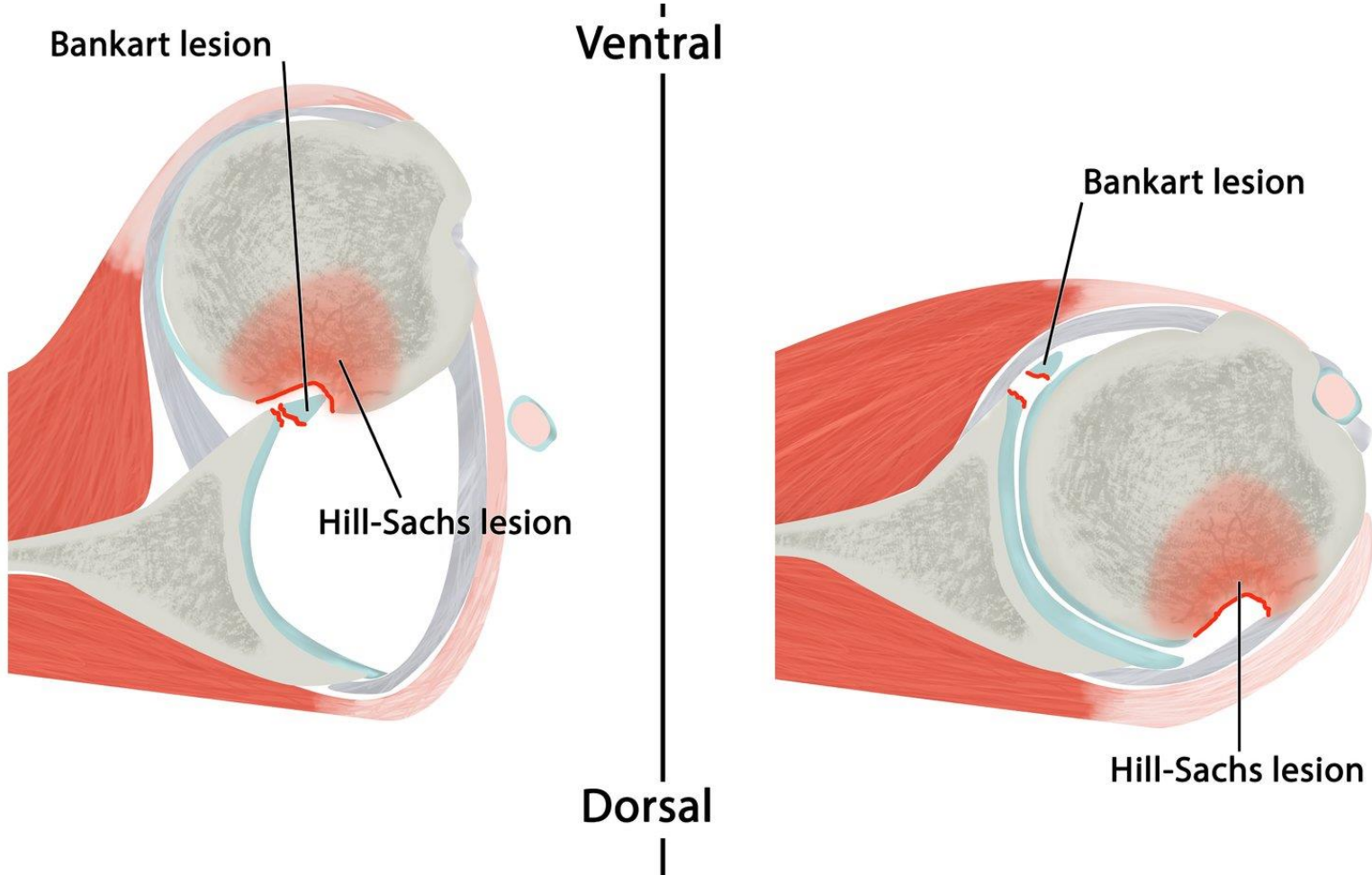
Posterior dislocation

Lightbulb sign

Inferior dislocation

Hill-Sachs and Bankart lesion

In an anterior shoulder dislocation, the glenoid rim may indent on the dorsolateral surface of the humeral head, which is called a Hill-Sachs lesion. In Bankart lesions, the anterior inferior lip of the glenoid labrum is also damaged.



Management

❖Emergent management

- Immobilization of the joint with a splint/sling, Analgesia

❖Conservative management

- Closed reduction
- Indications:
  - Inferior dislocation and most anterior dislocations (except subclavicular or intrathoracic displacements)
  - Uncomplicated posterior dislocations presenting early (< 6 weeks)
  - Cases with no evidence of major arterial injury, associated injuries (Bankart lesion, Hill-Sachs lesion, disruption of the labrum), or associated fractures

❖Surgical management

- Indications:
  - Unsuccessful closed reduction
  - Concomitant dislocated fracture of humerus, clavicle, or scapula
  - Displaced Bankart lesion
  - Recurrent shoulder dislocations
  - Young and active individuals may require early surgery to prevent recurrent dislocations in the future.

Complications

- High rate of recurrence (dislocation with 1 year)
  - Most patients younger than 30 experience at least one recurrence after the first dislocation.
  - Incidence decrease with change
- Damage to the axillary nerve
  - Numbness or sensory loss over the lateral surface of the shoulder
  - Malfunction of the deltoid muscle, resulting in an inability to abduct the arm
- Injury to the brachial plexus, axillary artery, and/or axillary vein
- Avulsion fracture of the major and/or minor tubercles
- Shoulder joint instability
- Rotator cuff injury
- Shoulder stiffness (More commonly seen in elderly)
- Osteoarthritis of the shoulder joint

Which of the follow is wrong about this case ?

a. Most common type is anterior
b. Most common subtype is sub-coracoid
c. Common in middle age
d. Patient presents with external rotation and abduction
e. Radial nerve injury is the most common one

سنوات (4)

Shoulder dislocation

سنوات (3)
- **What lesion would form at the glenoid labrum ?**
  - Bankart lesion

سنوات (2)
- **What is the best management ?**
  - Closed reduction under anesthesia

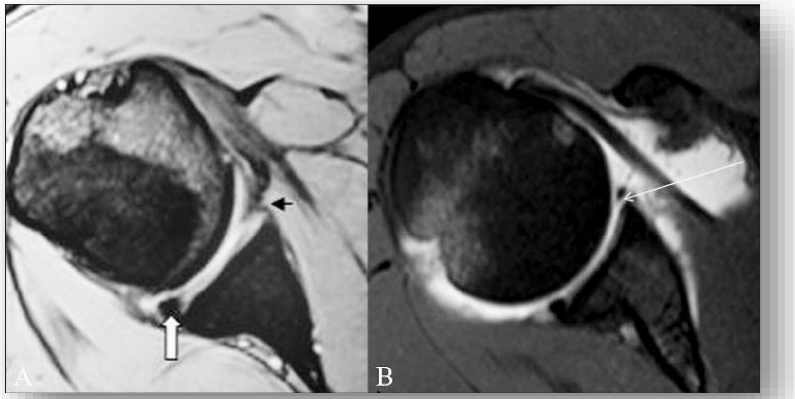
سنوات (1)
- **Patient presented with shoulder dislocation 4 time what's the management ?**
  - Surgery

Shoulder dislocation

- **What is the name of this abnormality ?**
  - Hill Sachs lesion
- **It is associated with what ?**
  - Recurrent shoulder dislocation
- **What expected inability may be seen in this condition ?**
  - Loss of lateral arm sensation

What is your diagnosis ?

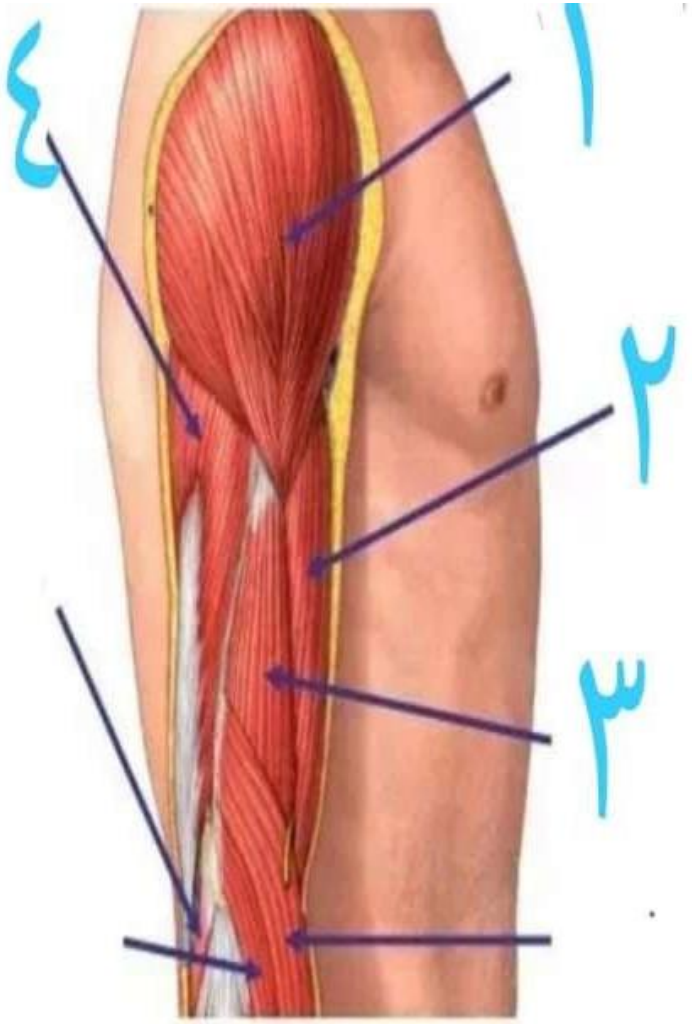
a. Bankart lesion: anterior inferior glenoid labrum injury



Arm

Identify these muscles :

1. Deltoid
2. Biceps
3. Brachialis
4. Triceps



Humerus fracture

❖ Epidemiology

- Proximal humerus fractures are the most common humerus fractures
- Incidence increases with age; Osteoporosis related fracture
- Sex: ♀ > ♂

❖ Mechanism of injury

- Falls with axial loading on an outstretched hand (most common cause)
  - Commonly proximal humerus fracture in the elderly or distal supracondylar fracture in children.
- Motor vehicle accidents
- Direct blow to the back of the humerus
- Pathologic fractures (less common)

Classification

❖Proximal humerus fracture (common in the elderly)

- The proximal humerus has four major segments: the anatomical neck, the humeral shaft, the greater tuberosity, and the lesser tuberosity (the surgical neck is distal to the lesser and greater tuberosity)
- **Neer classification**: a commonly used classification that is based on whether one or more of these four segments have been displaced
  - One-part fracture: fracture lines involve 1–4 parts, but no parts are displaced
  - Two-part fracture: fracture lines involve 2–4 parts, and 1 part is displaced
  - Three-part fracture: fracture lines involve 3–4 parts, and 2 parts are displaced
  - Four-part fracture: fracture lines involve 4 parts, and 3 parts are displaced

❖Humeral shaft fracture

- Classification according to location: proximal third, middle third (most common location), distal third
- Classification according to comminution: type A (no comminution), type B (butterfly fragment), and type C (comminution is present)

Classification cont.

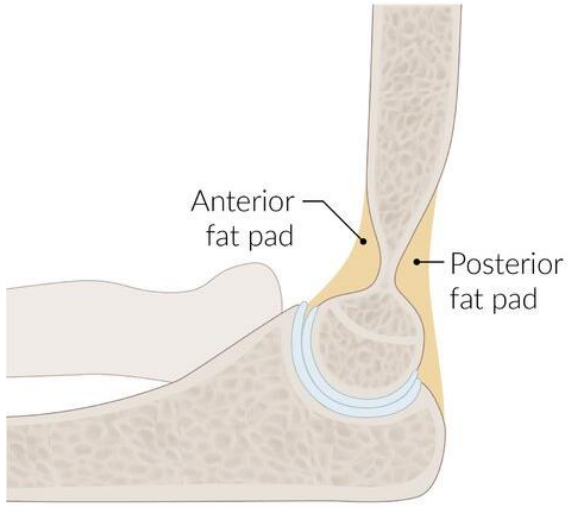
❖ Distal humerus fracture

- Classification according to anatomical site
  - Lateral/medial fractures
  - Supracondylar fractures: a fracture of the distal humerus, superior to the elbow joint (most common pediatric fracture)
    - Typically, a transverse fracture above the medial and lateral epicondyles
    - The most common pediatric elbow fracture
- AO classification
  - Type A: extra-articular fracture
  - Type B: partial articular
  - Type C: complete articular fracture

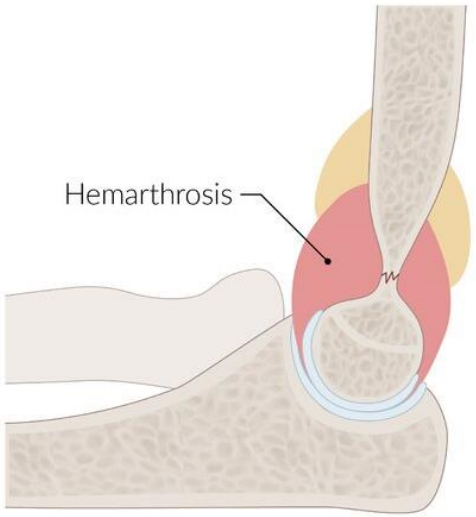
Diagnostics

- **X-ray** (AP and lateral views of the humerus as well as transthoracic and axillary views of the shoulder)
  - Radiographic features of fractures
  - In the case of supracondylar fracture: possibly positive fat pad sign
    - Represent elbow joint effusion and may indicate an occult fracture
    - Can be seen on a lateral view of the elbow joint in which the joint is flexed at ~ 90°
    - **Posterior fat pad sign**: a radiographic sign characterized by the presence of a lucent crescent in the olecranon fossa (can also be positive in radial head fractures)
    - **Anterior fat pad sign (sail sign)**: a radiographic sign characterized by the presence of a lucent crescent in the coronoid fossa
  - In the case of pathological fractures: signs of other entity (e.g., cysts, tumor)
- **CT**: if x-ray is not diagnostic
- **MRI**: if pathological fracture is suspected and/or to evaluate rotator cuff injury

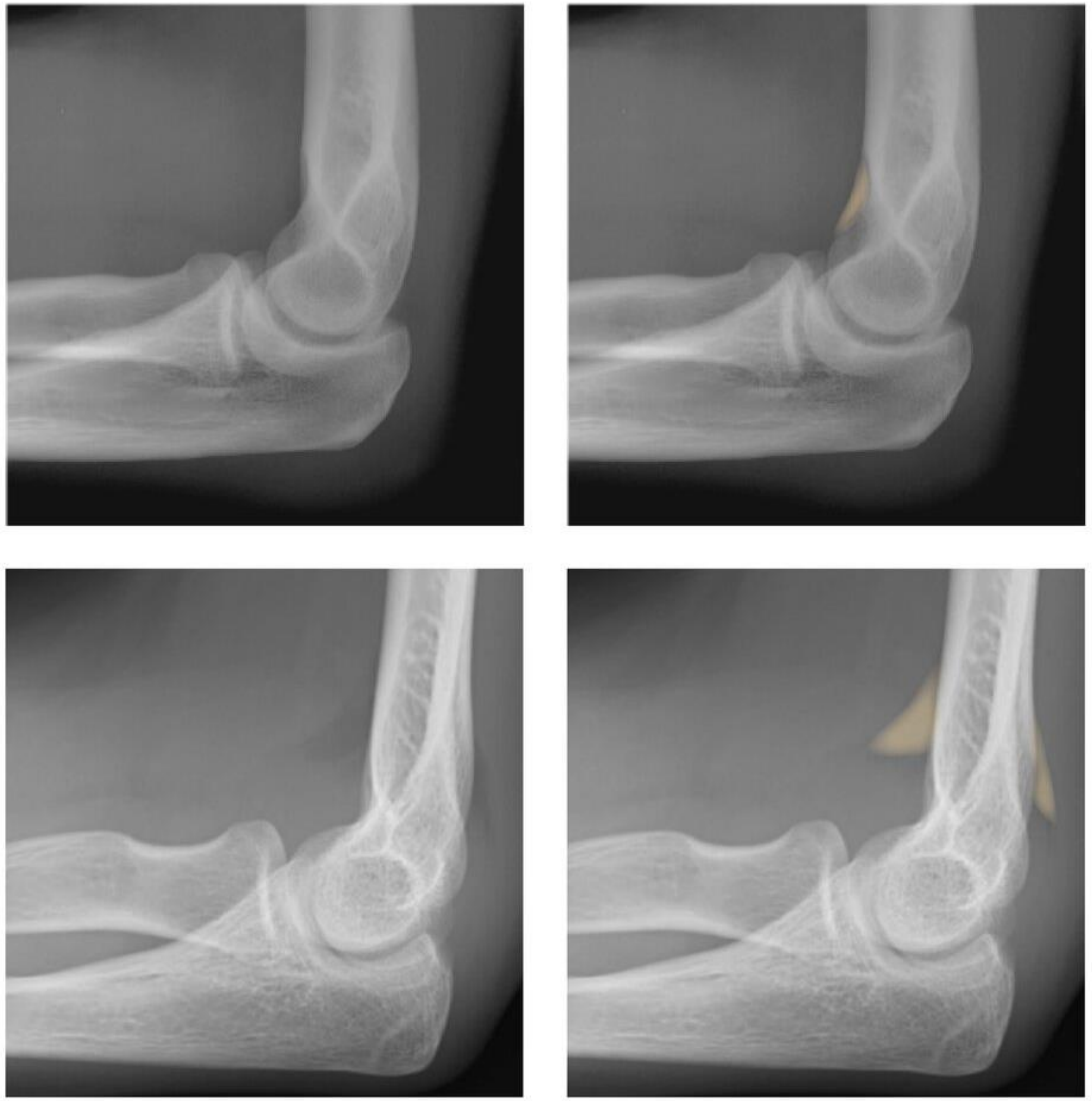
Anterior and posterior fat pad signs in supracondylar humerus fracture



Normal



Supracondylar humerus fracture



Elevation of the anterior fat pad (**sail sign**)

Management

- **Conservative therapy**
  - **Indication**: nondisplaced, closed fractures
  - **Procedures**
    - Hanging-arm cast or coaptation splint and sling for approx. one to two weeks with subsequent follow-up x-ray and brace
    - Early physical therapy to restore function
- **Surgical treatment**
  - **Indication**: open fractures, displaced fractures that cannot be reduced, associated injuries (nerves, blood vessels), floating elbow (simultaneous humerus and forearm fracture), pseudarthrosis
  - **Procedures**
    - Internal fixation using plates and screws, or intramedullary implants (especially supracondylar fractures)
    - External fixation (e.g., open fracture, polytrauma)
    - Arthroplasty of humeral head or elbow (e.g., in complex fractures), especially in elderly patients

Complications

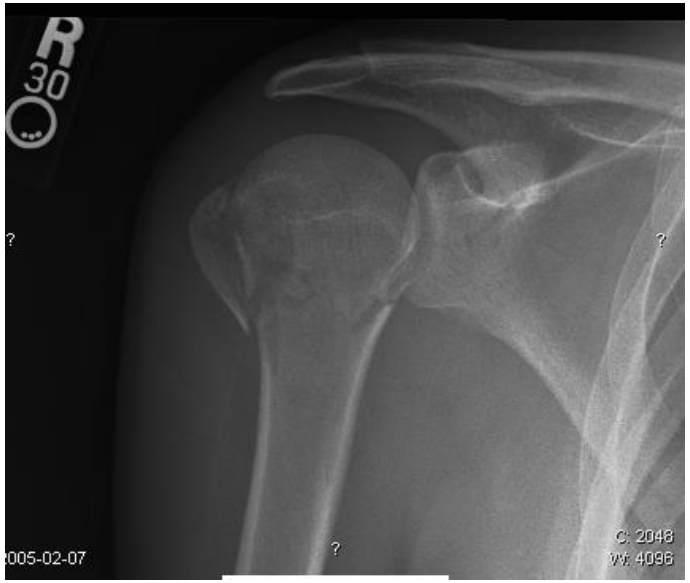
- **Proximal humerus fracture**
  - Malunion
  - Tuberosity malunion may cause rotator cuff dysfunction
  - Nonunion
  - AVN (of humeral head)
- **Humeral shaft fracture**
  - Radial nerve injury
- **Distal humerus fracture**
  - Malunion and varus deformity of elbow
  - Brachial artery injury (common)

Humerus fracture nerve palsies

Nerve	Motor function	Sensory function	Associated site of humerus fracture
Axillary	• Flat deltoid • ↓ Arm abduction at shoulder > 15 degrees	• ↓ Sensation over deltoid and lateral arm	• Proximal humerus
Radial	• Wrist drop • ↓ Grip strength	• ↓ Sensation over dorsal hand and posterior arm	• Humeral shaft • Distal humerus
Ulnar	• Claw hand deformity • Froment sign • Radial deviation when wrist is flexed	• ↓ Sensation over medial 1 ½ fingers (5th digit and half of the 4th digit) including hypothenar eminence	• Distal humerus
Median	• Anterior interosseous nerve syndrome: unable to oppose index finger and thumb of affected hand • ↓ Wrist flexion • ↓ Flexion of lateral fingers and ↓ thumb opposition	• ↓ Sensation over thenar eminence and over lateral 3½ fingers (first 3½ digits, beginning with the thumb)	• Distal humerus

Proximal humerus fractures

- **This type of fracture is commonly seen in which demographic ?**
  - Elderly due to osteoporosis
- **What is the most common mechanism of injury ?**
  - Falls with axial loading on an outstretched hand
- **Which nerve can be injured in this type of fracture ?**
  - Axillary nerve
- **Mention a possible complication of this fracture ?**
  - AVN of humerus head



Hx: 7 years old patient

What is the management ? سنوات (1)

a. Arm splint
b. Closed reduction
c. Open reduction
d. ORIF
e. Casting

What is the management ? سنوات (2)

a. Open reduction and internal fixation
b. Closed reduction
c. Arm sling
d. Surgery
e. Close reduction with wires

This is a proximal non-displaced humerus fracture in the pediatric group. Leaving it alone will result in spontaneous healing and remodeling. There is no need for surgical intervention, just fixation for 3 weeks.

Hx: 7 years old patient

This patient was treated with external fixation only (e.g., Arm splint)

Before

After

Humeral midshaft fracture

سنوات (2)

❖**Which nerve is most probably to be injured in this fracture ?**

- Radial Nerve

سنوات (6)

❖**What is the function of the most probably injured nerve ?**

- Extension (Dorsiflexion) of wrist

سنوات (1)

❖**How do you test the nerve most probably injured in this fracture ?**

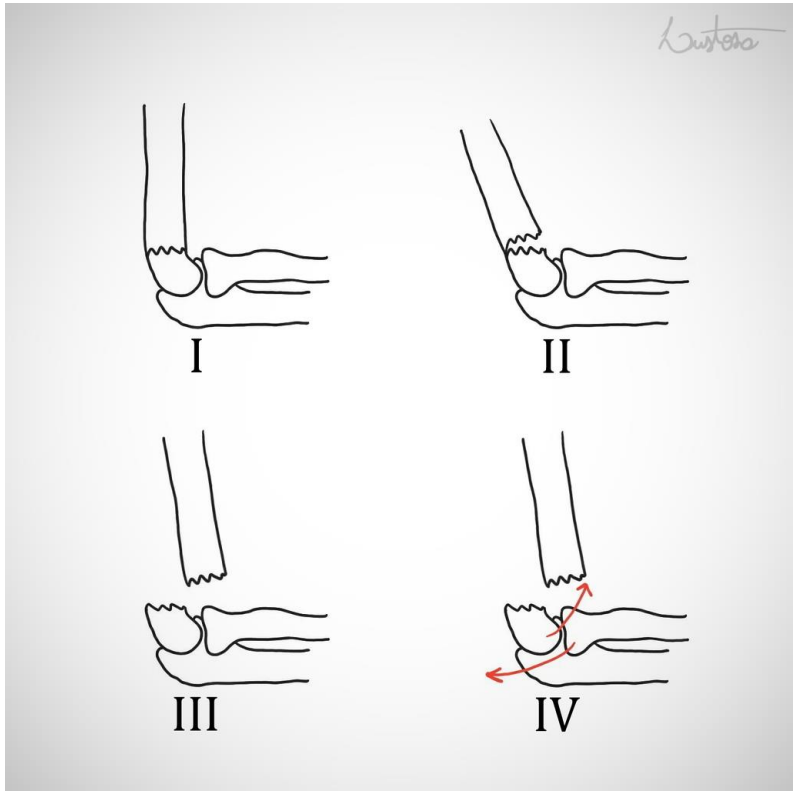
- Dorsiflexion of the wrist

Supracondylar fracture

- **This type of fracture is commonly seen in which demographic ?**
  - In pediatrics
- **What type of fracture is this ?**
  - Supracondylar fracture, Gartland type 2
  - Gartland classification next slide
- **What is the appropriate management ?**
  - Closed reduction and fixation

Gartland classification

Type	Characteristic	Management
Type 1	Non-displaced	Cast immobilization x 3-4wks, with radiographs at 1 week
Type 2	Posterior cortex and posterior periosteal hinge intact	Closed reduction percutaneous pinning (CRPP)
Type 3	Displaced, in 2 or 3 planes	CRPP or open reduction if needed
Type 4	Complete periosteal disruption with instability in flexion and extension	CRPP or open reduction if needed



Gartland classification

Gartland Type 1

Gartland Type 2

Gartland Type 3

Gartland Type 4

Supracondylar fracture

❖**What type of fracture is this ?**

- Supracondylar fracture, Gartland type 4

سنوات (3)

❖**What is the appropriate management ?**

- Close reduction and fixation using wires or open reduction if needed

سنوات (1)

❖**Which nerve is most common likely to be affected in this fracture ?**

- Anterior interosseous nerve

سنوات (1)

❖**Which movement is affected with this fracture ?**

- Flexion of fingers

Supracondylar fracture

- **This type of fracture is commonly seen in which demographic ?**
  - In pediatrics
- **What type of fracture is this ?**
  - Supracondylar fracture, Gartland type 4
- **What is the appropriate management ?**
  - Close reduction and fixation using wires or open reduction if needed
- **What is the name of the red line ?**
  - Anterior humeral line

سنوات (3)

Anterior humeral line

- The anterior humeral line is key to demonstrating normal elbow alignment and should be used whenever reading a pediatric elbow radiograph to exclude a subtle supracondylar fracture.
- A line drawn down the anterior surface of the humerus should intersect the middle third of the capitellum.
- When an axial force is applied down the radius (such as after a fall onto an outstretched hand), the radial head impacts the capitellum. This results in the narrowest and weakest part of the distal humerus is placed under stress. The result is often a fracture through the supracondylar portion of the distal humerus and this usually results in posterior displacement of the capitellum.

Supracondylar fracture

❖**Which nerve is never affected by this fracture ?**

a. Axillary nerve
b. Radial nerve
c. Median nerve
d. Ulnar nerve
e. Anterior interosseous nerve

Complications and deformities of supracondylar fracture

- Cubitus varus (gunstock deformities)
- Cubitus valgus

Lateral condyle Fracture

سنوات (5)

❖What is your diagnosis ?

- Lateral condyle Fracture

❖What is the Management ?

- Closed or open reduction with internal fixation

سنوات (2)

❖Mention one complication of this fracture

- Hemarthrosis
- May damage the growth plate.
- Nonunion can happen due to synovial fluids
- Malunion can occur (cubitus valgus)

Medial condyle fracture

- **What is your diagnosis ?**
  - Lateral condyle Fracture
- **What is the Management ?**
  - Closed or open reduction with internal fixation

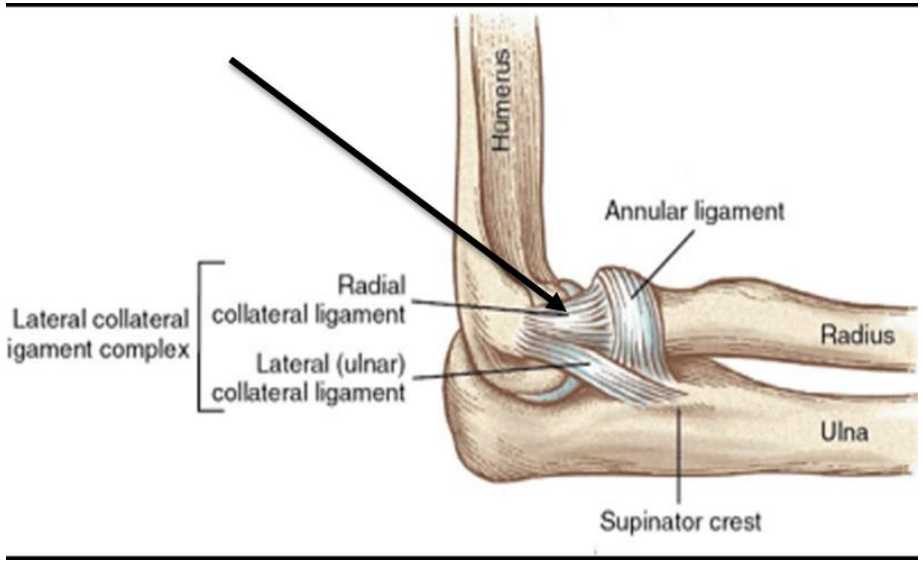
Elbow

Elbow joint

- Three articulations
  - Humeral (trochlea)–ulnar
  - Humeral (capitellar)–radial
  - Proximal radioulnar (PRUJ)
- Ligaments are the man stabilizers of the elbow joint
- Muscles
  - Lateral epicondyle
    - Common extensor of the wrist
    - Radial Nerve
  - Medial Epicondyle
    - Common flexor of the wrist
    - Ulnar Nerve

Anatomy question

- **What is the name of this structure ?**
  - Radial collateral ligament



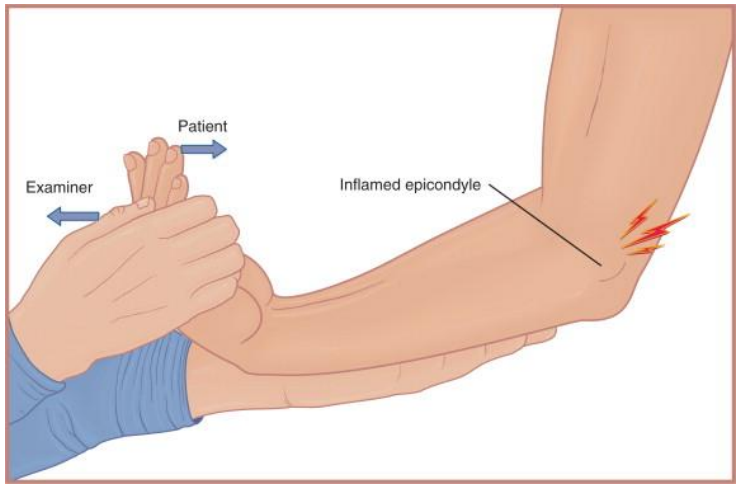
Pathology of muscles

❖Lateral epicondylitis (Tennis Elbow)

- ECRB muscle
- Forceful repetitive wrist extension
- Examination: Cozen's test; Localized tenderness
- Management: Rest & NSAIDs, Counterforce brace

❖Medial Epicondylitis (Golfer Elbow)

- New studies show all muscles of common flexor tendon (CFT) affected except palmaris longus
- Examination: Medial epicondylitis test
- Management: Rest & NSAIDs, Counterforce brace



Pathology of muscles

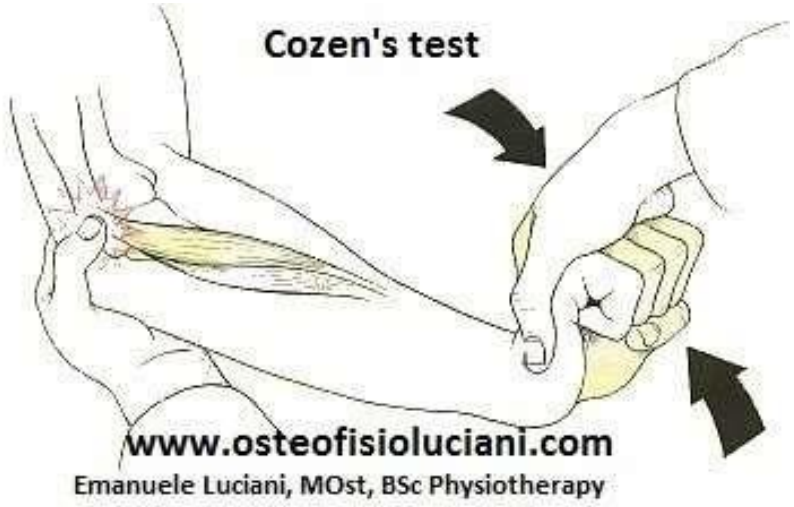
- Elbow pain exacerbated by hand movement and resisted wrist extension

❖ **What is your diagnosis ?**

- lateral epicondylitis (Tennis elbow)

❖ **What is the affected tendon ?**

- ECRB



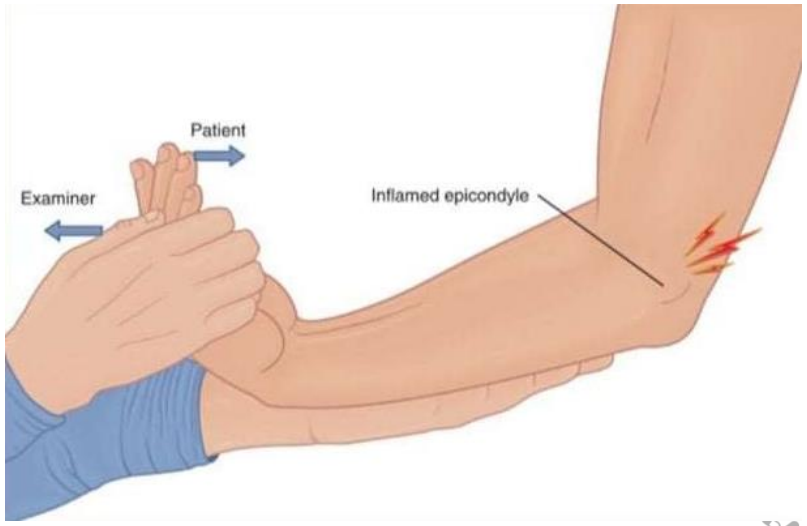
- Elbow pain exacerbated by hand movement and resisted wrist flexion

❖ **What is your diagnosis ?**

- Medial epicondylitis

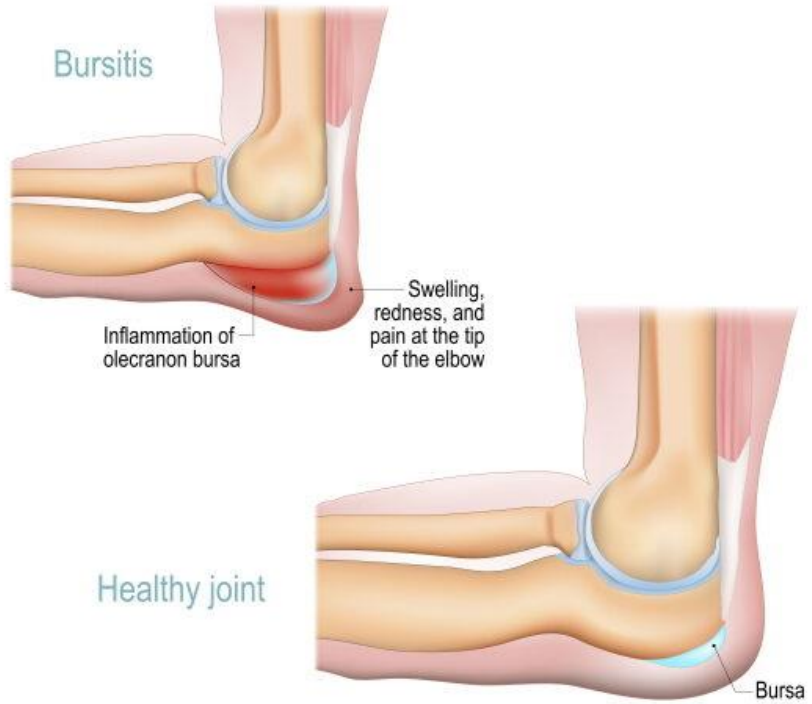
❖ **What is the affected nerve ?**

- Ulnar nerve



Olecranon bursitis (Student's elbow)

- Enlarged bursa as a result of continual pressure or friction
- Causes
  - Trauma
  - Gout → calcification on the xray
  - RA



Pulled elbow (Nursemaid elbow)

❖Definition

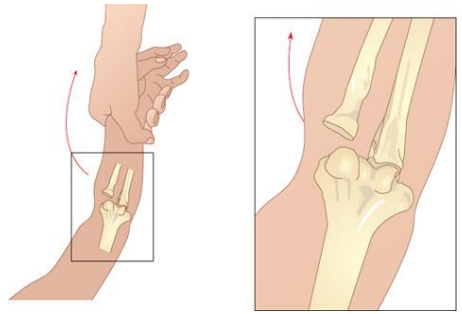
- Subluxation of the radial head, facilitated by the weakness of the immature annular ligament, causing the radius to slip out of the annular ligament and the annular ligament to become entrapped within the humeroradial joint

❖Epidemiology

- Age: 1–5 years (peak incidence between two and three years)
- Radial head subluxation is the most common elbow injury in children under 5 years of age and occurs exclusively in this age group.
- Sex: ♀ > ♂

❖Mechanism of injury

- Traumatic (most common)
  - Sudden axial traction of the pronated and extended forearm
  - Typical activities: adult quickly pulls up a falling child by the hand, swings a child by the hands, or drags a child by the arm (hence the term “nursemaid's elbow”)



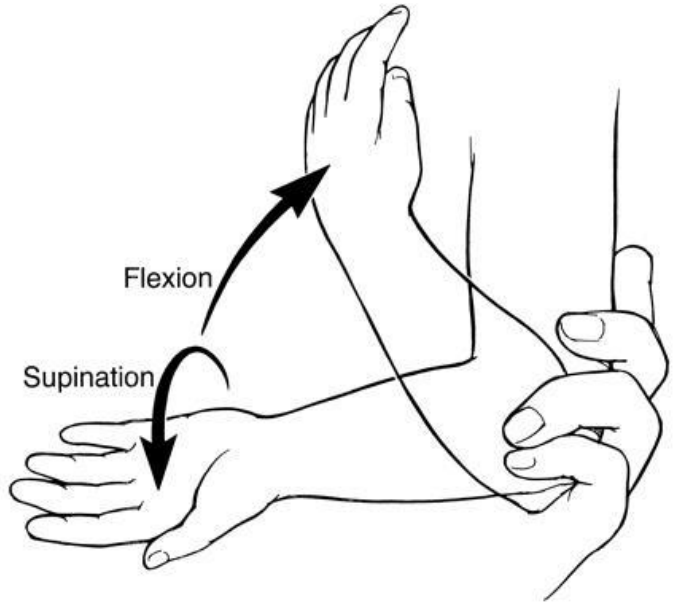
Pulled elbow (Nursemaid elbow)

❖Clinical features

- Painful arm and irritable child
- History of the child being hold from the arm & crying
- The forearm is held in pronation & extension.
- No X-ray changed.

❖Management

- Supination and hyper-flexion of the elbow



Elbow dislocation

❖ Epidemiology

- Second most frequently dislocated joint (after the shoulder joint)
- Sex: ♂ > ♀
- Peak incidence: 10–20 years; usually sports injuries

❖ **Mechanism of injury**: Trauma

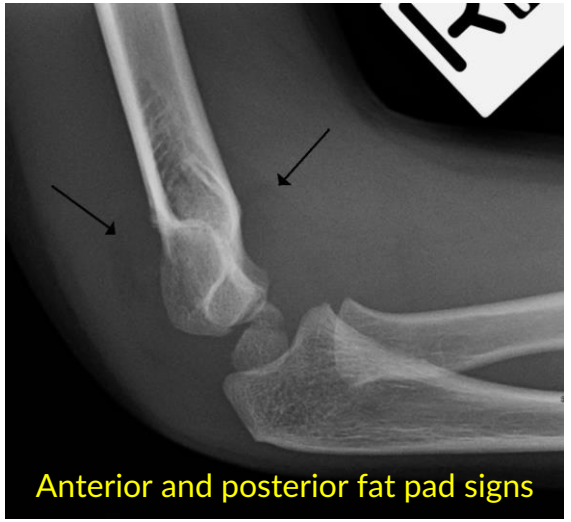
- Fall on an outstretched hand (most common) → posterior elbow dislocation
- A posterior, direct trauma to a flexed elbow → anterior elbow dislocation
- Medial/lateral trauma to the elbow → medial/lateral elbow dislocation
- High impact trauma to the elbow → divergent elbow dislocation

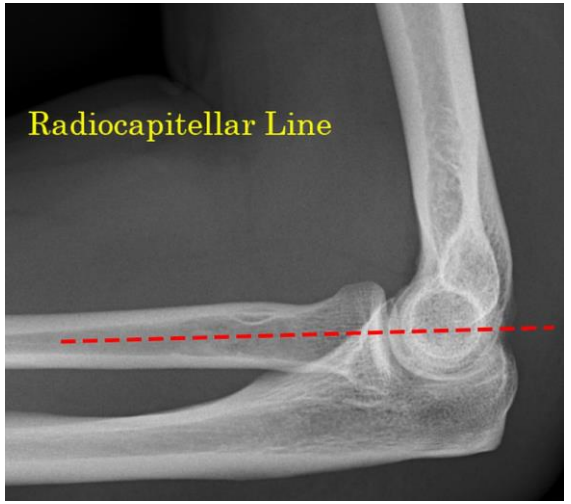
❖ Classification

- **Anatomical classification**: Posterior, Anterior, Medial, Lateral, Divergent
- **Presence of co-existent fractures**: Simple dislocation, Complex dislocation

Imaging

- X-ray of the elbow joint
  - AP view and lateral view to confirm dislocation and exclude fracture
  - **Posterior fat pad sign**: seen in patients with concomitant fractures (usually of the humerus/radial head)
  - **Radiocapitellar line**: on a lateral x-ray of the elbow joint, an imaginary line drawn through the center of the neck of the radius should pass through the center of the capitellum of the humerus. If an elbow dislocation is present, the line does not intersect the capitellum.
- CT scan of the elbow joint: indicated only if a complex elbow dislocation is suspected to evaluate the extent of associated fractures


Anterior and posterior fat pad signs



Management

- **Conservative management**
  - **Indication**: simple elbow dislocation (no fracture)
  - **Procedure**:
    1. Obtain prereduction x-rays and check neurovascular status
    2. Closed reduction; Signs of successful reduction: return of the normal triangular orientation of the 3 bony prominences of the elbow; decrease in pain
    3. Post-reduction x-rays are obtained, and neurovascular status should be rechecked
    4. Immobilization of the relocated elbow in a posterior splint or brace, in pronation and 90° flexion for 7–10 days

Management

- **Surgical intervention**
  - **Indication**: complex elbow dislocation (concomitant fracture); failed closed reduction; joint instability post-reduction; vascular injury
  - **Procedure**
    1. Closed reduction of elbow
    2. Open reduction and internal fixation of the fractured segments and repair of the torn medial and/or lateral collateral ligaments of the elbow
  - **After surgery**
    - Obtain elbow x-rays
    - Check neurovascular status of the forearm and hand
  - Immobilization of the elbow in a posterior splint or brace in pronation and 90° flexion for 3 weeks
- **Rehabilitation**: range of motion exercises (active and passive)

Elbow dislocation

❖**What is the type of dislocation in this photo ?**

- Simple dislocation, posterolateral

❖**What is your management ?**

1. Prereduction X-rays and neurovascular status
2. Closed reduction
3. Post-reduction X-rays and neurovascular status
4. Immobilization for 7–10 days

❖**What is the terrible triad (bad prognosis) of the elbow dislocation ?**

- Dislocated elbow
- Radial head fracture
- Coronoid process fracture

Olecranon fracture

- **Epidemiology**
  - Rare in children, Common in adults
- **Mechanism of injury**
  - Avulsion fracture: Tension applied by the triceps with flexion of the elbow → transverse fracture
  - Direct trauma → Comminuted fracture
  - Indirect trauma: by falling and landing with an outstretched arm
- **X-ray**
  - AP view, Lateral view, Oblique view; sometimes helpful, especially for radial head)
- **Management**: Anatomical reduction; intra-articular fracture
  - Simple transverse fracture: Tension band
  - Comminuted fracture: Plates and screws

Olecranon fracture

- **What is the pattern of this fracture ?**
  - Transverse
- **What is the most likely mechanism of injury ?**
  - Avulsion fracture by the triceps
- **What is the management of this fracture ?**
  - Open reduction with tension wire banding

Elbow distortions

- Cubitus varus
- Cubitus valgus
- Hyperextension

Forearm

Which nerve supply this muscle ?

a. Ulnar
b. Median
c. Radial
d. Axillary
e. Musculocutaneous nerve

Brachioradialis muscle

Forearm fractures

- **Olecranon fracture** (discussed earlier)
- **Radial neck fracture**
- **Monteggia fracture**: proximal (or middle) ulnar fracture with concomitant dislocation of the radial head
- **Galeazzi fracture**: radial shaft fracture with disruption of the distal radioulnar joint
- **Parry fracture**: isolated fracture of the ulna (typically a defensive injury)
- **Complete forearm fracture**: fracture of the radial and ulnar shafts
- **Distal Radius Fractures**

Radial neck fracture

- **Epidemiology**
  - ChildreN: Neck
  - ADults: HeaD
- **Mechanism of injury**
  - Fall on the outstretched hand forcing the elbow into valgus & pushing the radial head against the capitulum
- **Clinical features**: Signs of fracture with Pain on rotating the forearm
- **Management**
  - Less than 30°radial head tilt & up to 3 mm of transverse displacement: Casting for 2-3 weeks then ROM
  - If >30°: Either closed or open reduction with splinting

Radial neck fracture

- **What is your diagnosis ?**
  - Radial neck fracture
- **What nerve is affected by this fracture ?**
  - Posterior interosseous nerve
- **What is your management ?**
  - Either closed or open reduction with splinting

Monteggia fracture

- **Definition**: proximal (or middle) ulnar fracture with concomitant dislocation of the radial head
- **Mechanism of injury**
  - Low-energy trauma, e.g., fall on outstretched and pronated forearm
  - High-energy trauma, e.g., direct blow to the forearm from a motor vehicle accident
- **Clinical features**
  - Pain, deformity, and limited range of movement of the elbow joint
  - Paresthesia at or below the elbow joint
  - Possibly nerve injury: most commonly posterior interosseous nerve palsy
- **Diagnostics**: X-ray shows a fracture of the proximal (or middle) ulna with dislocation of the radial head (dislocation can be anterior, posterior, or lateral).
- **Management**
  - In children with uncomplicated fractures: closed reduction and casting
  - In adults or complicated fractures in children: open reduction and internal fixation (plating, K-wire fixation)

Monteggia fracture

سنوات (2)

- **What is the type of the fracture ?**
  - Monteggia fracture

سنوات (1)

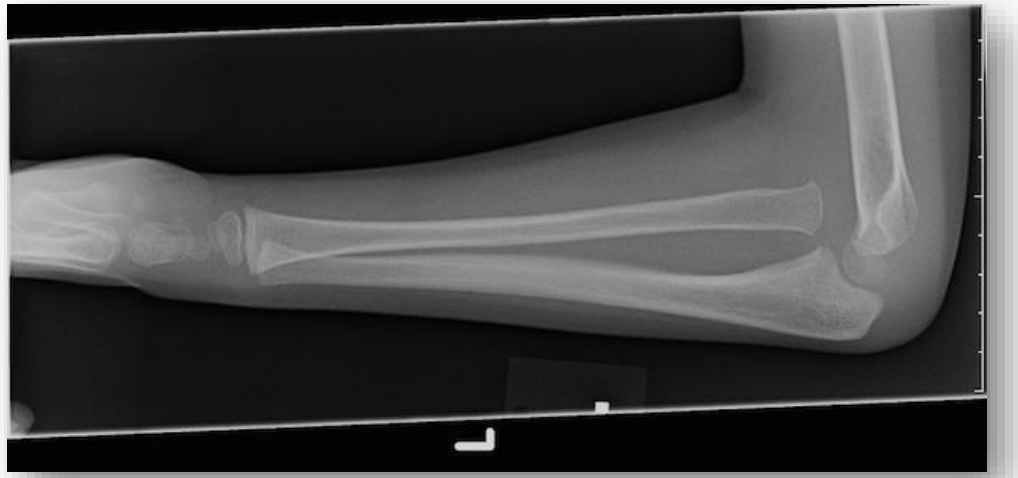
- **Which nerve is affected in this fractured?**
  - Posterior interosseous nerve

سنوات (2)

- **What is the function of the nerve injured in this fracture ?**
  - Extension of MCP joint
- **Which radiological sign is important during forearm x-ray interpretation to rule out this type of fracture ?**
  - Radiocapitellar line

VERY IMPORTANT NOTE

- Radiocapitellar line is very important during forearm x-ray interpretation as it help us diagnose radial head dislocation especially in pediatrics
- Radiocapitellar line: A line drawn down the neck of the radius should intersect the capitellum. If the line does not intersect the capitellum, there is radial head dislocation.
- In this photo no discontinuity of the bone is seen thus it can be misdiagnosed as normal.
- When we use the radiocapitellar line, there is radial head dislocation and as we concentrate on the ulna, a bowing fracture (plastic deformity) is present, so this is a Monteggia fracture.



Galeazzi fracture

- **Definition**: radial shaft fracture with potential disruption of the distal radioulnar joint
- **Epidemiology**: more common in children
- **Mechanism of injury**: fall on outstretched and pronated forearm
- **Clinical features**
  - Pain, deformity, and limited range of movement at the distal-third radial fracture site and wrist joint
  - Anterior interosseous nerve (AIN) palsy can occur.
- **Diagnostics**: x-ray
  - Shows a fracture of the junction of the distal third and middle third of the radius shaft with subluxation or dislocation of the distal radioulnar joint
  - A tear in the interosseous membrane can only be seen indirectly on the x-ray.
- **Management**
  - In children with uncomplicated fractures: closed reduction and casting
  - In adults or complicated fractures : open reduction and internal fixation (plating, K-wire fixation)

Galeazzi fracture

- **What is your diagnosis ?**
  - Galeazzi fracture (fracture of radius and dislocation of ulna)
- **Which nerve is affected in this fractured?**
  - Anterior interosseous nerve
- **What is your management ?**
  - Open reduction and internal fixation (ORIF)

In ER do AP x-ray with the next step?

a. Lateral X-RAY
b. Splint
c. Ask for MRI
d. Surgery
e. Reduction

❖ To rule out potential DRUJ instability

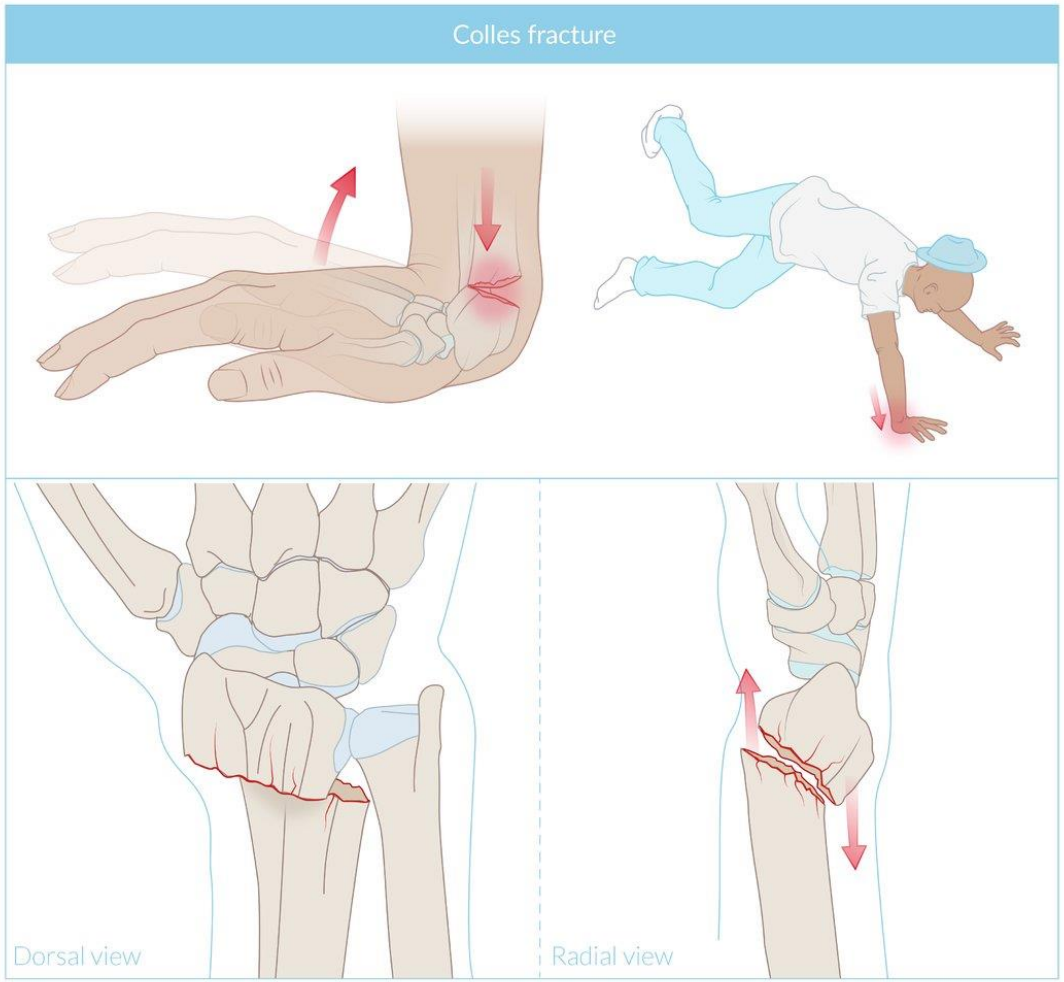
Distal radius fractures

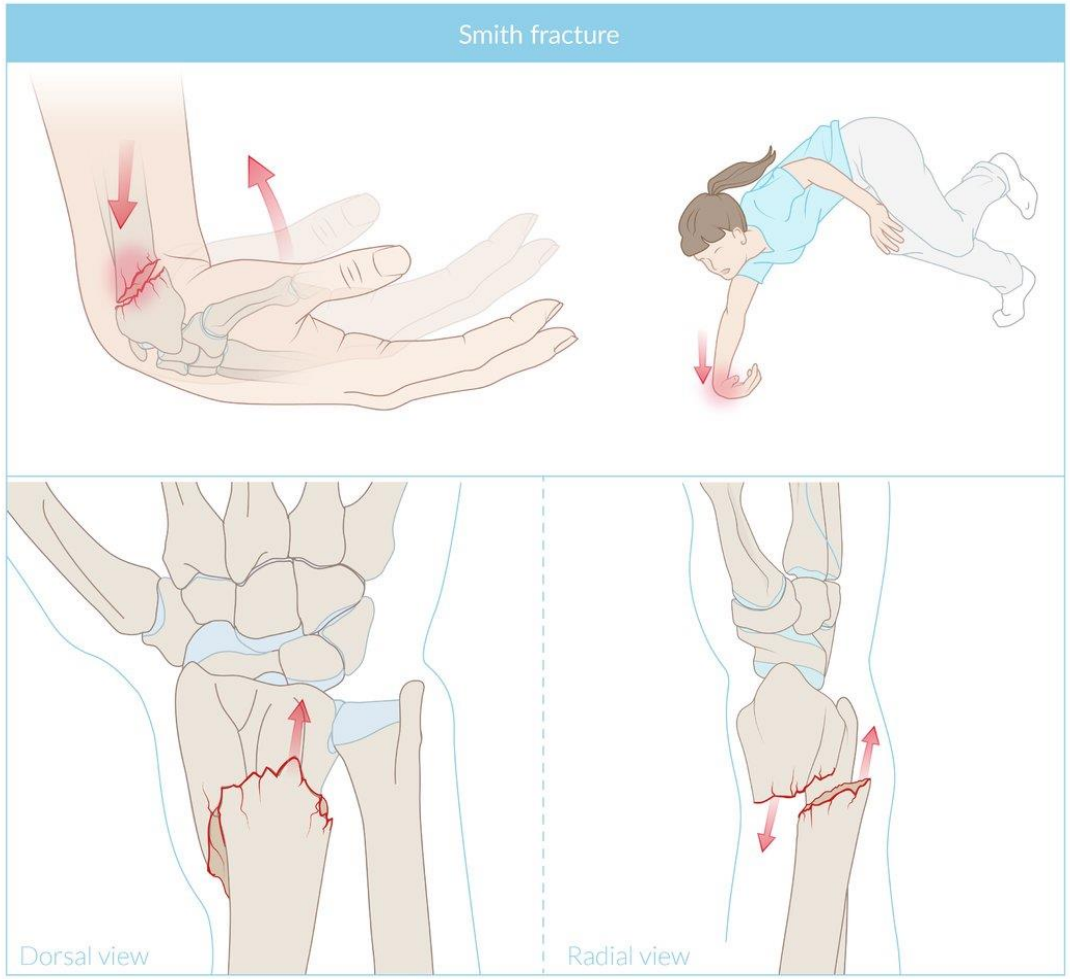
- **Epidemiology**: Bimodal peak incidence
  - 10–30 years of age; typically, due to high-energy trauma in males (The most common sites of childhood fracture)
  - > 65 years of age; typically, due to low-energy trauma in women with osteoporosis
- **Mechanism of injury**
  - Fall onto an outstretched hand
    - Dorsiflexed wrist (a typical protective action used to break one's fall) → extension fracture (Colles fracture)
    - Palmar-flexed wrist → flexion fracture (Smith fracture)

Classification

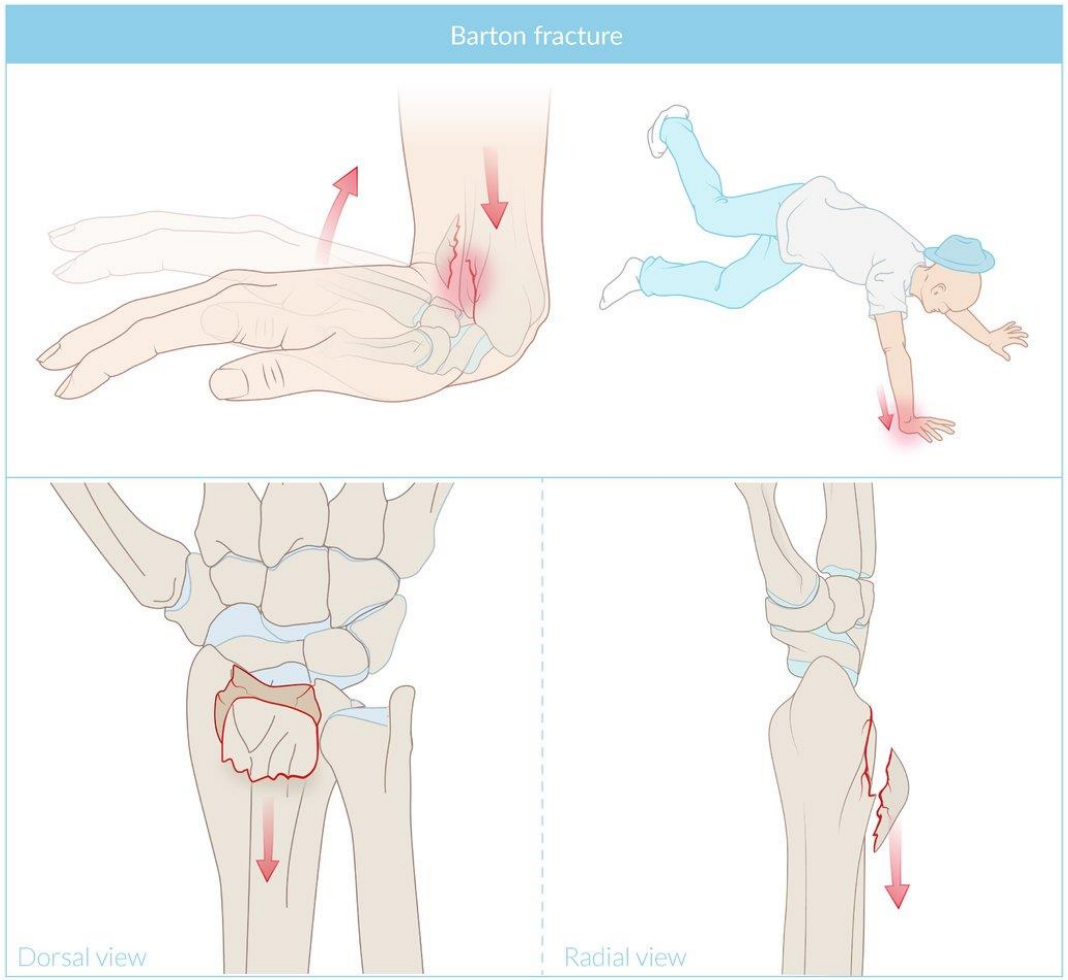
- **Colles fracture**
  - Extension fracture
  - The distal fragment is usually radially and dorsally displaced.
- **Smith fracture**
  - Flexion fracture
  - The distal fragment is radially and volarly displaced.
- **Barton fracture**
  - Extension fracture
  - Involves radial avulsion and dorsal displacement of the radiocarpal segment
- **Reverse Barton fracture**
  - Flexion fracture
  - Involves avulsion and volar displacement of the radiocarpal segment
- **Hutchinson fracture**: avulsion fracture of the radial styloid

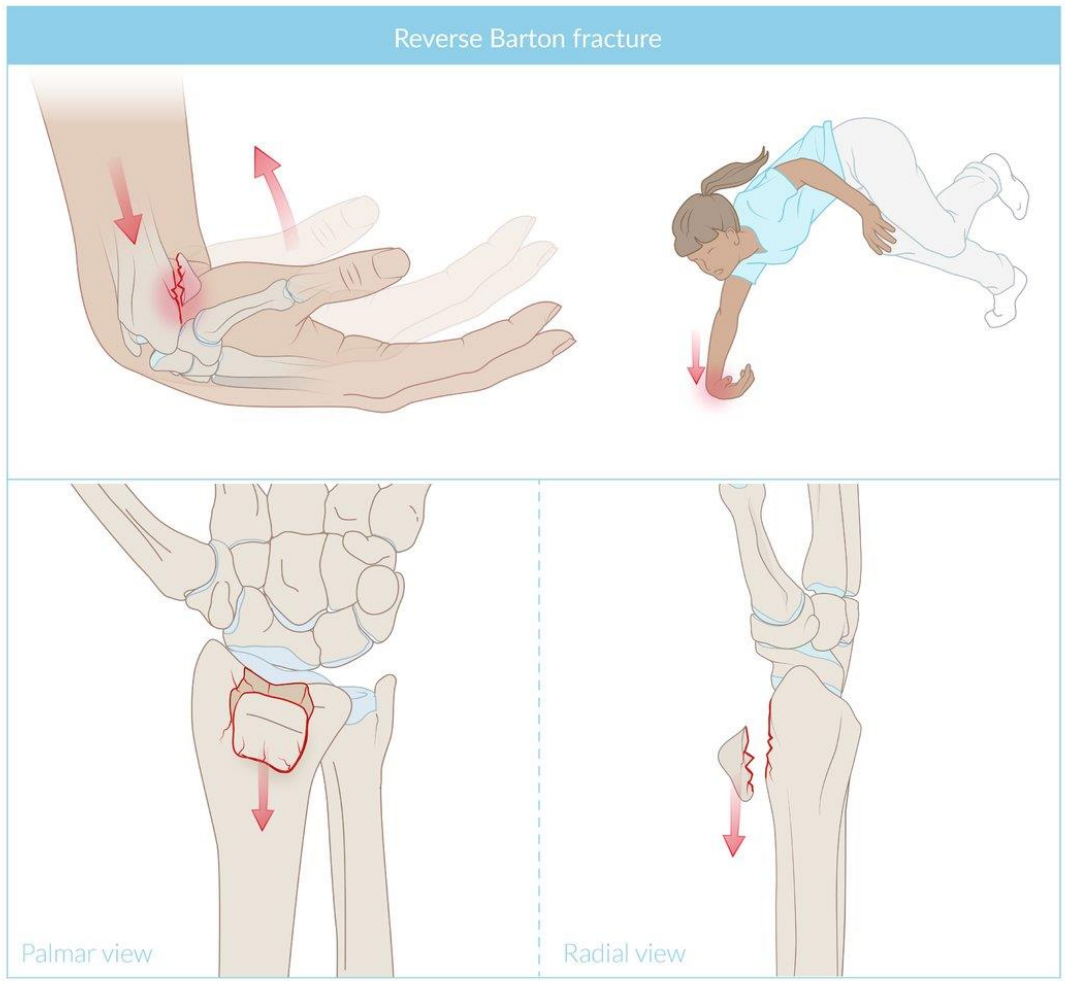
Classification





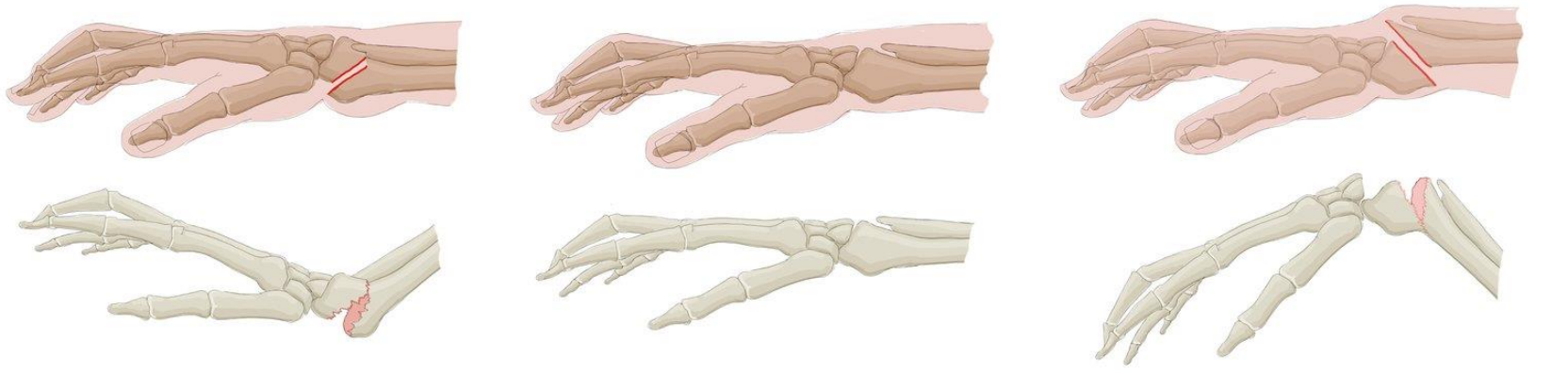
Classification





Clinical features

- Pain, tenderness, and soft tissue swelling
- Reduced range of motion at the wrist joint
- Wrist deformities based on the type of fracture
  - Colles fracture: dorsally displaced and dorsally angulated fracture (bayonet or dinner fork deformity)
  - Smith fracture: garden spade deformity



Colles fracture
(from fall on an outstretched hand)

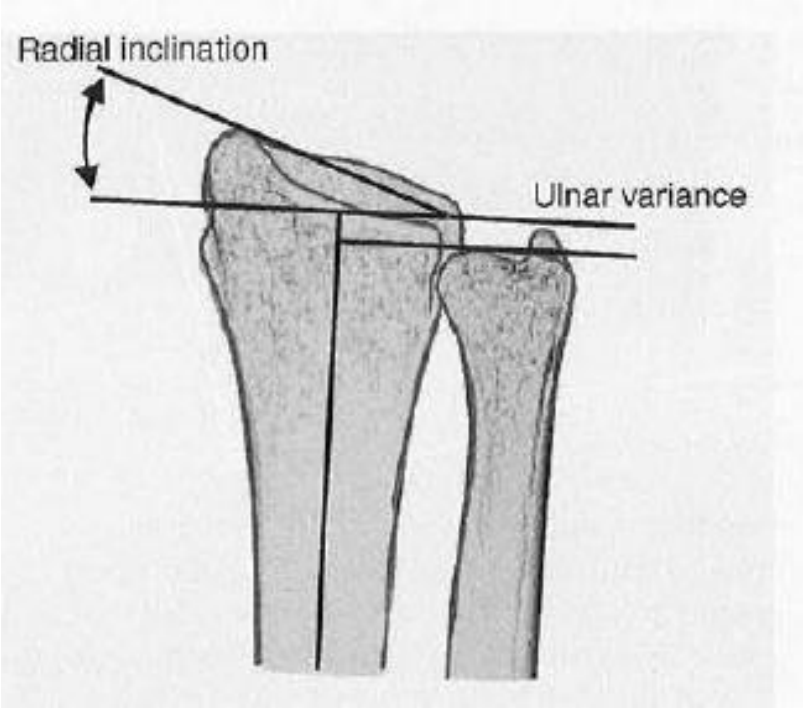
Normal

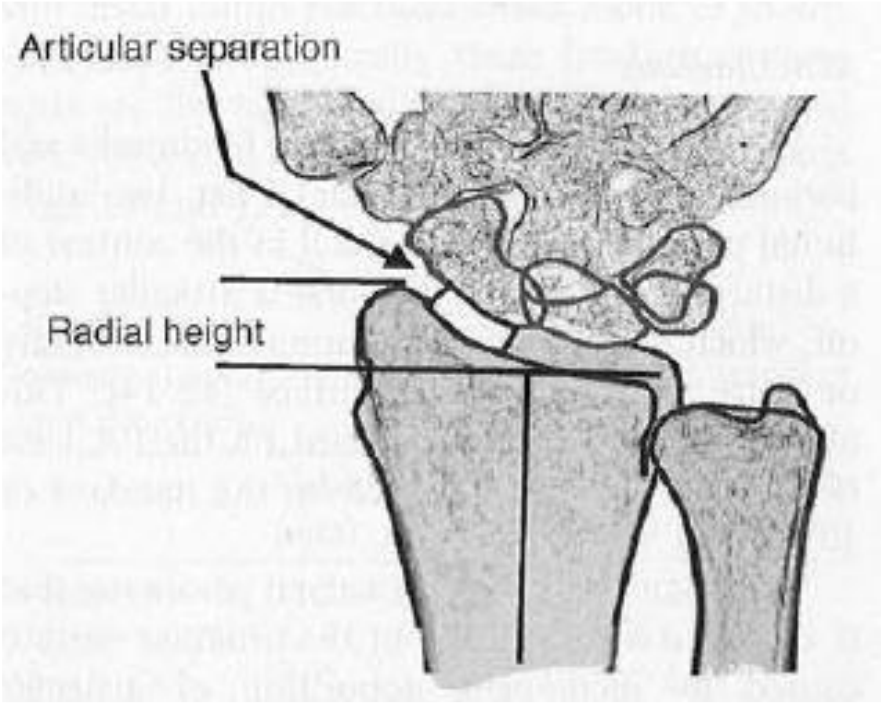
Smith fracture
(from a fall on a flexed wrist/direct blow to the back of the wrist)

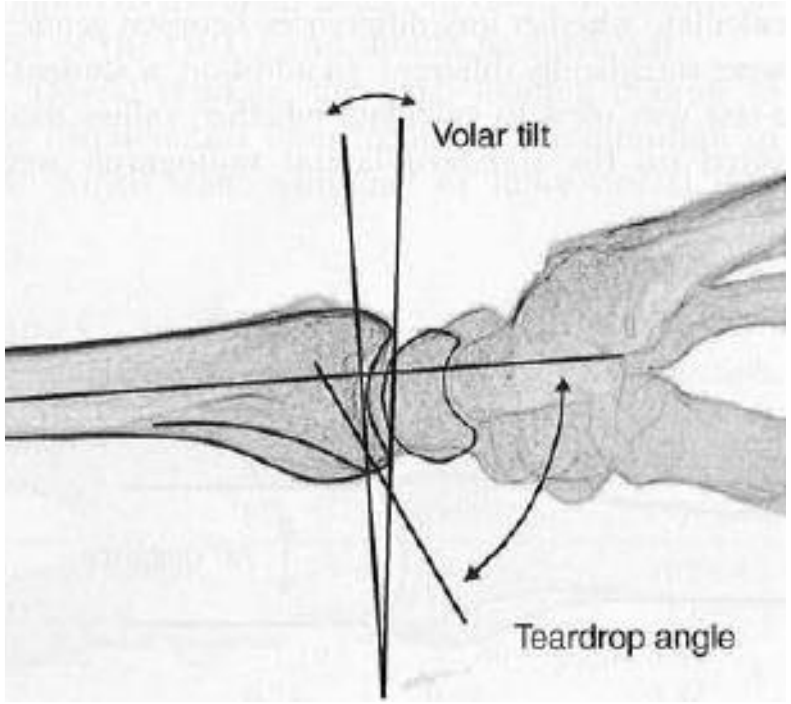
Diagnostics

- **Clinical evaluation**: peripheral perfusion, motor function, sensation and handedness (influence the management)
- **X-ray**: 3views; anterior-posterior, lateral, and oblique view of the wrist (including the carpal bones)
  - Radial inclination: In the posteroanterior view of a normal wrist joint, a line that is drawn tangential to the radial styloid, connecting the ends of the distal radius, makes a 30º angle with a line drawn perpendicular to the long axis of the radius
  - Volar inclination: In the lateral view of a normal wrist joint, a line that is drawn parallel to the articular surface of the distal radius makes a 10° angle with a line drawn perpendicular to the long axis of the radius.

Diagnostics







Management

- **Conservative therapy**
  - Closed reduction while applying longitudinal traction through the fingers
  - Dorsal forearm splint/casting and post-reduction x-rays
  - Cast removal after 6 weeks
- **Surgical therapy**
  - **Indications**
    - Open, significantly displaced, intra-articular, and/or unstable fractures
    - Neurovascular damage
  - **Procedures**
    - Open reduction and internal fixation
    - K-wire fixation
    - Internal fixation with fixed-angle plates
    - External fixation
  - Postoperative immobilization of the forearm and in a dorsal forearm splint

The treatment of this fracture is

a. Closed reduction and casting at ER
b. Closed reduction and casting at OR
c. Open reduction and fixation with plate
d. Open reduction and fixation with cast
e. Total wrist replacement

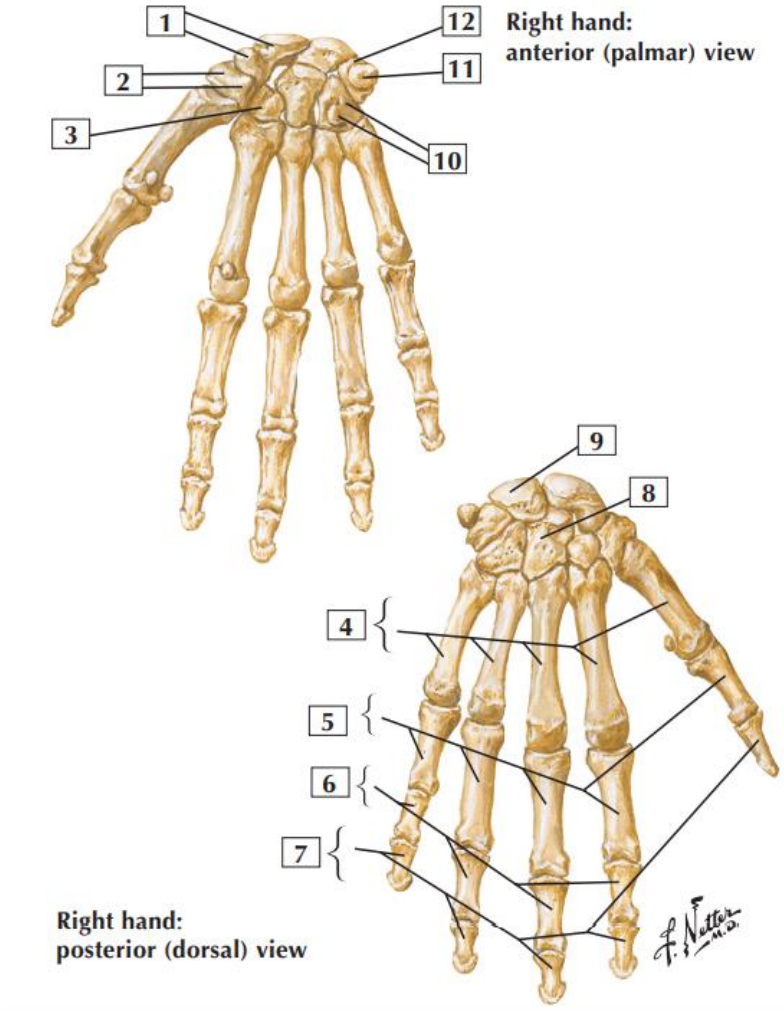
This pt. is presented to ER

- **Mention 4 structure may be injured (2 tendons, 1 artery, 1 nerve)**
  - Palmaris longus, Flexor carpi radialis tendons
  - Median nerve
  - Ulnar artery, radial artery
- **What is the medico-legal importance ?**
  - Suicidal attempt

Za Hando

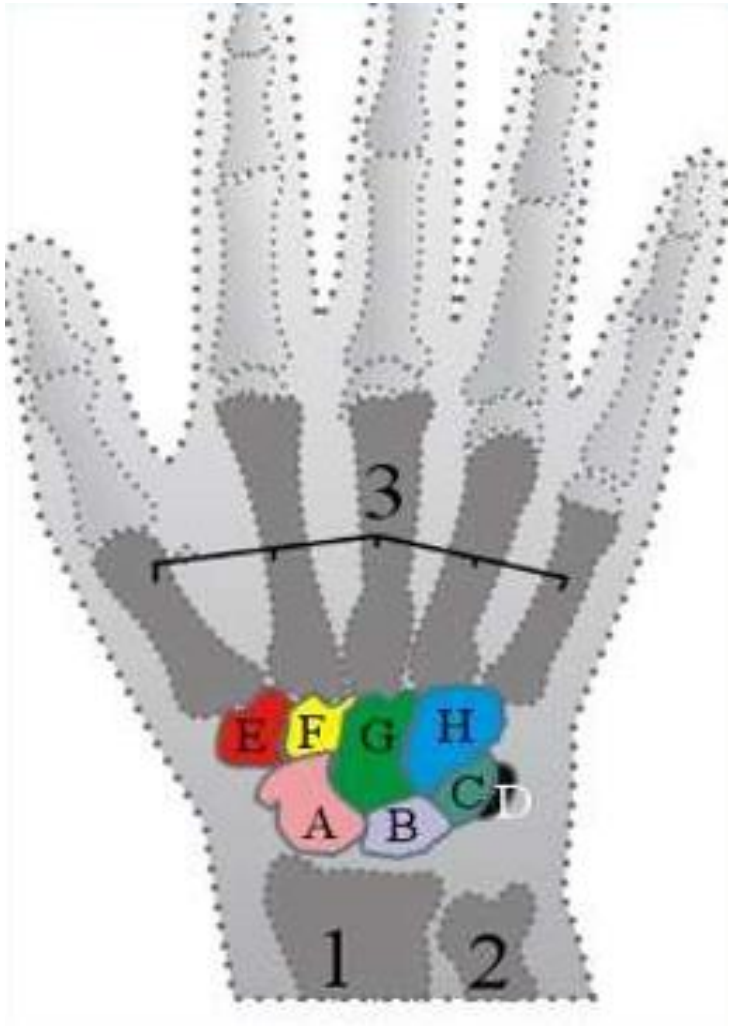
Bones of Wrist and Hand

1. Scaphoid and Tubercle
2. Trapezium and Tubercle
3. Trapezoid
4. Metacarpal bones
5. Proximal phalanges
6. Middle phalanges
7. Distal phalanges
8. Capitate
9. Lunate
10. Hamate and Hook
11. Pisiform
12. Triquetrum



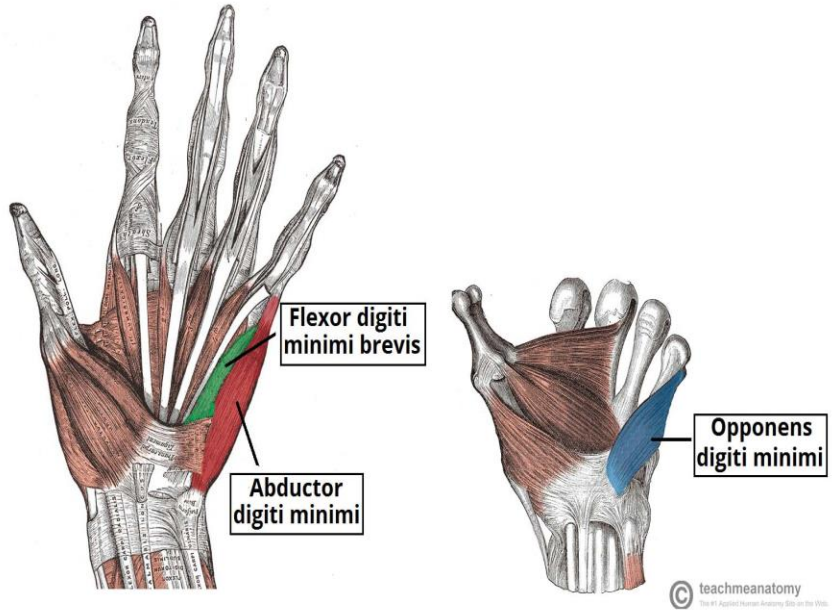
The name of the bone in green marked with letter G is

a. Scaphoid
b. Capitate
c. Lunate
d. Pisiform
e. Trapezium



Anatomy question

- Name of the muscle
  - Flexor dididti mini brevis



Scaphoid fracture

- **Epidemiology**
  - Most common carpal bone fracture (50–80%)
  - Peak incidence: 15–19 years
- **Mechanism of injury**
  - Indirect trauma when an individual falls onto the outstretched hand with a hyperextended and radially deviated wrist
- **Classification**: According to the localization of the fracture
  - Proximal third, Middle third (Most common), Distal third
- **Clinical features**
  - Pain when applying pressure to the anatomical snuffbox

Diagnostics

1. **Best initial test**
   - x-ray of the wrist in a posteroanterior, lateral, 45° oblique, and possibly scaphoid view (a x-ray view with ulnar deviation of the wrist and full pronation of the forearm to eliminate overlapping shadows of the radius)
   - ~ 25% of scaphoid bone fractures are initially undetectable on x-ray.
2. **If initial x-ray is negative, one of the following**
   - If the patient is not willing to immobilize the wrist: MRI of the wrist
   - If the patient is willing to immobilize the wrist: cast the wrist and repeat an x-ray in 10–14 days
3. **If repeat x-ray is normal but continued clinical suspicion of scaphoid fracture**: MRI of the wrist

Management

- Pain management:
  - Over-the-counter analgesics and strengthening exercises
- Nondisplaced fractures or displaced fractures < 1 mm:
  - Wrist immobilization via thumb spica cast for a minimum of 6–8 weeks with x-ray re-evaluation in 2 weeks
- Surgical treatment
  - Usually, internal fixation
  - Indications are complicated cases that include:
    - Displaced fractures > 1 mm
    - Open fractures
    - Proximal pole fractures high risk of AVN

Complications

- Avascular necrosis (especially in proximal fractures that disrupt blood flow from branches of the radial artery) of the scaphoid bone in up to 50% of cases
- Nonunion (especially in proximal fractures) in approx. 10%
- Delayed union of fracture (more common in smokers)
- Instability among carpal joints
- Post-traumatic arthritis

- **Note**: Fractures in the distal third tend to heal better because of the retrograde blood supply reaching the bone from the distal pole.

Scaphoid fracture

سنوات (1)

❖ **What is your diagnosis ?**

- Scaphoid fracture

سنوات (1)

❖ **What is the most common complication for this fracture ?**

- Avascular necrosis

سنوات (1)

❖ **Mention other complications**

- Carpal tunnel
- Osteoarthrosis

LOW YIELD

Metacarpal fractures

- **Epidemiology**: Most commonly involve the 5th metacarpal (Boxer fracture)
- **Mechanism of injury**: Direct or indirect trauma to the metacarpal bones (e.g., striking a firm object with a clenched fist)
  - **4th metacarpal**: Professional boxer fracture
  - **5th metacarpal**: Non-professional boxer fracture
- **X-ray**: Definitive diagnosis typically requires three radiographic views: anteroposterior, lateral, and oblique
- **Management**: The majority of metacarpal fractures can be treated conservatively: Closed reduction and immobilization

LOW YIELD

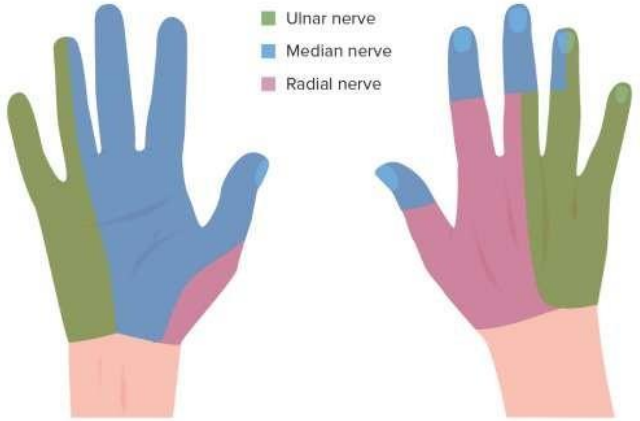
Phalanges fractures

- **Mechanism of injury**: Direct or indirect trauma
- **Management**
  - The majority of metacarpal fractures can be treated conservatively
  - Angulation or displacement consider surgical (any displacement will result in discrimination between bone and tendon length resulting in weakness)
  - Tuft fractures are managed as an open fracture (4As)
    1. Analgesia
    2. Anti-tetanus
    3. Adequate irrigation and debridement within 4-8 hrs
    4. Antibiotic prophylaxis: first or second generation cephalosporine + aminoglycoside (high energy) + penicillin (barnyard).

Hand Muscles

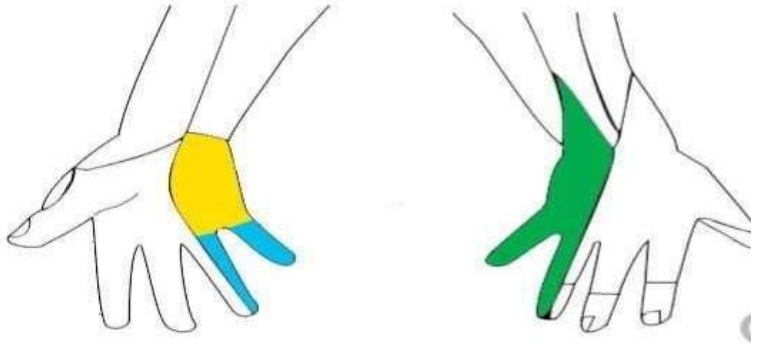
❖**Which of the following muscles is not supplied by the nerve that supplies the blue area**

a. Adductor pollicis
b. Flexor pollicis brevis
c. 1st thenar
d. 2nd thenar



❖**Which of these muscles is supplied by nerve which highlighted with green color**

a. Adductor pollicis
b. 1st lumbrical
c. Second lumbrical
d. Oppones policies
e. Flexor pollicis brevis



Hand infections & Common Hand Disorders

LOW YIELD

Hand infection – Principles of treatment

- **Antibiotics**
  - flucloxacillin, fucidic acid or cephalosporin
- **Rest, splintage and elevation**
  - The hand must be splinted in the position of safe immobilization
    - With the wrist slightly extended
    - The MCP joints in full flexion
    - The IP joints extended
    - the thumb in abduction
- **Drainage**
  - The incision should be planned to give access to the abscess without causing injury to other structures but never at right angles across a skin crease
- **Rehabilitation**

LOW YIELD

Cellulitis

- **Definition**: Acute inflammation of the connective tissue of the skin
- **Etiology**: Most common: Streptococcus, Staphylococcus
- **Clinical features**: Red, hot, irritated and painful “Tight, glossy, "stretched" appearance of the skin“ with Skin lesion or rash (macule)
- **Treatment**: Antibiotic / NSAID / Splintage

LOW YIELD

Paronychia

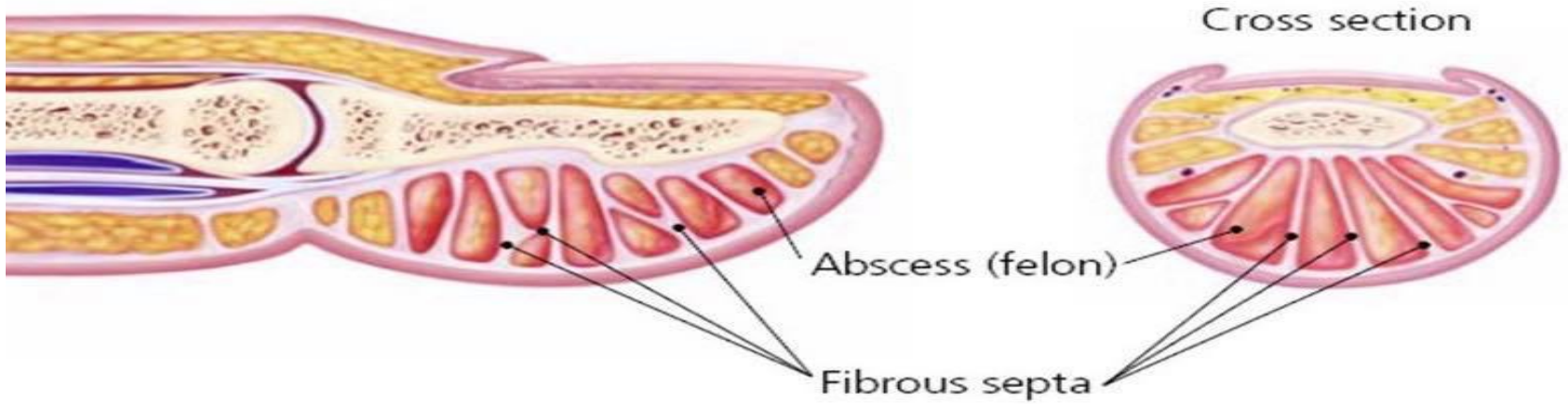
- **Definition**: infection of the perionychium (also called eponychium), which is the epidermis bordering the nail ,it is the commonest hand infection
- **Etiology**: Staphylococcus aureus and Streptococcus pyogenes
- **Clinical features**: The edge of the nail-fold becomes red and swollen and increasingly tender. A tiny abscess may form in the nail-fold
- **Treatment**:
  - Antibiotics and frequent warm soaks
  - If pus is present, it must be released by an Incision at the corner of the nail-fold in line with the edge of the nail
  - If pus has spread under the nail, part or all of the nail may need to be removed
- **Chronic paronychia**: due to fungal infection or inadequate drainage of an acute infection

LOW YIELD

Pulp space infection

❖What is the pulp space ?

- The distal finger pad is essentially a closed fascial compartment filled with compact fat and subdivided by radiating fibrous septa
- A rise in pressure within the pulp space causes intense pain and, if unrelieved, may threaten the terminal branches of the digital artery which supply most of the terminal phalanx



LOW YIELD

Pulp space infection

- **Etiology**: usually due to prick or splinter injury
- **Microbes**: Staphylococcus aureus
- **Clinical features**: The fingertip is swollen, red and acutely tender
- **Treatment**: Antibiotics, if pus has formed it must be released via a small incision over the site of maximal tenderness
- **Complications**:
  - osteomyelitis
  - sinus formation
  - digital vessel obliteration
  - flexor tenosynovitis
  - septic arthritis of DIPJ

LOW YIELD

Herpetic whitlow

- **Etiology**: HSV-1; auto-inoculation or during dental surgery
- **Clinical features**: Small vesicles form on the fingertip, then coalesce and ulcerate
- **Treatment**: Aciclovir

LOW YIELD

Deep fascial space infection

- **Etiology**
  - Directly by penetrating injuries
  - Secondary spread from a web space or an infected tendon sheath
- **Clinical features**: Little or no swelling but extensive tenderness and the patient holds the hand as still as possible
- Occasionally, deep infection extends proximally across the wrist, causing symptoms of Median nerve compression

LOW YIELD

Bites

Dog bite (70%)	Cat bite (10%)	Human bite (15%)
Rarely involve hand (lower part of body)	More frequently lead to infection, deeper penetration (in face)	• Often delayed presentation • May not give accurate history • Fist fights cause 60-80% of human bites
Streptococcus, Staphylococcus, Pasteurella multocida	> 50% Pasteurella multocida	S. aureus, Streptococci
irrigation, debridement, delayed 10 suture, Augmentin	Antibiotics and surgical drainage	Augmentin

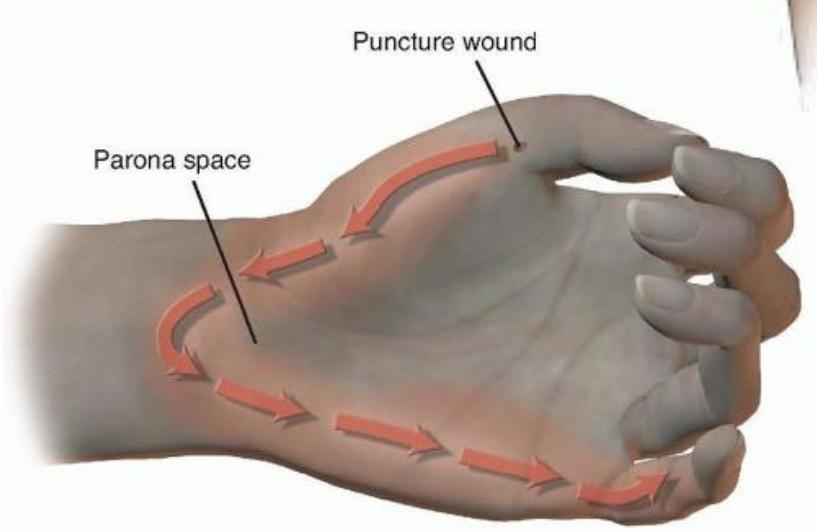
LOW YIELD

Human bites

- Human bite injuries to the hand usually result from a direct bite or a "fight bite" (also known as a "clenched-fist" injury).
- Direct human bite injuries are often visually evident. A clenched-fist injury typically is characterized by a 3- to 5-mm laceration on the dorsum of the hand or overlying an MCP joint
- A tooth may penetrate an extensor tendon and MCP joint capsule, sometimes fracturing a metacarpal or phalangeal bone .
- Do x-ray: to exclude fractures

Tendon sheath

- The tendon sheath is a closed compartment extending from the distal palmar crease to the DIP joint.
- In the thumb and little finger, the sheaths are co-extensive with the radial and ulnar bursae, which envelop the flexor tendons in the proximal part of the palm and across the wrist; these bursae also communicate with Parona's space in the lower forearm



Tenosynovitis

- **Tenosynovitis** is the inflammation of a tendon (tendinitis) and its synovial sheath (synovitis)
- **Etiology**
  - Non-infectious tenosynovitis (most common)
    - Overuse tendinitis: repetitive use of the involved tendon (e.g., texting, typing, gaming)
    - Systemic diseases (e.g., rheumatoid arthritis, sarcoidosis, diabetes mellitus)
  - Infectious tenosynovitis
    - Direct inoculation following penetrating trauma
      - Animal/human bites
      - IV drug use
      - Thorn prick injuries
    - Hematogenous spread of infection
      - Neisseria gonorrhoeae
      - Mycobacterium tuberculosis

Tenosynovitis – Clinical features

- Tendons of fingers and wrist are commonly affected
- First sign: pain on passive extension of the affected tendon (affected fingers are slightly flexed at rest)
- Swelling
- Palpable crepitation
- Fever and erythema in the case of bacterial infections
- Late signs
  - Tenderness along the affected tendon
  - Sharp, stabbing pain worsened by activity, followed by constant dull ache at rest

Tenosynovitis – Subtypes and variants

❖ Pyogenic tenosynovitis

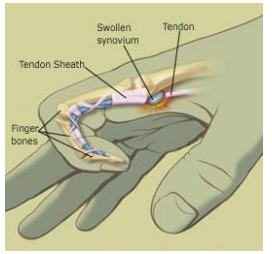
- **Epidemiology**: It is uncommon but Dangerous. It usually follows a penetrating injury
- **Etiology**: Staphylococcus aureus
- **Management**
  - Analgesics and broad-spectrum IV antibiotics (e.g., cephalosporins, clindamycin)
  - Splinting and elevation of the affected finger (to decrease the edema)
  - Surgery: incision and drainage, saline irrigation, and open debridement of necrotic/infected tissue

The main & first step in management is

a. I.V antibiotic
b. Oral antibiotic
c. NSAIDs
d. Steroid injection
e. Surgery for drainage

Tenosynovitis – Subtypes and variants

❖Stenosing tenosynovitis (trigger finger)



- **Epidemiology**: Sex: ♀ > ♂ (6:1), Age: > 40 years
- **Etiology**: usually idiopathic
- **Pathophysiology**: fibrocartilaginous metaplasia of the tendon sheath of the A1 annular pulley → loss of smooth gliding of the finger flexor tendons under the annular pulley → finger gets locked in flexed position
- **Clinical features** (it's a clinical diagnosis)
  - Trigger finger: locking of a finger in flexed position which releases suddenly with a snap/pop on extension; often painful
  - Often associated with tenderness and a palpable nodule at the base of the metacarpophalangeal joint
  - Mostly affects thumbs and ring fingers
- **Management**: corticosteroid injection → refractory cases need operation

Stenosing tenosynovitis (trigger finger)

- **What is your diagnosis ?**
  - Trigger Finger
- **What is your initial management ?**
  - Corticosteroid injection
- **If this patient return to you with recurrence of the deformity within 4 months what is your management ?**
  - Second corticosteroid injection
- **If this patient still refractory to your management what is your next step ?**
  - Surgery (incision over the distal palmar crease, or in the MCP crease of the thumb – the A1 section of the fibrous sheath is incised until the tendon moves freely

Tenosynovitis – Subtypes and variants

❖ De Quervain tenosynovitis

- **Description**: noninflammatory thickening of the tendons of the abductor pollicis longus and extensor pollicis brevis due to myxoid degeneration
- **Epidemiology**: Sex: ♀ > ♂, Age: 30–50 years
- **Etiology**
  - Repetitive/prolonged abduction and extension of the thumb: often seen in golfers and tennis players, individuals who text a lot, and young parents (due to the repeated strain of lifting the baby)
  - Inflammatory conditions such as rheumatoid arthritis
- **Clinical features** (it's a clinical diagnosis)
  - Pain with or without swelling of the radial styloid
  - Pain may radiate to thumb or elbow, exacerbated by movement/grasping objects.
  - Positive Finkelstein test: examiner grasps the affected thumb and exerts longitudinal traction across the palm of the hand towards the ulnar side, which causes pain

De Quervain tenosynovitis

❖ **What is this test used to diagnose ?**

- De quervain disease

❖ **Which extensor compartment of the wrist is affected ?**

- 1st extensor compartment of the wrist (extensor pollicis brevis, abductor pollicis longus)

❖ **What is your management ?**

- NSAIDs and rest
- Corticosteroid injection
- Resistant cases need an operation, which consists of slitting the thickened tendon sheath

Finkelstein's test

Carpal tunnel syndrome

❖Risk factors

- Previous fracture of the wrist, Manual work, Rheumatoid arthritis, Pregnancy, Osteoarthritis, Systemic amyloidosis, Renal failure and dialysis-associated deposition of amyloid, Diabetes mellitus, Hypothyroidism, Acromegaly

❖Clinical features

- **Symptoms**
  - Develop in the areas innervated by the median nerve: palmar surface of the thumb, index, and middle fingers, and radial half of the ring finger.
    - Paresthesia: burning sensation, tingling, Loss of sensation/numbness, Pain
- **Examination findings**: thenar atrophy

Carpal tunnel syndrome

❖ Diagnostics

- Provocative tests for CTS
  - Phalen test: The patient's wrist is held in full flexion (90°) for one minute
  - Tinel sign: The examiner percusses or taps with the fingertips over the carpal tunnel
- Electrophysiological tests: Nerve conduction studies (confirmatory test)

❖ Treatment

- Conservative management
  - Immobilization
  - Glucocorticoids: First-line: steroid injection, e.g., methylprednisolone
- Surgery: Open or endoscopic release of the transverse carpal ligament

Dupuytren's contracture

❖ Epidemiology

- Peak incidence: 40–60 years, Sex: ♂ > ♀

❖ Etiology

- The exact etiology is unknown

❖ Predisposing factors

- **Genetic predisposition**: ~ 70% of patients have a positive family history.
- **Risk factors**: these factors may cause ischemic injury of the palmar fascia with subsequent development of Dupuytren contracture in genetically predisposed individuals
  - Cigarette smoking, Recurrent trauma, Diabetes, Alcohol abuse, Liver cirrhosis

Dupuytren's contracture

❖Pathophysiology

- Dupuytren's contracture (palmar fibromatosis) is a fibroproliferative disorder of the palmar fascia
- Injury (trauma/ischemia) to the palmar fascia triggers myofibroblasts → fibroblast proliferation and collagen (collagen type III) deposition → thickening of the palmar fascia → formation of nodules in the palmar fascia
- The nodules are adherent to the overlying dermis → characteristic puckering of palmar skin
- Nodules progress to form cords in the palmar fascia → flexion contractures of the palmar fascia

❖Clinical features

- The 4th and 5th fingers are most commonly involved
- Skin puckering near the proximal flexor crease: earliest sign
- Flexion contracture of affected fingers

Dupuytren's contracture

- The initial description of Dupuytren's disease diathesis included 4 factors:
  1. The patient is below the age of 50 years old (middle age)
  2. Positive family history 60%
  3. Both of the hands are affected
  4. The palm is puckered, nodular and thick. (Garrod's pads)

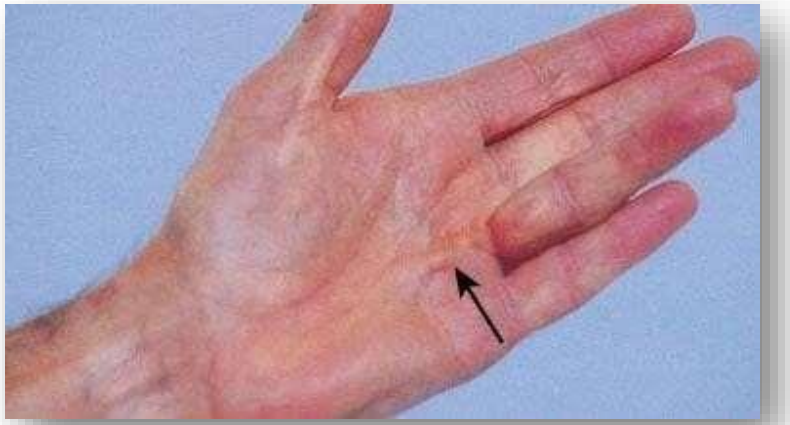
- Similar nodules may be seen on the soles of the feet Ledderhose's nodules

Dupuytren's contracture

- **Conservative therapy**: Indicated in patients with early disease (skin puckering; nodules) and no functional disability.
  - Observation
  - Physiotherapy
  - Hand splint/brace
- **Intralesional injections**: Indicated in patients with rapidly progressing disease or painful nodules
  - Corticosteroids (triamcinolone)
  - Collagenase
- **Surgery**: Indicated in patients with functional disability due to contractures
  - Fasciotomy
  - Fasciectomy
- **Prognosis**
  - Variable prognosis
  - Recurrence rates are high, even after surgery (~ 60%)

Old age patient present with this lesion

- **What is your diagnosis ?**
  - Dupuytren's contracture
- **If you find similar lesion on the patient soles, what are they called ?**
  - Ledderhose’s nodules
- **What is your management ?**
  - Conservative
- **What are the risk factors ?**
  - Family history (most important)
  - Cigarette smoking, Recurrent trauma, Diabetes, Alcohol abuse, Liver cirrhosis



Mallet finger

- **Affected tendon(s) or ligament(s)**
  - Extensor digitorum tendon
- **Mechanism of injury**
  - Sudden hyperflexion of the DIP (forced flexion) → avulsion/rupture of the distal portion of the ED tendon from the distal phalanx
  - May be associated with an avulsion fracture of the distal phalanx
- **Clinical features**
  - Loss of extension of the DIP
- **Treatment**
  - Conservative: splint in extension position
  - Surgical repair for: Displaced fracture, ≥ 45-degree extension deficit

Mallet finger

❖**The deformity shown in this picture is**

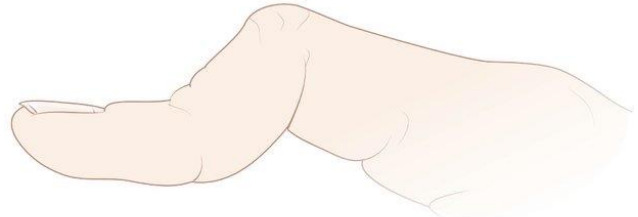
- Mallet finger

❖**What is the affected tendon ?**

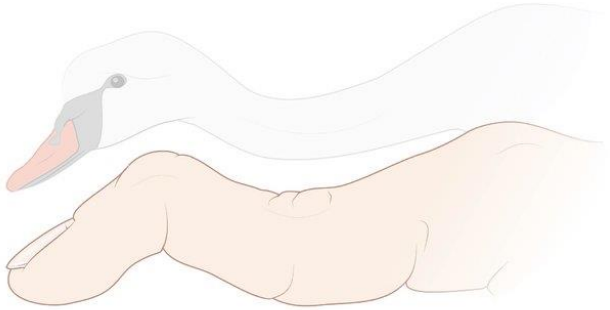
a. Flexor digitorum profundus
b. Flexor digitorum superficialis
c. Extensor pollicis brevis
d. Terminal extensor tendon

Hand manifestation in rheumatology

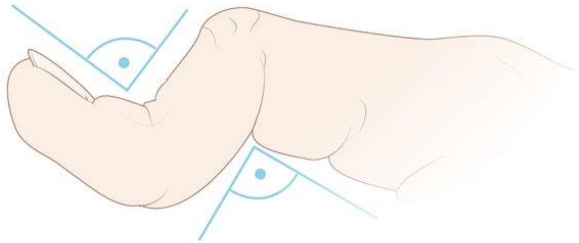
- **Boutonniere deformity**: PIP flexion and DIP hyperextension.
- **Swan neck deformity**: PIP hyperextension and DIP flexion
- **Hitchhiker thumb deformity (Z deformity of the thumb):** hyperextension of the interphalangeal joint with fixed flexion of the MCP joint
- Ulnar deviation of the fingers



Boutonniere deformity



Swan neck deformity

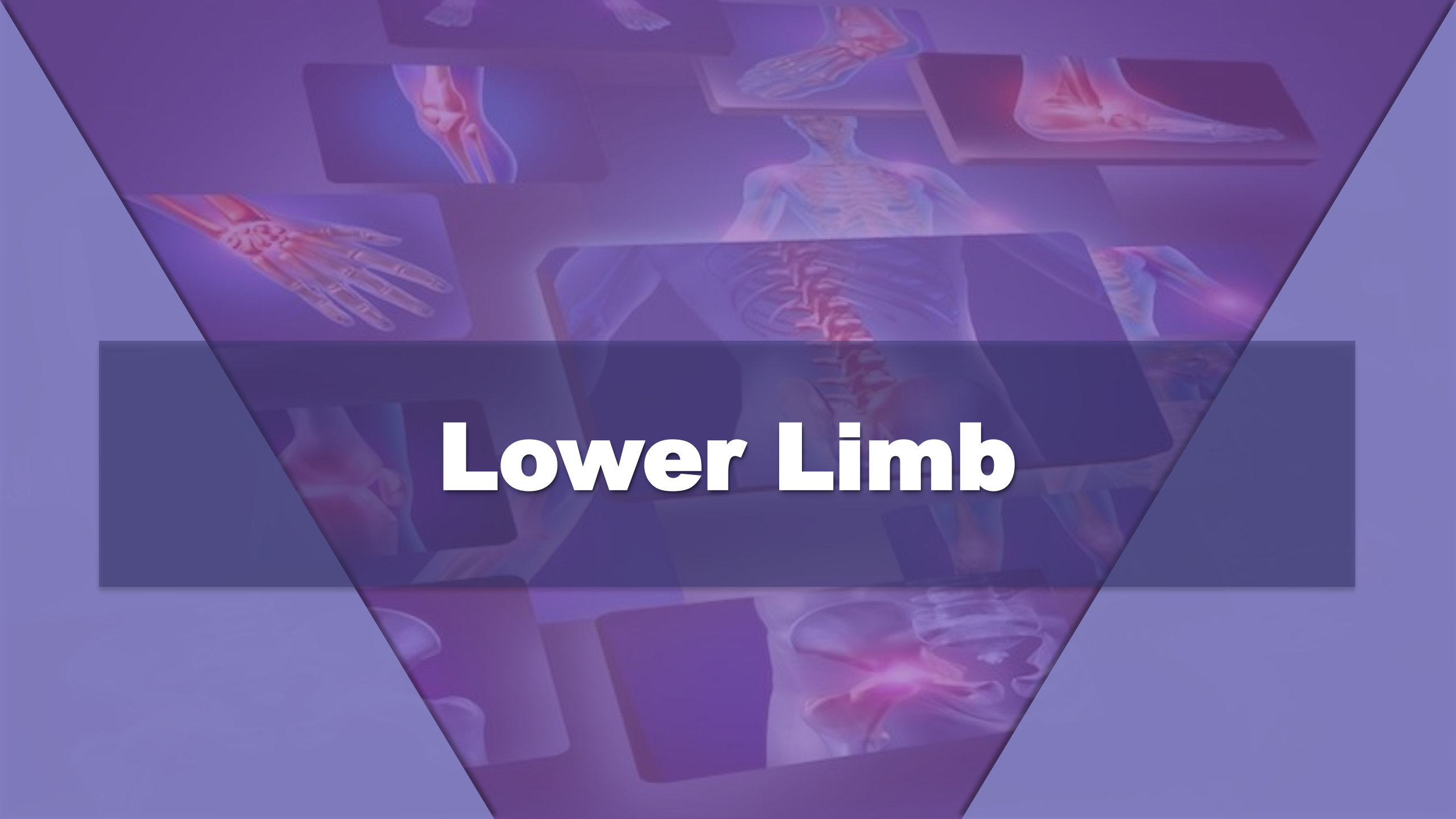


Z deformity

What is your diagnosis ?

- Syndactyly (fused finger)

- It is considered the most common congenital malformation of the limbs

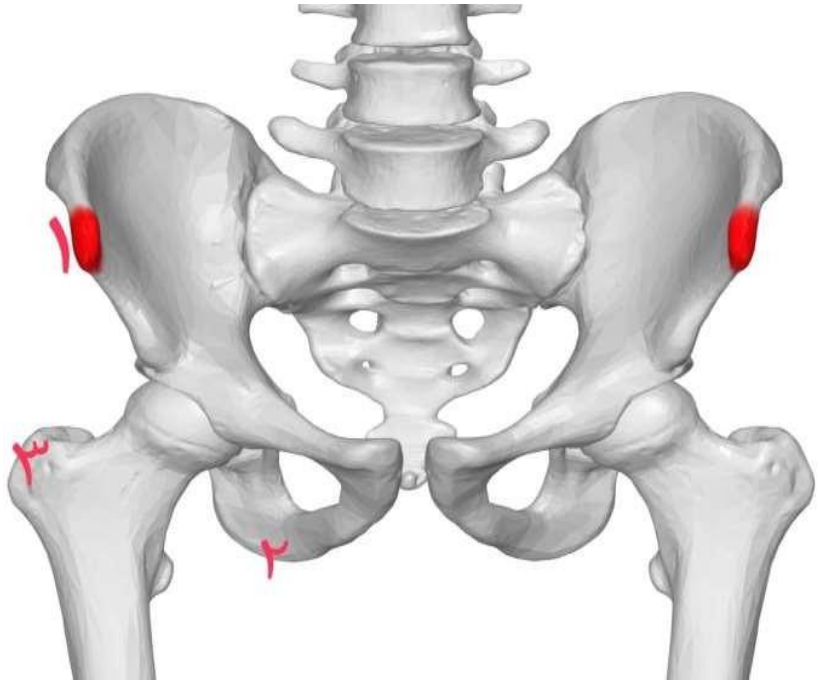


Lower Limb

Pelvis

The name of the structures and the muscle attached to it

1. Sartorius – ASIS
2. Hamstring muscle – Ischial tuberosity
3. Hip rotator muscle – Greater trochanter



Pelvic fracture

❖Epidemiology

- Peak incidence: 15–28 years
- 20% of multiple trauma patients have a pelvic injury.
- 60% of patients with pelvic injury have multiple trauma.

❖Mechanism of injury

- High speed car and motorcycle accidents
- Falls, especially in the elderly

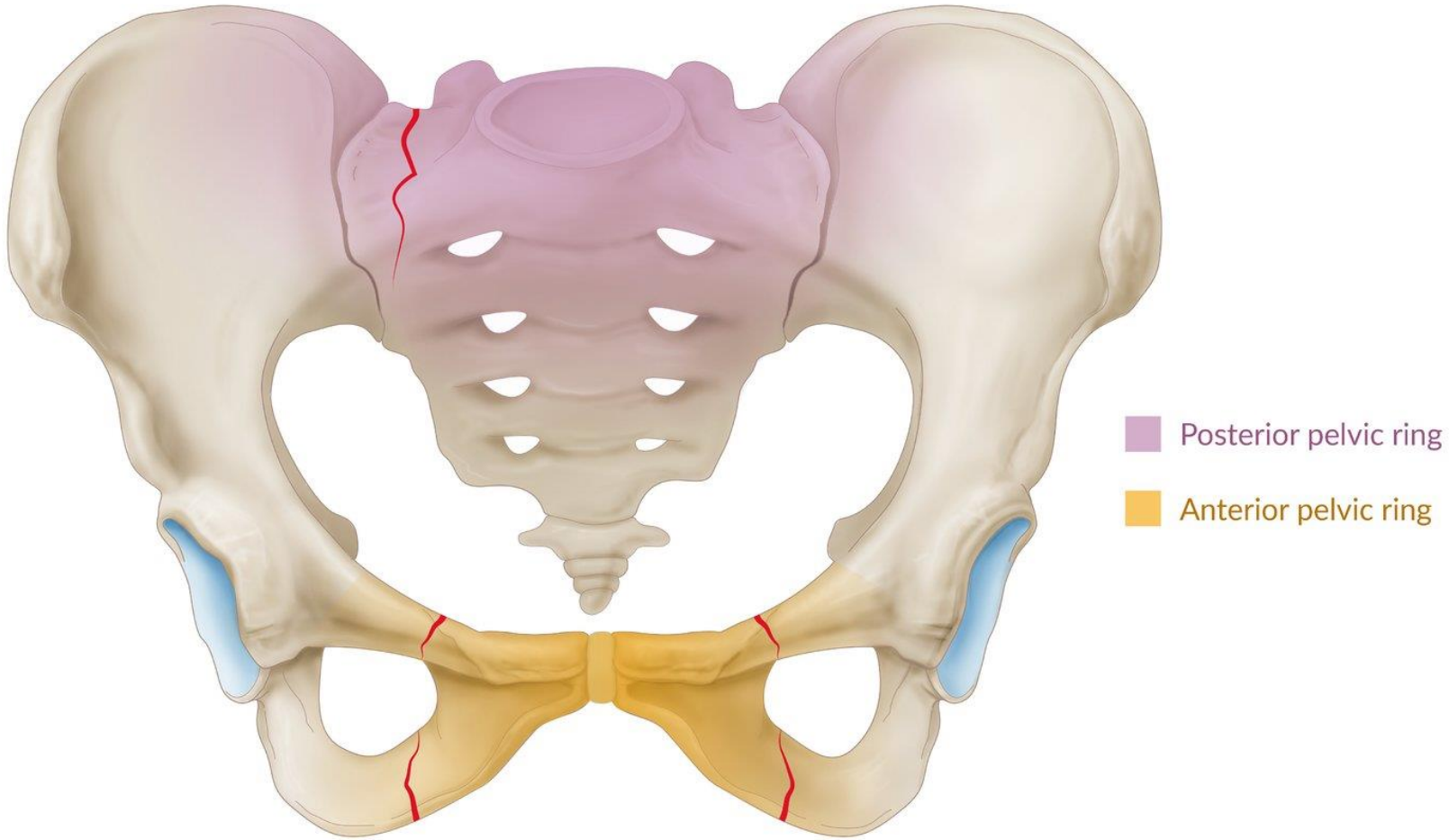
❖Clinical features

- Pelvic pain
- Tilted pelvis and unequal leg length with reduced range of motion in the hip joint
- Pelvic instability
- Labial, scrotal, flank, and inguinal hematomas

Pelvic fracture

- Concomitant injuries may occur
  - Urethral injury: blood at urethral meatus, high-riding or nonpalpable prostate, perineal swelling
  - Bladder injury: frank hematuria
  - Rectal, vaginal, perineal lacerations suggest an open fracture
  - Acute abdomen in abdominal trauma (bowel perforation, spleen, liver rupture)
  - Neurovascular injury : decreased rectal tone, perianal paresthesia, compromise of lower limbs
  - Axial and long bone injuries

Classification – Pelvic ring

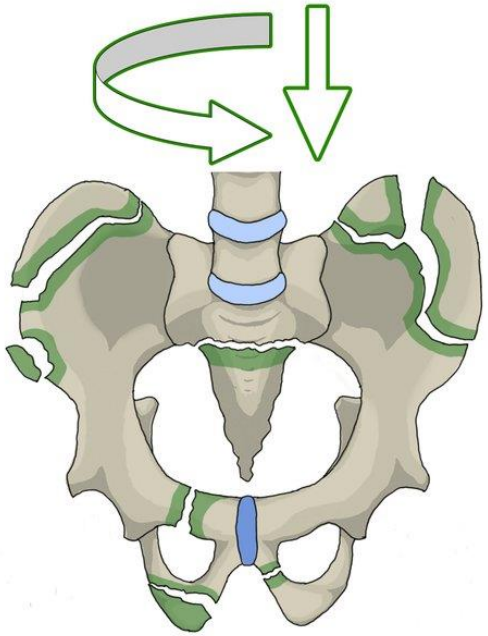


Classification

Classification is based on fracture location and remaining stability of pelvic ring

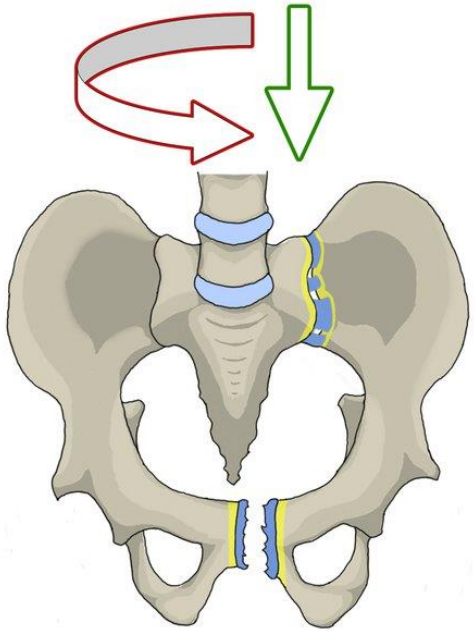
- **Type A**: stable or minimally displaced (Isolated pelvis fracture)
  - **Type A1**: fracture of the pelvic edge (avulsion or pelvic wing)
  - **Type A2**: fracture of the anterior pelvic ring
  - **Type A3**: Transverse sacral fracture of the sacrum/coccyx
- **Type B**: pelvic ring fractures that are rotationally unstable and vertically stable (anterior and posterior pelvic ring affected)
  - **Type B1**: symphysic diastasis (“open-book” injury; external rotation)
  - **Type B2**: lateral compression injury (internal rotation)
  - **Type B3**: bilateral fractures
- **Type C**: injury of the pelvic ring with rotational and vertical instability (The posterior pelvic ring is completely unstable)
  - **Type C1**: unilateral fracture of the iliac bone (C1-1), sacroiliac dislocation (C1-2), or sacral fracture (C1-3)
  - **Type C2**: bilateral fracture with one side type B fracture and one side type C fracture
  - **Type C3**: bilateral fracture with bilateral type C fractures

Classification



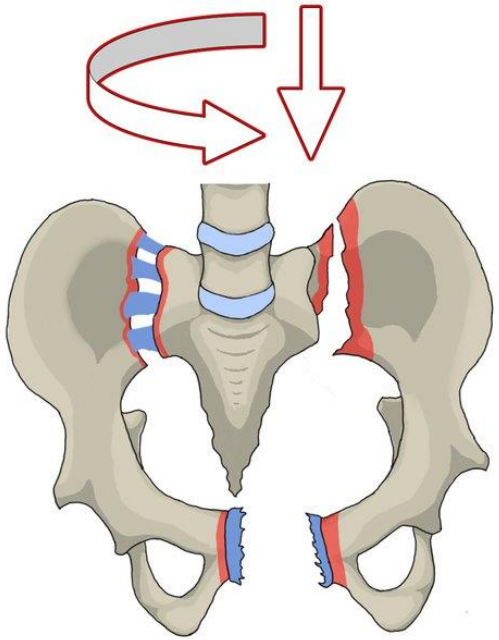
A

Stable or minimally displaced fracture (fracture of the pelvic edge, the anterior pelvic ring, or the sacrum/coccyx)



B

Rotationally unstable, vertically stable fracture (symphysis diastasis, diastasis of the sacroiliac joint)



C

Injury of the pelvic ring with rotational and vertical instability (anterior and posterior pelvic ring fracture with bilateral diastasis of the sacroiliac joint and symphysis diastasis)

Diagnostics

- **Pelvic X-ray**: (anterior-posterior, as well as special inlet and outlet views; views of the obturator and ala): confirm pelvic fracture
- **CT (in stabilized patients)**: detailed imaging (fractures, deformities) and the exclusion of further injuries (tissue, ligaments, intra-abdominal organs)
- **Angiography**: diagnostic and therapeutic of vascular injury and active hemorrhage (e.g., superior gluteal artery)
- Suspected injury of the urinary tract
  - Retrograde pyelourethrogram
  - Only consider suprapubic catheterization, not transurethral, if confirmed!

Management

- **General**: Prompt pelvic stabilization with an external pelvic binder
- **Conservative treatment**
  - **Indication**: stable pelvic fracture
  - **Methods**: bed rest, analgesia, thrombosis prevention, early physical therapy, periodic blood pressure and hematocrit check
- **Surgical treatment**
  - **Indication**: open or unstable fractures, complications (e.g., urological injury), hemorrhage
  - **Procedures**
    - Emergency surgery in the case of massive bleeding: angiography with embolization of affected blood vessels, external fixation , or pelvic C-clamp if needed
    - Definitive surgical treatment of the pelvic fracture and post-intensive care stabilization: stabilization and refixation of dislocated fragments, employing plates or screw external or internal fixation (for hemodynamically stable patients)
    - Rapid treatment of concomitant injuries (urinary tract, sphincter, intestinal injuries)

Complication

- Intraperitoneal and retroperitoneal bleeding can cause hemorrhagic shock
- Abdominal compartment syndrome
- Thromboembolism (A pelvic injury always requires thrombosis prevention because of the high risk of thrombosis associated with it)
- Neurological injury: bowel and bladder incontinence, sexual dysfunction
- Sciatic nerve injury
- Persistent sacroiliac pain

Patient suffer from left hip and thigh pain

❖**What is your diagnosis ?**

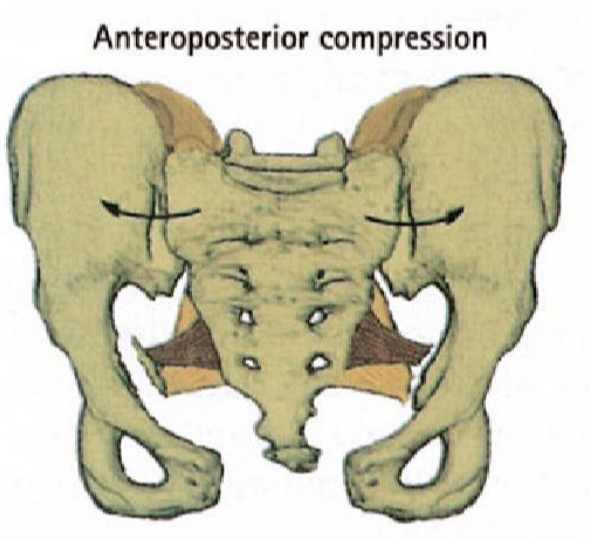
- X-ray of pelvis demonstrating fractures of the left superior and inferior pubic rami.

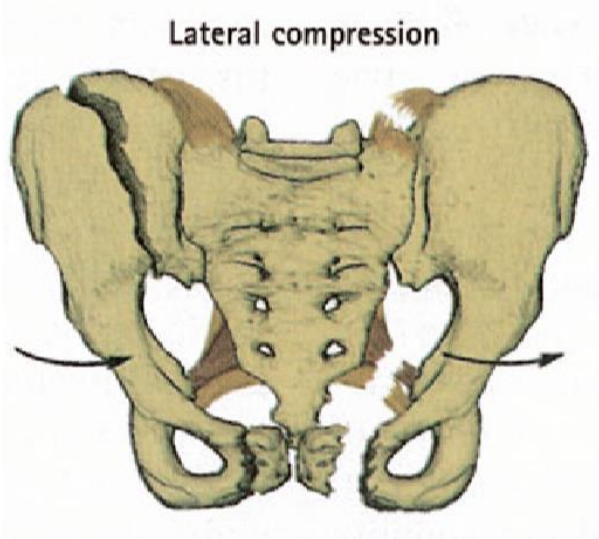
❖**What is your management ?**

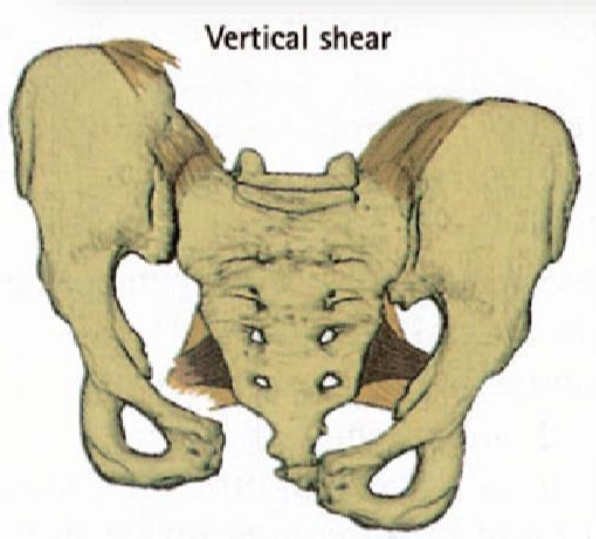
1. External pelvic binder
2. Bed rest, analgesia, thrombosis prevention, early physical therapy, periodic blood pressure and hematocrit check

What is the mechanism of fracture ?

a. Vertical shear
b. Anteroposterior compression
c. Stress fracture
d. Lateral compression
e. Avulsion







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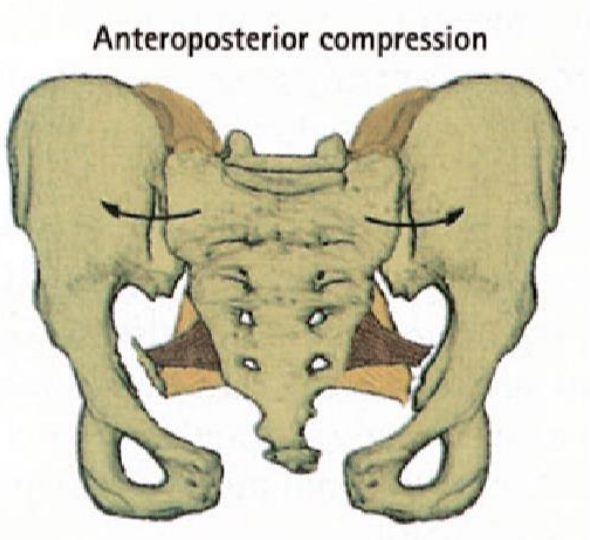

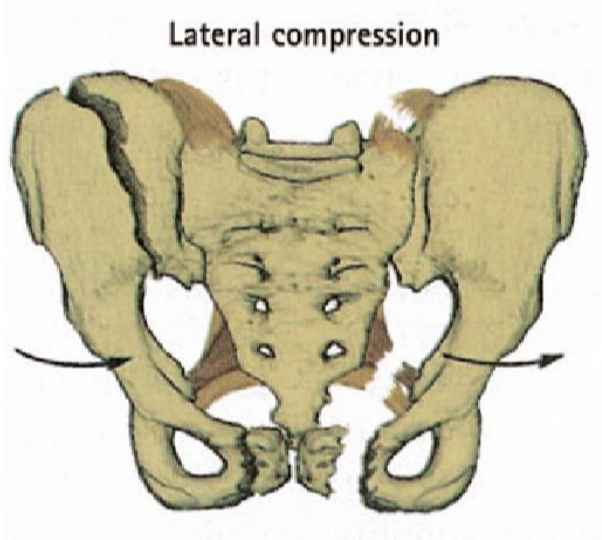

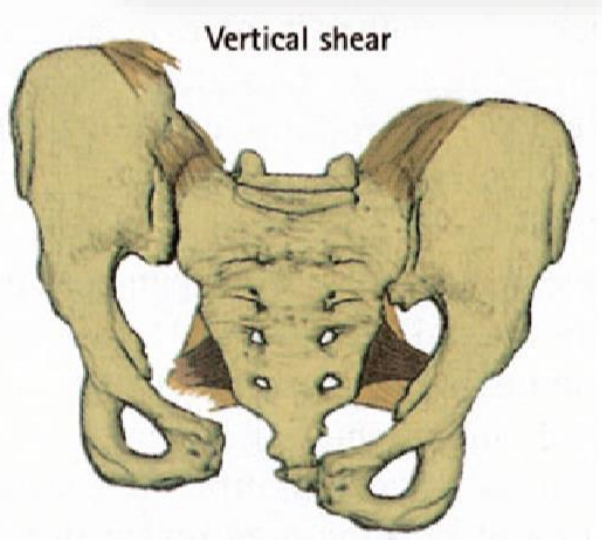

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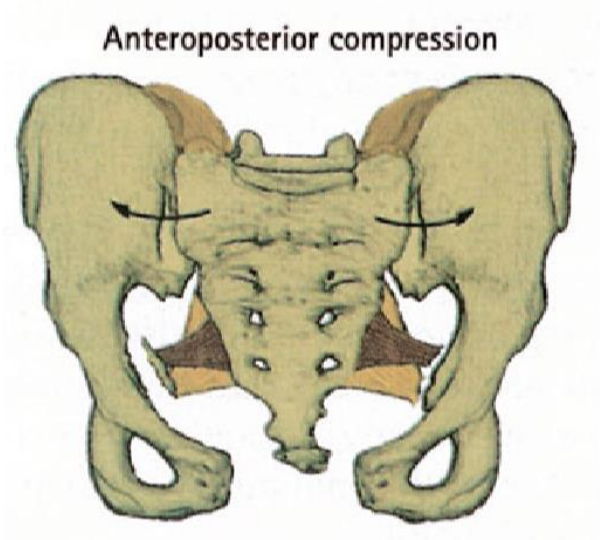
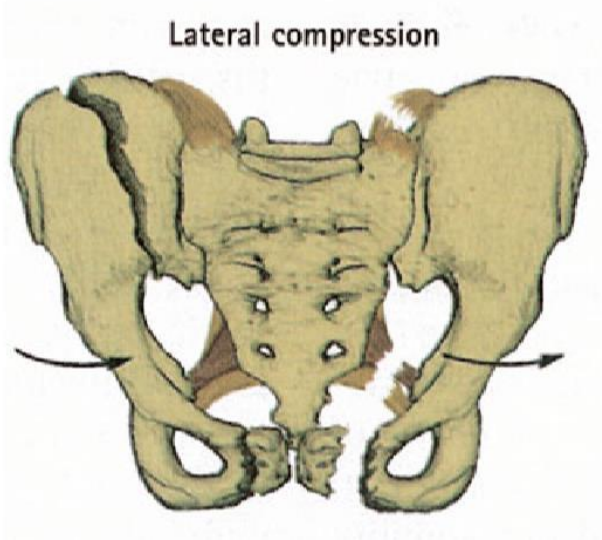
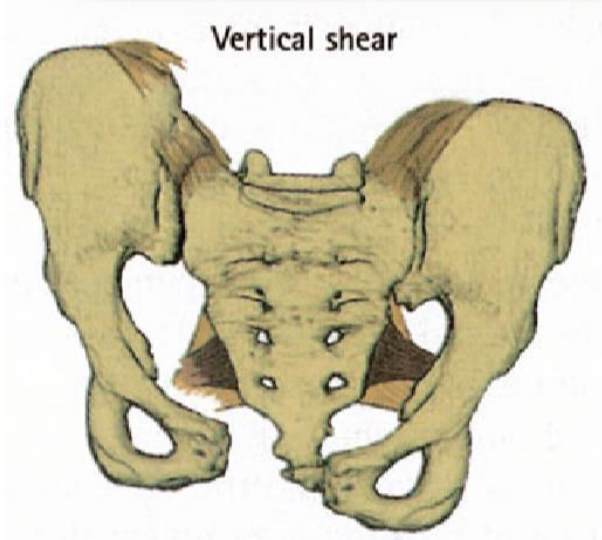
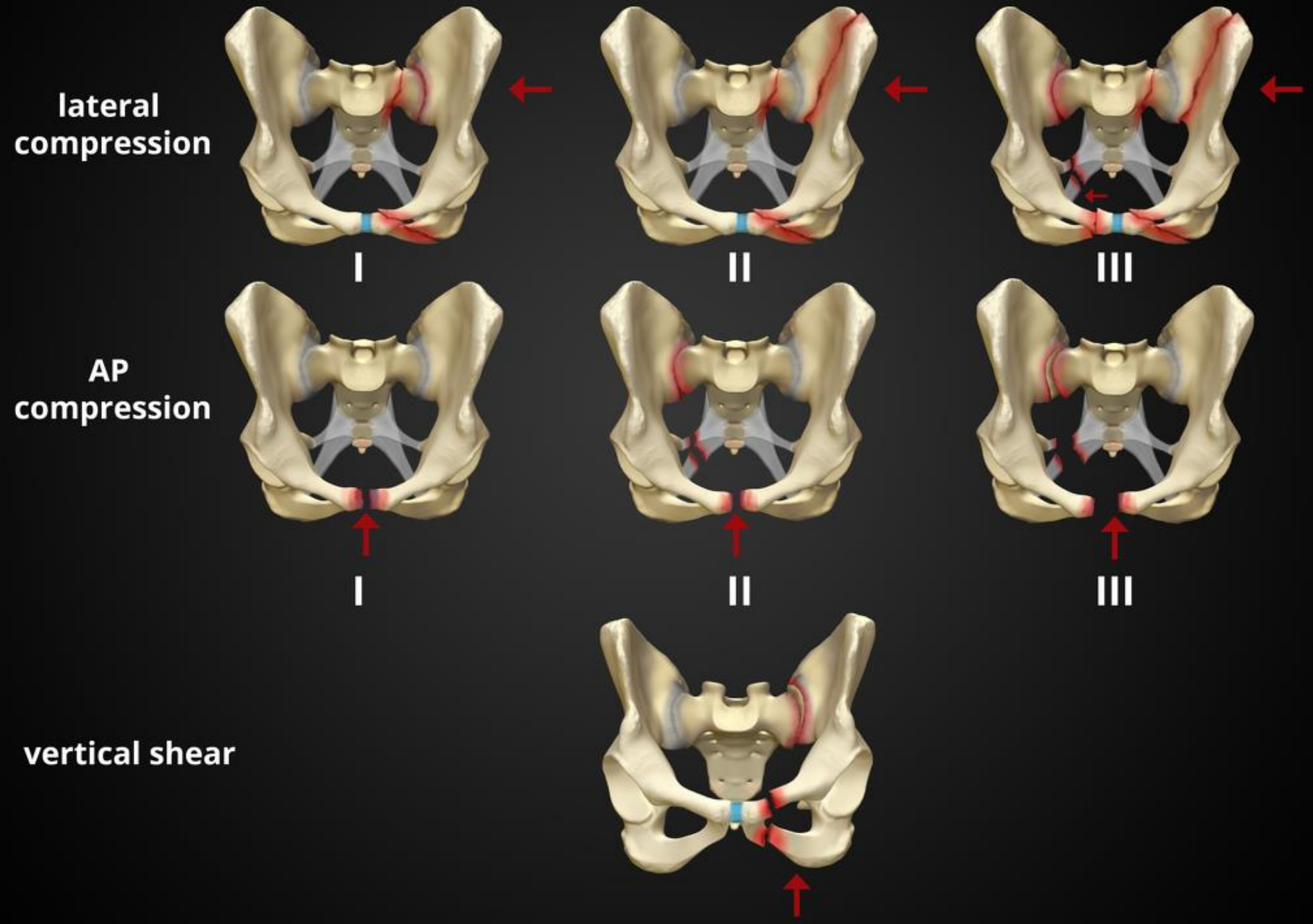
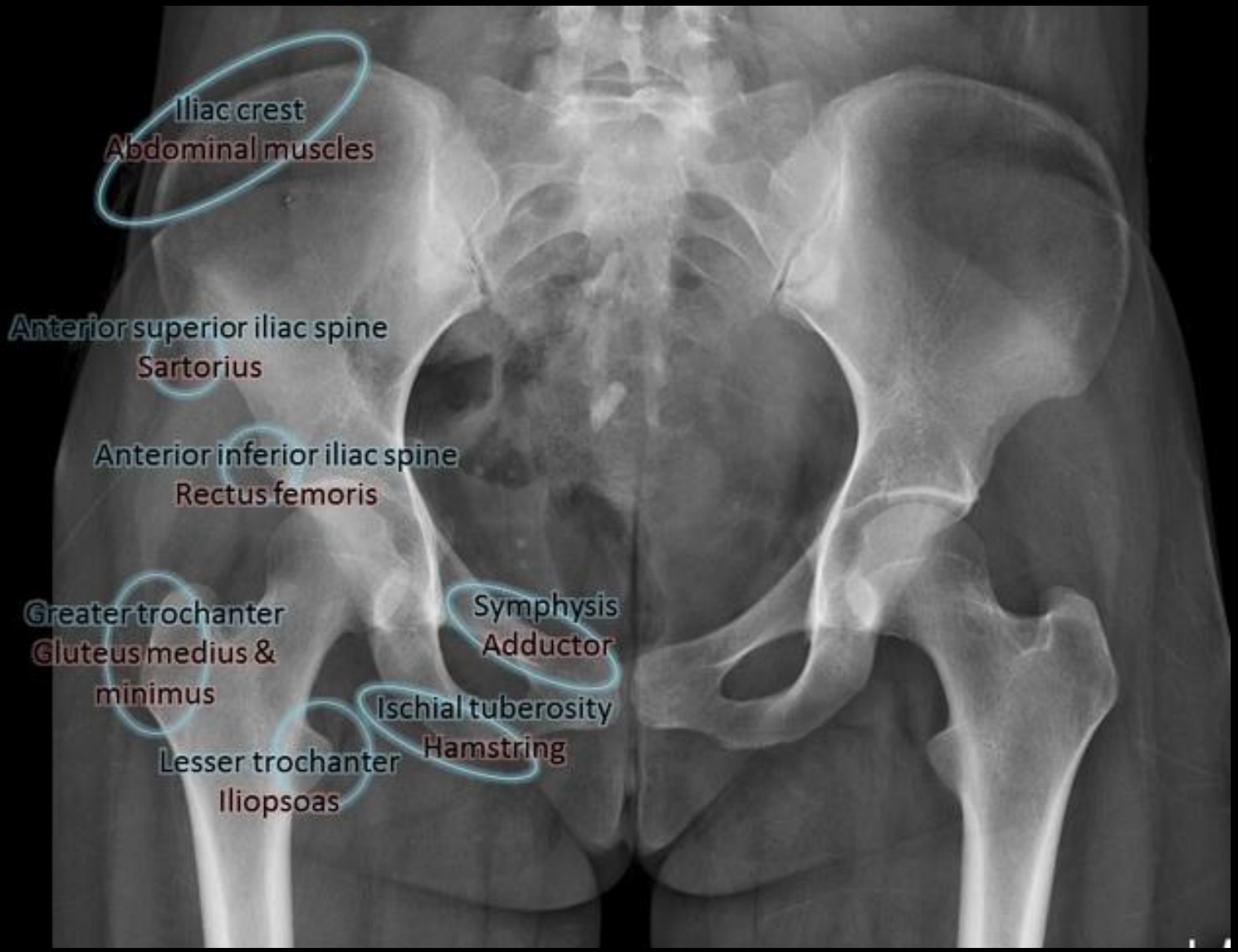







lateral compression
I
II
III
AP compression
I
II
III
vertical shear

Avulsion fractures and their muscles



What is the muscle involved in this fracture ?

a. Sartorius muscle
b. Rectus femoris
c. Gluteus Medius
d. Iliopsoas
e. Hamstring

The best easy initial management in suspected pelvic fracture ?

a. Pelvic bender
b. Angiography
c. Open reduction
d. Closed reduction

One of these sentences is wrong about this case

a. Blood at the pubic area
b. Shortening of the right leg
c. Anteroposterior compression
d. Weak upper and lower extremity pulse
e. Absent ankle reflex

LOW YIELD

Acetabular fractures

- **Mechanism of injury**: Head of the femur is driven into the pelvis
  - Blow on the side (as in a fall from a height).
  - Blow on the front of the knee, usually in a dashboard injury when the femur also may be fractured.
- **Management**
  - Conservative: indications:
    - acetabular fractures with minimal displacement (in the weightbearing zone, less than 3mm.
    - displaced fractures that do not involve the superomedial weightbearing segment (roof) of the acetabulum – usually distal anterior column and distal transverse fractures.
    - a both-column fracture that retains the ball and socket congruence of the hip by virtue of the fracture line lying in the coronal plane and displacement being limited by an intact labrum.
    - fractures in elderly patients, where closed reduction seems feasible.
    - patients with 'medical' contraindications to operative treatment (including local sepsis)
  - Surgical

LOW YIELD

Acetabular fractures

- Complications
  - Iliofemoral venous thrombosis.
  - Sciatic nerve injury (early complication)
  - Heterotopic bone formation.
  - Avascular necrosis.
  - Loss of joint movement (stiffness).
  - Secondary osteoarthritis

Acetabular fractures

- All of these are late complications except
  a. Nerve injury (sciatic nerve injury)
  b. Avascular necrosis
  c. Secondary osteoarthritis

LOW YIELD

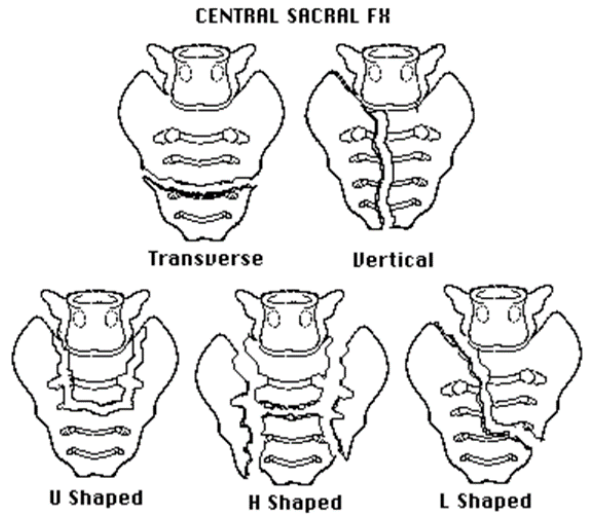
Sacral and coccygeal fractures

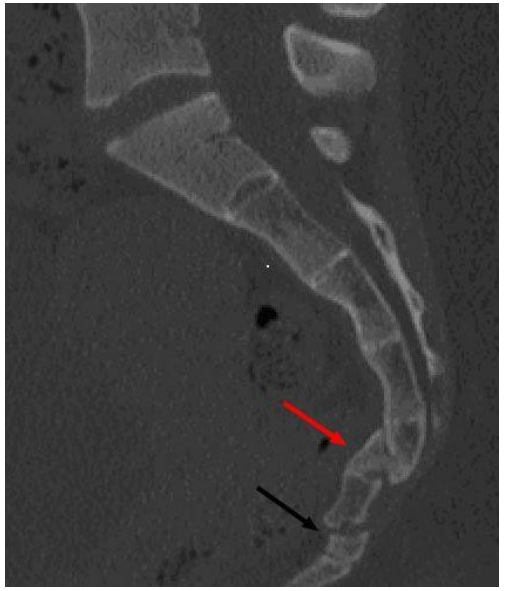
❖Mechanism of injury

- Blow from behind of falling down into the tail may fracture the sacrum and coccyx or strain the joint between them.

❖Management

- Rubber ring cushion when sitting.
- Persistent pain, especially on sitting, is common after coccygeal injuries. If the pain is not relieved by the use of a cushion or by the injection of local anaesthetic into the tender area, excision of the coccyx may be considered.





Hip

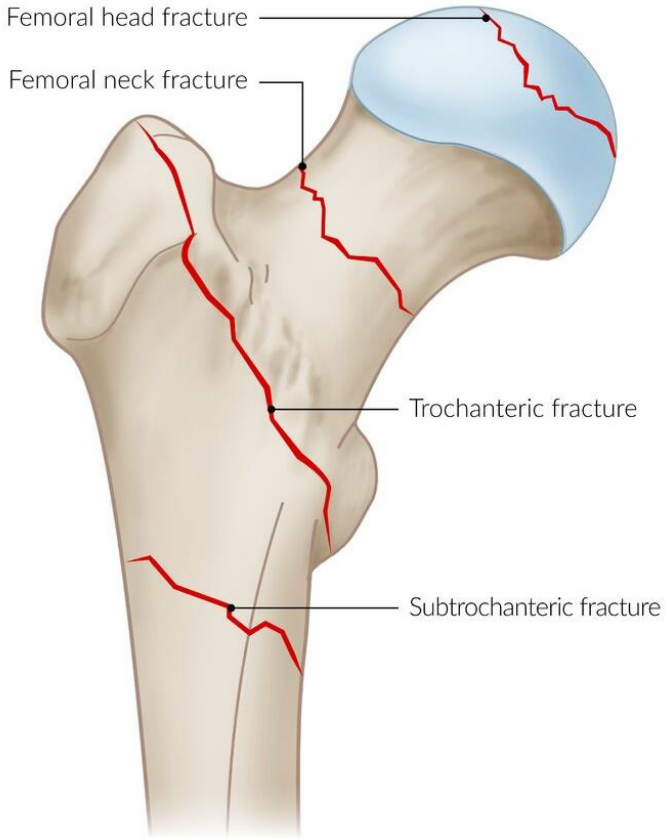
Hip fractures

- **Epidemiology**
  - Peak incidence: > 70 years
  - Sex: ♀ > ♂
- **Mechanism of injury**: (most commonly due to)
  - Older adults: Fall onto greater trochanter/lateral hip
  - Children and young adults: high-speed trauma
  - Pathological fracture
- **Risk factors**
  - Osteoporosis (Osteoporosis related fracture)
  - Low body weight
  - Poor nutrition (vitamin D deficiency or calcium deficiency)

Types of hip fractures

Hip fractures are divided into:

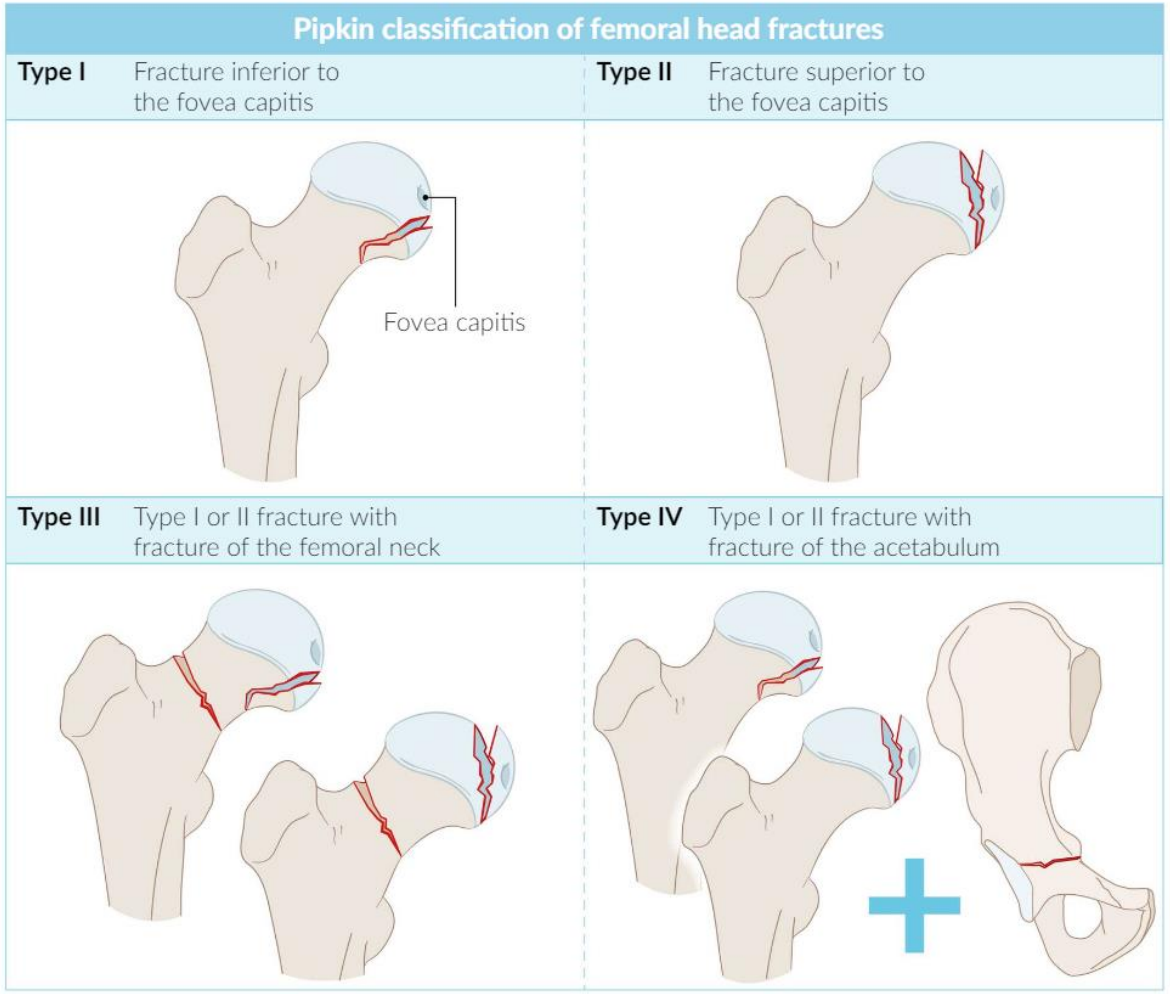
- **Intracapsular**
  - Femoral head
  - Femoral neck
- **Extracapsular**
  - Trochanteric
  - Intertrochanteric
  - Subtrochanteric



Femoral head fracture

- **Occurrence**: uncommon but often associated with a posterior hip dislocation following a dashboard injury
- **Clinical features**
  - Groin pain
  - Local swelling and ecchymosis
- **Diagnostics**
  - Hip x-ray (AP with internal rotation and lateral view; should include the proximal thigh): abnormal trabecular pattern, cortical defects, shortening and angulation of the femoral neck
  - X-rays of both hips should be made for comparison
  - MRI if findings are unclear or if an occult fracture is suspected
  - Watch out for sciatic nerve injury in patients with femoral head fractures.

Femoral head fracture



Treatment

- Type 1
  - Conservative: immobilization
  - Surgical: ORIF
- Type 2
  - Surgical: ORIF
- Type 3 & 4
  - Children & young adults: ORIF
  - Older adults or those with predispositions or instabilities: total hip replacement

Femoral neck fracture

❖Clinical features

- Groin pain, Shortened and externally rotated leg, Minimal bruising

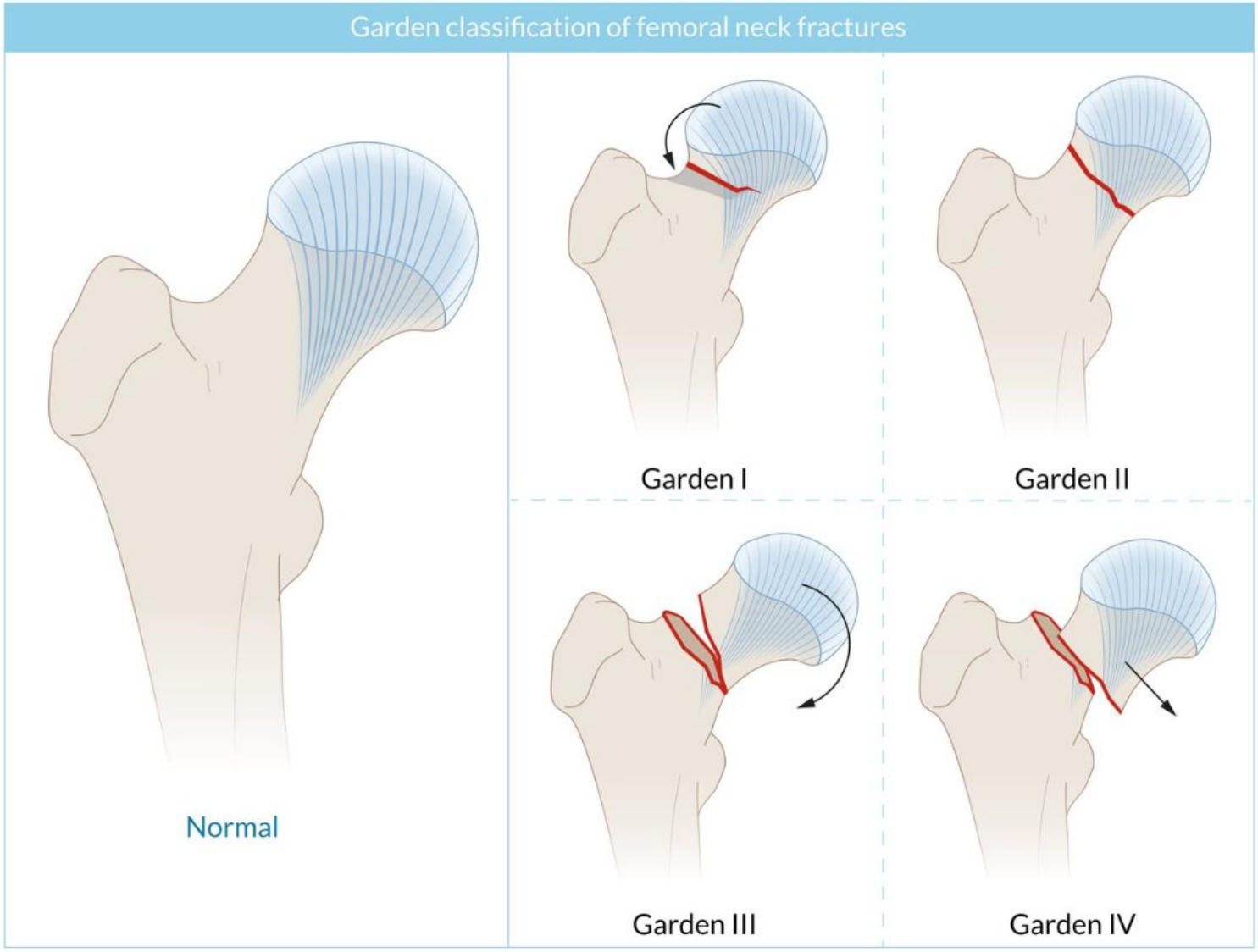
❖Diagnostics

- X-ray (AP and lateral view of the pelvis with internal rotation of the affected limb)
- MRI or bone scan if clinical suspicion is high despite absent findings on x-ray

❖Classification

Garden Classification	
Garden I	Nondisplaced, incomplete, impaction fracture
Garden II	Complete, but nondisplaced fracture
Garden III	Partially displaced, complete fracture with medial contact of the fracture elements and varus displacement of the femoral head
Garden IV	Entirely displaced, complete fracture

Femoral neck fracture



Femoral neck fracture

- Conservative management
  - Indication: stable, nondisplaced fractures, especially abduction fractures , mostly in debilitated patients
  - Methods
    - Temporary bed rest or use of crutches followed by mobilization with physical therapy
    - Venous thromboembolism prophylaxis
- Surgical therapy (usually within 72 hours) is indicated for unstable fractures, typically adduction fractures, and fragment dislocation
  - For children and young adults
    - Attempt preservation of the femoral head
    - Early open reduction internal fixation (ORIF)(within 6 hours)
  - For older adults: total hip replacement (THR) or hip hemiarthroplasty

Garden’s classification of femur neck fracture ?

a. Type 1
b. Type 2
c. Type 3
d. Type 4
e. Type 5

Trochanteric fracture

❖Clinical features

- A greater trochanter fracture is suggested by local pain exacerbated by abduction
- A lesser trochanter fracture presents with groin pain, which radiates to the knee or posterior thigh, and worsens with hip flexion and rotation

❖Diagnostics

- X-ray showing avulsion of the greater or lesser trochanter
- MRI if a pathological fracture is suspected)

❖Treatment

- Most heal with conservative treatment (e.g., nonweightbearing)
- Surgical repair for displaced fractures (> 1 cm)

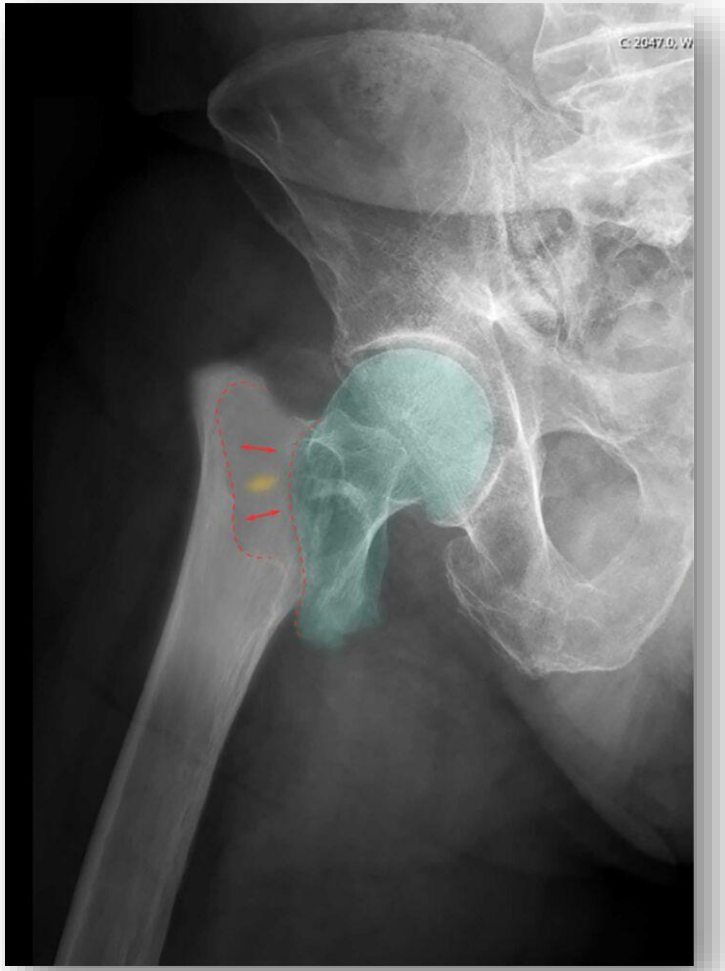
Intertrochanteric fracture

❖Clinical features

- Hip pain and swelling
- Shortened and externally rotated leg
- Significant ecchymosis
- Often associated with other injuries (e.g., other extremity fractures)

❖Diagnostics

- X-ray (AP view with maximal internal rotation and lateral view): proximal femur fracture between the greater and lesser trochanters
- MRI if a pathological fracture is suspected



Intertrochanteric fracture

❖ **Treatment**

- Nonsurgical approach for high-risk patients
- Surgery
  - Dynamic hip screw (DHS) for stable fractures
  - Intramedullary nail (Gamma nail) for stable or unstable fractures, fractures extending into the subtrochanteric region, or reverse oblique fractures
  - Arthroplasty may be considered for comminuted fractures, pathological fractures, or if other surgical modalities fail.

Name of the fracture and it’s management

a. Femur Neck fracture, Hip replacement
b. Femur Neck fracture, Fixation with plate and screws
c. Intertrochanteric fracture, partial hip replacement
d. intertrochanteric fracture, Fixation with plate and screws
e. Sub-trochanteric fracture, Nail fixation

Subtrochanteric fracture

❖Clinical features

- Hip pain with swelling
- Shortened and externally rotated leg
- Significant ecchymosis

❖Diagnostics

- X-ray: fracture between the lesser trochanter up to 5cm below that (distally)
- MRI if a pathological fracture is suspected

❖Treatment

- Consider conservative approach (e.g., traction) in surgically unstable patients
- Surgery is indicated in displaced/nondisplaced fractures in adults, especially if associated with multiple trauma, an open fracture, or pathological fractures
  - Long intramedullary nail with a lag screw
  - Locking plate may be considered for complicated fractures (e.g., pre-existing femoral deformity, associated femoral neck fracture)

Subtrochanteric fracture

- **What is your diagnosis ?**
  - Subtrochanteric fracture
- **Mention one muscle leads to the deformity**
  - Iliopsoas muscle
- **Treatment**:
  - Surgery (open reduction and internal fixation)

Complications of hip fractures

- Avascular necrosis (AVN) of the femoral head
  - Fracture dislocations are at greatest risk of avascular necrosis of the femoral head.
  - AVN is less common in intertrochanteric fractures, but the outcome is worse compared to femoral neck fractures.
- Thromboembolism
  - Thrombolytic therapy reduces the risk of deep vein thrombosis in patients with hip fractures
- Infection
- Chronic pain and posttraumatic arthritis
- Nonunion
- Dislocation

Hip fracture-dislocation

Hip fractures, especially fractures of the femoral head, are often associated with a hip dislocation

Type of hip dislocation	Etiology	Clinical features	Diagnostics	Treatment	Complications
Posterior hip dislocation (90% of cases)	• Dashboard injury in which a posteriorly directed force (e.g., dashboard during a motor vehicle accident) is directed towards an internally rotated, flexed, and adducted hip	• Hip pain which radiates to the knee • Shortened, internally rotated (adducted) hip	• X-ray • CT/MRI to exclude associated (especially pathological) fractures	• Closed reduction within 6 hours • Open reduction if closed reduction is unsuccessful, the joint is unstable, or if bony fragments/tissue sit within the joint space	• Sciatic nerve injury or peroneal nerve injury (branch of the sciatic nerve)
Anterior hip dislocation (10% of cases)	• Direct blow to the posterior hip or to an abducted leg	• Hip pain which radiates to the knee • Lengthened, externally rotated leg			• Femoral nerve injury

Old age patient with history of falling down

سنوات (2)
- **What is your diagnosis ?**
  - Posterior hip dislocation

سنوات (1)
- **How would he hold his limb ?**
  - Slight flexion, adduction, internal rotation

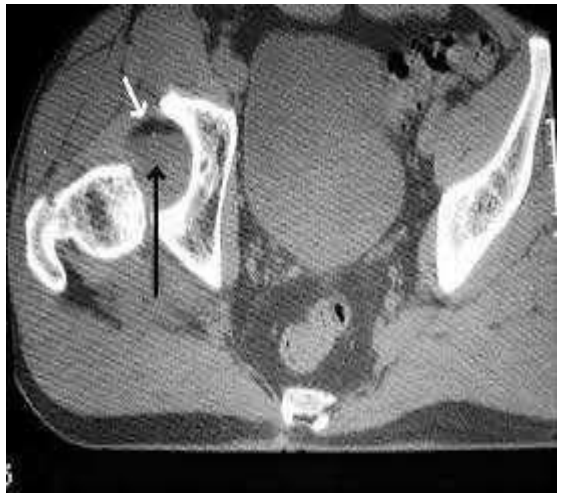
سنوات (1)
- **What is the most common affected nerve ?**
  - Sciatic nerve

History of RTA

- **What is your diagnosis ?**
  - Posterior hip dislocation
- **If there was blood at external genitalia, what injury do you suspect ?**
  - Urethra

History of RTA

- **What is the most common affected nerve?**
  - Sciatic nerve
- **If This patient was hemodynamically stable What is the next step management of this patient ?**
  - Closed reduction
  - If failed open reduction



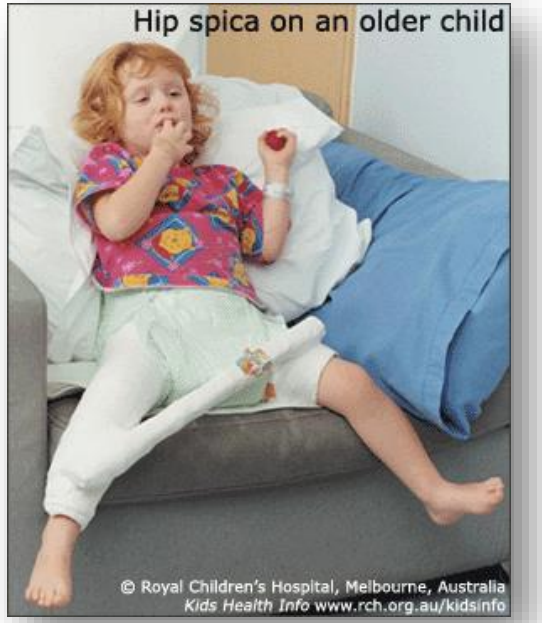
23 years old male fall of 3 meters and had hip dislocation

What is your diagnosis ?

a. Osteoarthritis
b. Osteonecrosis
c. Focal femoral degeneration

Keep in mind when dealing with pediatrics

- The trauma that causes hip fracture in children is high energy trauma (RTA or Falling from Hight)
  - Always role out other associated injuries
  - If the trauma is not significant then Role out pathological fracture
- The fracture pattern may disrupt the blood supply of the proximal femoral head → AVN
- Head and neck are worse than inter-troch and sub-troch
- **Management**: closed reduction and hip spica +- fixation
- Avoid injury to the proximal femoral physis when fixing.



Hip fracture in elderly

- 75 years old patient with right hip fracture Your management
  - Hip replacement

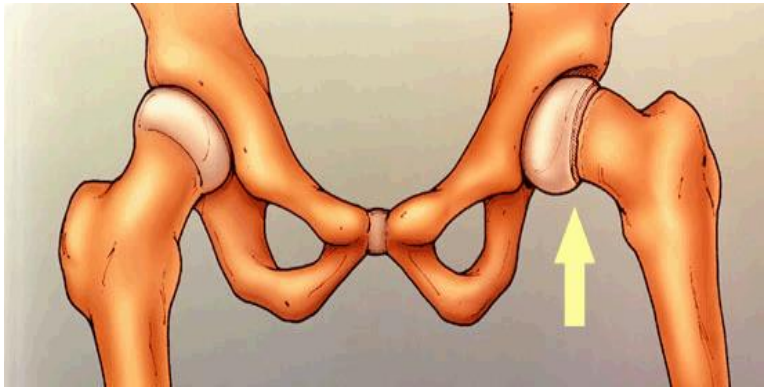
Pediatric Hip Disorders

Presentation

- **Hip pathology may cause**
  - Groin pain
  - Referred thigh or knee pain
  - Refusal to bear weight
  - Altered gait in the absence of pain
- Hip pain may also be referred from low back or pelvic pathology
- Any child with knee pain
  - Examine hip range of motion
    - Prone and supine
  - Check AP and frog lateral hip films, particularly if limited hip motion

Slipped Capital Femoral Epiphysis (SCFE)

- **Definition**: the posterior and inferior displacement of the femoral head in relation to the femoral neck at the proximal femoral growth plate.
- **Epidemiology**:
  - Most common hip disorder in adolescents
  - Peak incidence: 10-16 years
  - Sex: ♂ > ♀
- **Etiology**: is not entirely understood
- **Risk factors**:
  - Obesity
  - Family history
  - Endocrine or hormonal factors (e.g., hypothyroidism)
  - Trauma (e.g., sports-related injury or fall)



Slipped Capital Femoral Epiphysis (SCFE)

- **Pathophysiology**:
  - Poor cartilaginous maturation and endochondral ossification in the epiphyseal growth plate leads to unusually wide and unstable proximal femoral epiphyseal growth plate
  - Increased shear force (e.g., due to obesity, trauma) across the growth plate leads to posterior and inferior displacement of femoral epiphysis from the femoral neck
- **Onset**:
  - Acute
  - Chronic (3 weeks to several months)
  - Acute on chronic (chronic with acute exacerbations)
- **Location**: bilateral in 20–40% of cases

SCFE – Clinical features

❖**Symptoms**:

1. Dull pain in the medial thigh, knee , groin, or hip (often left > right)
2. Limping
3. Restricted range of motion
4. Reduced internal rotation and abduction
5. Patients may hold their hip in passive external rotation
6. **Drehmann sign positive**: external rotation and abduction during passive flexion of the affected hip in supine position

❖**Stability of the physis**:

- **Stable**: able to bear weight on affected hip, with or without crutches
- **Unstable** : inability to ambulate and bear weight on affected hip, even with crutches and associated with a high risk of avascular necrosis

SCFE – Diagnostics

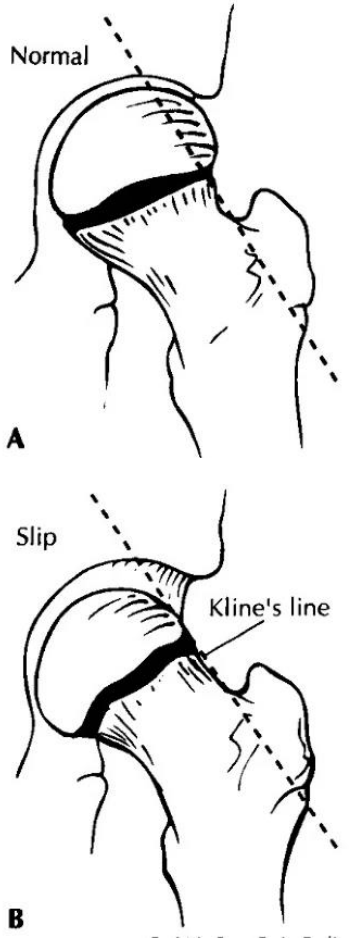
❖**Imaging**:

- 2 views:
  - AP pelvis x-ray
  - Frog leg lateral view (supine position, flexion of 45° and abduction of 45° in the hip): It allows for better evaluation of both hips, femoral head and neck.

❖**Laboratory tests**: to exclude endocrinopathies in patients with an atypical age of onset or short stature

SCFE – Imaging Findings

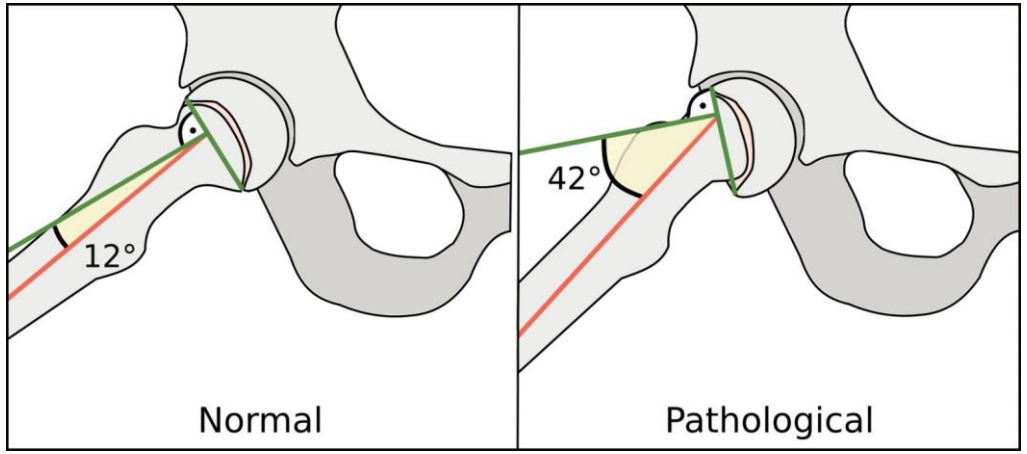
- Widening of the joint space
- The femoral head is displaced posteriorly and inferiorly in relation to the femoral neck.
- Klein line not passing the femoral head: It is a straight line drawn along the superior border of the femoral neck that normally passes through the femoral head.
- Frog leg projection line not passing the femoral head: It is a line drawn through the center of the epiphysis that normally should pass through the center of the femoral neck.



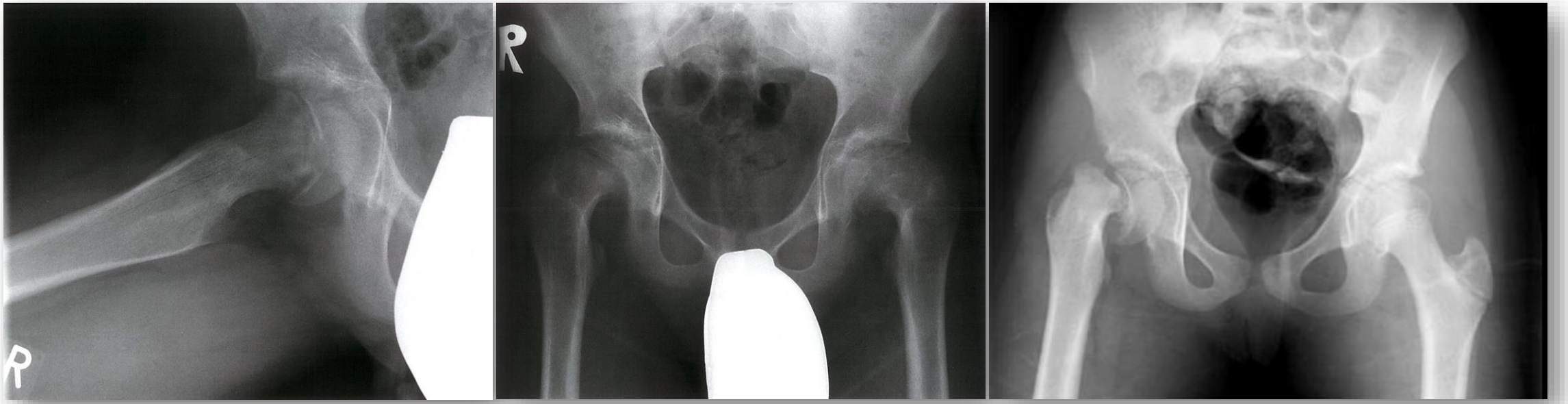
Klein line

SCFE – Imaging Findings cont.

- Southwick method (for measurement of the slip angle/severity): refers to the tilt of the femoral neck in relation to the femoral head
- The angle of Southwick (yellow) is the angle between a line that is drawn perpendicular to a line connecting the ends of the epiphyseal plate (green) and a line drawn along the longitudinal axis of the femur (red).
- A normal angle of Southwick is 12°.
- SCFE is classified as:
  - Mild: 13-30°
  - Moderate: 30-60°
  - Severe: >60°



Slipped Capital Femoral Epiphysis (SCFE)



Slipped Capital Femoral Epiphysis (SCFE)

❖ **Treatment**:
- Avoid weight bearing before stabilization
- Urgent surgical internal fixation with pinning of the femoral head
- Prophylactic fixation of the contralateral hip

❖ **Complications**:
- Avascular necrosis of the femoral head
- Early hip osteoarthritis
- Chondrolysis of the hip: rapid degeneration of articular cartilage

❖ **DDx**:
- Legg-Calvé-Perthes disease
- Transient synovitis
- Septic arthritis

سنوات (5)

14 years old male presented with left knee pain

سنوات (5) ❖**What is the pathology in this X-ray ?**

- Slipped Capital Femoral epiphysis

سنوات (3) ❖**What is the most appropriate management ?**

- Fixation

سنوات (1) ❖**Risk factors:**

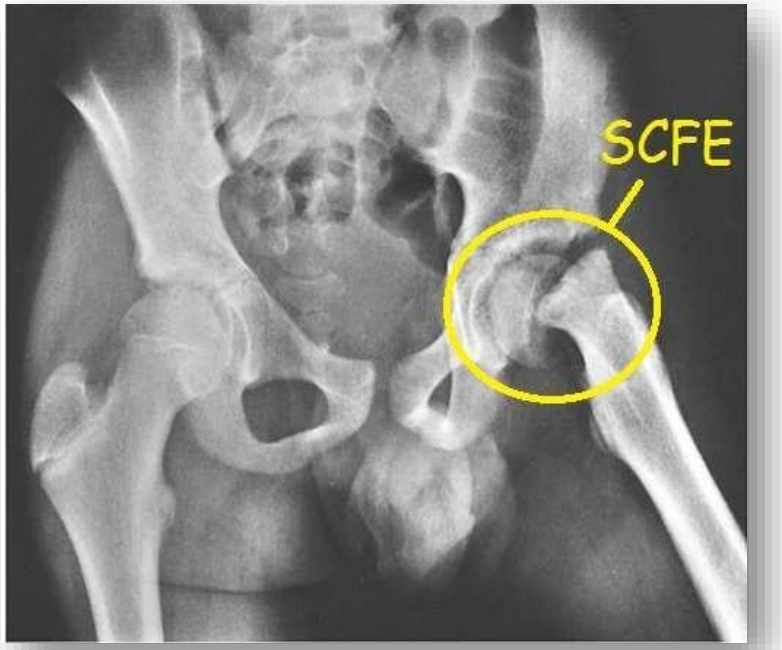
- Hormonal imbalance
- Obesity

سنوات (2) ❖**The affected layer in this deformity is**

- Hypertrophic zone

SCFE hip presentation on AP pelvic view

a. Internal rotation
b. Abduction
c. External rotation
d. Adduction



Q9: 7 years old male presented with left knee pain

❖**What is the most important lab test to do ?**

a. CBC
b. Thyroid hormone
c. KFT
d. LFT
e. ESR

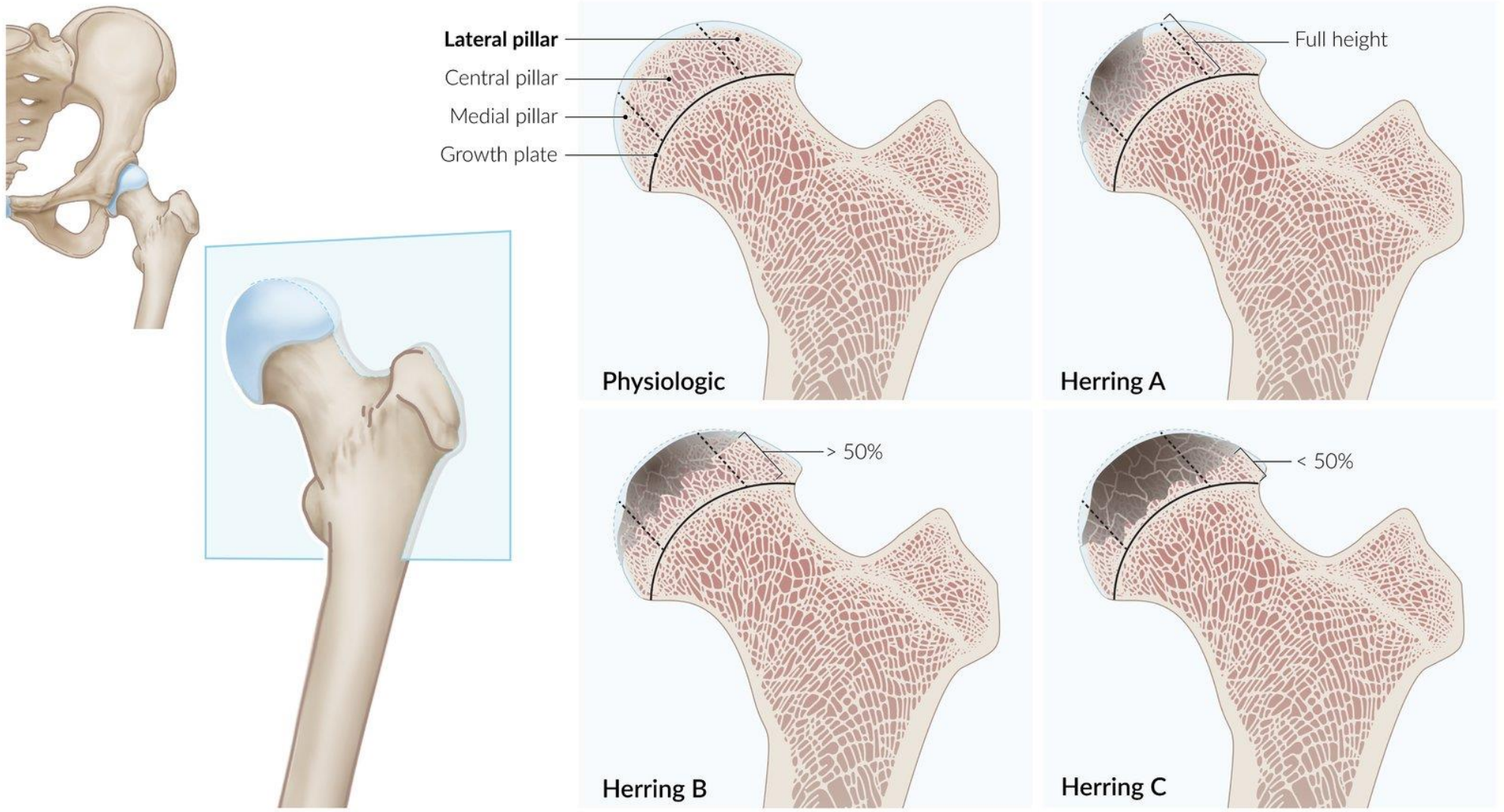
Legg-Calve-Perthes

- **Definition**: idiopathic, avascular necrosis of the femoral head
- **Epidemiology**:
  - Sex: ♂ > ♀ (4:1), Age: 4–10 years
- **Etiology**: Idiopathic disease
- Multiple factors might promote the development and progress of the condition, including:
  - Repetitive microtrauma (e.g., due to child's hyperactivity)
  - Bleeding disorders (e.g., excess factor VII, factor V Leiden, protein S deficiency)
  - Genetic factors (e.g., possible mutations in COL2A1 gene)
  - Environmental factors (e.g., maternal smoking, secondhand smoke exposure)
- **Pathophysiology**:
  - Avascular necrosis of the femoral head due to a mismatch between the rapid growth of the femoral epiphyses and the slower development of adequate blood supply to the area

Legg-Calve-Perthes – Lateral pillar classification

- This classification possesses the highest clinical relevance because it correlates best with long-term outcome. The crucial criterion in this classification is the height of the lateral third (“lateral pillar”) of the femoral head
- Modified (Herring) Lateral pillar classification
  - Group A: Height of the lateral pillar is 100% (no involvement)
  - Group B: Height of the lateral pillar is > 50%
  - Group C: Height of the lateral pillar is < 50%

Legg-Calve-Perthes – Lateral pillar classification



Legg-Calve-Perthes – Clinical features

- Antalgic gait (on weight-bearing leg)
- Pain in the hip or the upper leg, sometimes projecting to the knee
  - Insidious onset, pain may fluctuate depending on physical activity
  - Often exacerbated by internal rotation
  - FABER test (Flexion, ABduction, and External Rotation) might be positive.
  - Groin tenderness on palpation
- Restricted range of movement is usually present, especially regarding internal rotation and abduction, and can cause the child to limp.
- Hinge abduction: refers to the lateral femoral head bumping into the ventrolateral acetabulum when the leg is abducted, possibly involving pain, a palpable clunk, and restriction in the range of movement
- Contralateral involvement in ~ 10% of cases
- Complications: Early osteoarthritis of the hip joint

Legg-Calve-Perthes – Imaging

- X-ray
  - 2 views: AP view and frog leg position
  - Findings:
    - Increased lucency of the femoral head
    - Flattening and fragmentation of the femoral head
    - Joint space widening
- MRI: indicated if initial imaging is unremarkable but clinical suspicion persists
  - "Head-at-risk" signs:
    - Lateral calcification
    - Lateral subluxation of the femoral head
    - Lesions extending to the metaphysis
    - Horizontal alignment of the epiphyseal plate
    - Gage sign: triangle-shaped osteoporotic area of increased radiolucency of the lateral femoral head
    - Crescent sign: subchondral lucency representing a fracture

Legg-Calve-Perthes – Imaging

Legg-Calve-Perthes – Treatment

Conservative treatment

- limited weight bearing, physical therapy
- Indicated in:
  - Young children (< 6 years of age)
  - Mostly undamaged femoral head
  - Lateral pillar A classification
- Casting and bracing can also be used until femoral head deformity develops or range of motion worsens.

Surgery

- femoral osteotomy
- Indicated in:
  - Older children (≥ 6 years of age)
  - Extensive damage to the femoral head (> 50%)
  - Lateral pillar B/C classification
- Hip arthroplasty can be considered in adults that develop osteoarthritis

What is your diagnosis ?

a. DDH
b. SCFE
c. Perthes disease
d. Displaced femur head fracture
e. Septic hip distruction

❖ **Poor prognostic factors ?**

- Older age
- gage sign on X-ray

What is your diagnosis ?

a. DDH
b. SCFE
c. Perthes disease
d. Displaced femur head fracture
e. Septic hip distruction

Transient synovitis (toxic synovitis) of the hip

- **Definition**: transient (1–2 weeks), self-limiting, nonspecific inflammation and hypertrophy of the synovial membrane of the hip joint
- **Epidemiology**:
  - Common cause of acute hip pain in children
  - Peak incidence: 3–8 years of age
  - Sex: ♂ > ♀ (2:1)
- **Etiology**:
  - Exact cause is unknown
  - Associated with recent upper respiratory infection and recent gastroenteritis
- **Pathophysiology**: nonspecific inflammation and hypertrophy of the synovial membrane

Transient synovitis (toxic synovitis) of the hip

❖Clinical features

- Transient acute unilateral and transient hip or groin pain
- Children may limp or refuse to bear weight on the affected side
- Possibly limited range of motion (mostly to the extreme abduction and internal rotation position) and tenderness on palpation
- Recent upper respiratory tract infection in approx. 70% of the patients

❖Diagnostics

- Clinical diagnosis
- Laboratory: mostly normal findings
- Imaging: to rule out other conditions in presence of physical examination or laboratory findings
  - Normal x-ray findings (anteroposterior view of the pelvis and lateral views of both hips)
  - Effusion on ultrasound that typically improves within days

Transient synovitis (toxic synovitis) of the hip

- **Treatment**: symptomatic (e.g., rest, NSAIDs)
- **Prognosis**
  - Typically resolves within 1 week
  - Recurrence in approx. 20% of the children

Developmental dysplasia of the hip

- **Definition**: Hip instability, subluxation/dislocation of the femoral head, and/or acetabular dysplasia in a developing hip joint.
- **Epidemiology**
  - **Incidence**: most common congenital abnormality of skeletal development
    - Hip instability: 1 in 100 births
    - Dislocation: 1 in 1000 births
  - **Sex**: ♀ > ♂ (4–5:1)
- **Etiology**: Unknown

Developmental dysplasia of the hip

❖**Risk factors**:

- Family history
- Breech presentation
- Inadequate intrauterine space for the fetus (e.g., oligohydramnios, first born child, twins, large birth weight)
- Diseases associated with ligamentous laxity
- The left hip is more commonly affected
- Secondary anatomic changes
  - Development of contractures around the hip
  - Problems associated with leg length discrepancy (e.g., abnormal gait, scoliosis, lordosis)

❖**Pathophysiology**:

- Children with DDH have varying degrees of abnormal hip growth such as hip instability, hip subluxation, and/or hip dislocation which result in
  - Hypertrophy of pulvinar fat in the acetabulum, transverse acetabular ligament, and/or ligamentum teres
  - Acetabular dysplasia

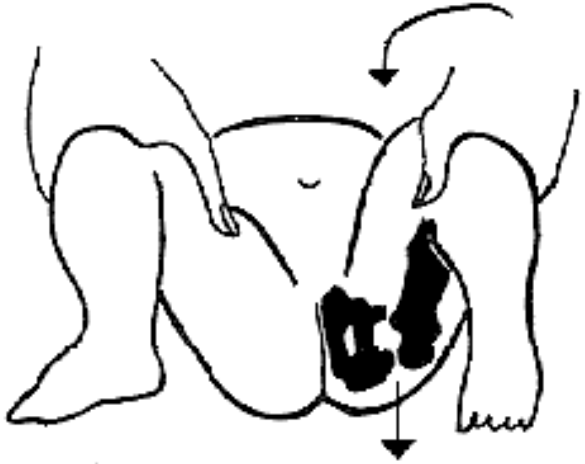
Clinical features

Age	Clinical features [3]
< 6 months	• **Asymptomatic** • Barlow sign: a palpable clunk caused by hip dislocation when the hip is flexed and adducted with application of downward pressure • Ortolani sign: a palpable clunk caused by hip reduction when the hip is flexed and abducted while applying upward pressure • Possibly Galeazzi sign
6–18 months	• Inability to **abduct** the hip • Barlow and Ortolani sign disappear • Prominent Galeazzi sign: unequal knee height and apparent shorter femur when a child placing supine with hips and knees flexed • Asymmetrical gluteal folds may be present.
> 18 months	• **Hip pain**, and/or pain referred from the hip to the knee and/or anterior thigh • Possibly a hip deformity (e.g., coxa vara) • Waddling or Trendelenburg gait • Leg length discrepancy and toe walking to compensate for the difference in leg length • Possibly lumbar lordosis

Diagnostics

- **Screening**:
  - Physical examination must be performed at every well-baby visit for up to 6 months (Barlow test, Ortolani test, Galeazzi sign, Asymmetric skin folds)
  - Screening with imaging is recommended up to 6 months of age only if one or more of the following risk factors are present
    - Breech presentation at birth
    - Positive family history of DDH
    - Clinical features of DDH
- **Imaging**:
  - Hip ultrasound: imaging of choice in all infants younger than 4 months
    - Alpha angle < 60°; Normally > 60°
    - Beta angle > 55°; Normally < 55°
  - Pelvic x-ray (in AP and frog leg lateral view): imaging of choice in infants older than 4 months

Physical examination



Barlow

- Femur gently adducted and flexed, posterior force applied
- Feel for palpable give or clunk as head leaves socket
- Indicates dislocatable hip

Ortolani

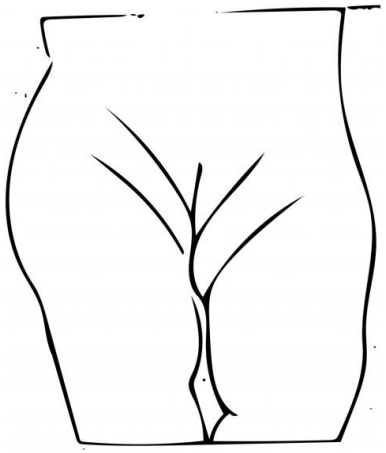
- Femur gently abducted, trochanter elevated
- Feel for palpable clunk as head falls into socket
- Indicates reducible hip

Galeazzi sign

- Femur appears short with hip flexed

Other signs

- Asymmetric abduction or motion of hip

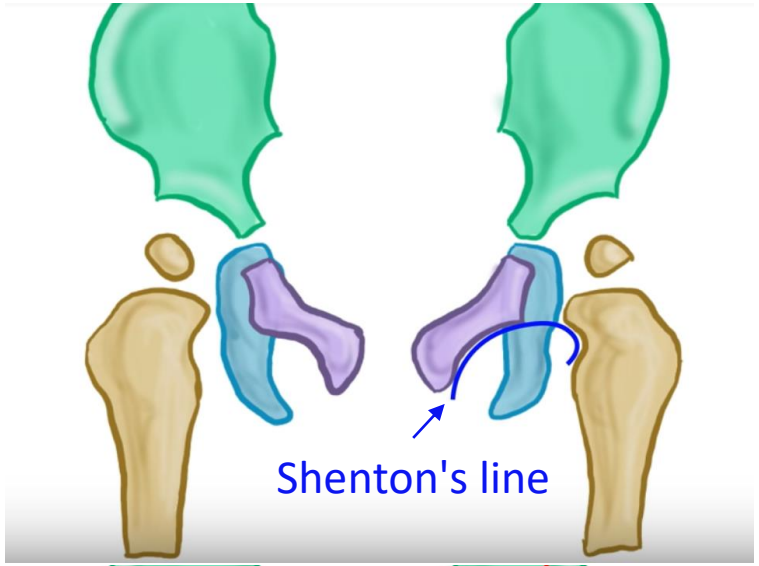


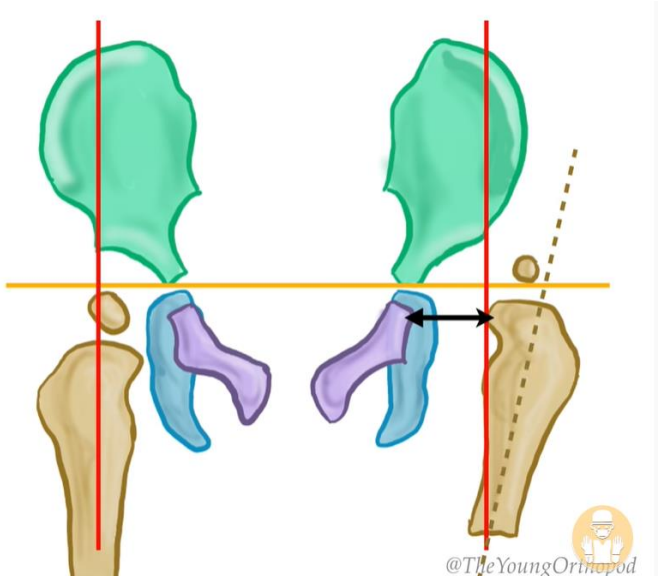
Asymmetric skin folds

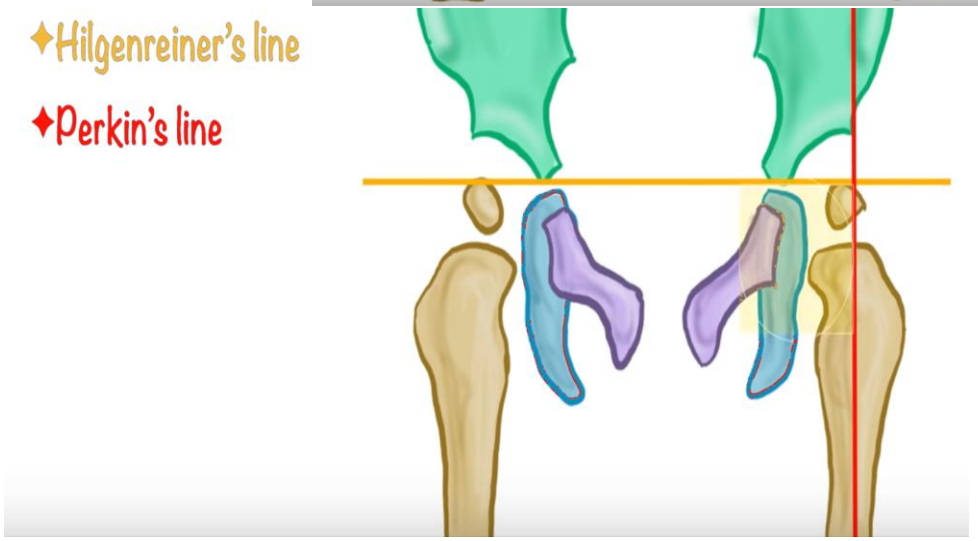
- Skin folds in groin or buttock, not thigh

Findings of hip dislocation on X-ray

- Interrupted Shenton's line
- The ossified nucleus of the femoral head lies at or above Hilgenreiner line
- The ossified nucleus of the femoral head lies at or lateral to Perkin line







Treatment

- **< 6 months**
  - Pavlik harness (most commonly used splinting device) that maintains the hips in 90–100° of flexion and 50° of abduction
  - Alternatives: rigid harnesses (e.g., von Rosen harness)
    - A rigid harness that is used to treat infants with developmental dysplasia of the hip (DDH) below the age of 6 months.
    - The harness keeps the hips abducted by 50° and flexed by 90–100° in order to achieve concentric reduction of the femoral head.
- **6–18 months or failure of bracing**: closed reduction followed by immobilization with a hip spica cast
- **> 18 months or failure of closed reduction**: surgical therapy (open reduction possibly with a pelvic/femoral osteotomy) followed by immobilization with a hip spica cast
- Older adolescents or adults: total hip arthroplasty

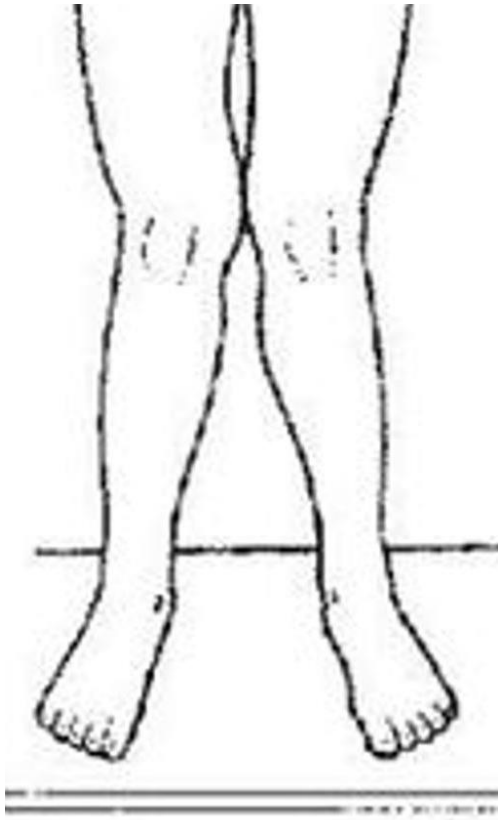
Complications

❖Complications of DDH

- Residual acetabular dysplasia, subluxation, and/or redislocation despite treatment
- Early osteoarthritis in the hip joint
- Leg length discrepancy which may present with back pain, functional scoliosis, and/or knee pain
- Genu valgum

❖Complications of treatment

- Avascular necrosis (AVN) of the femoral epiphysis
- Treatment-related transient femoral nerve palsy
- Pavlik harness disease



Genu valgum

What is the disease that can be seen in this X-ray

a. DDH
b. SCFE
c. Perthes disease
d. Displaced femur head fracture
e. Septic hip distruction

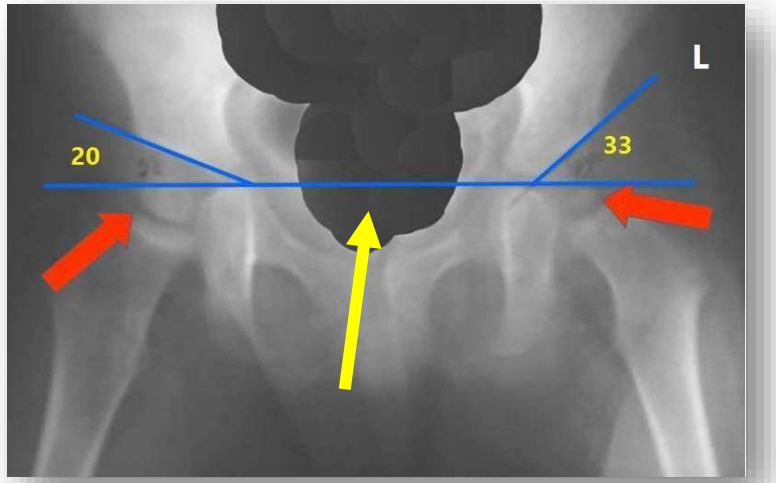
4 weeks baby with sign of DDH, Positive barlow test and galeazzi sign

What is your next step ?

a. Hip ultrasound
b. Pelvis X-RAY
c. Observation
d. Follow up after 6 week
e. Pavlik Harness

5th months old baby come for DDH screen

- **What is your DDx ?**
  - DDH
- **What is the name of line that is indicated by the yellow arrow ?**
  - Hilgenreiner line (H-Line)
- **What is your management ?** (MCQ)
  a. Pavlik harness
  b. Hip spica

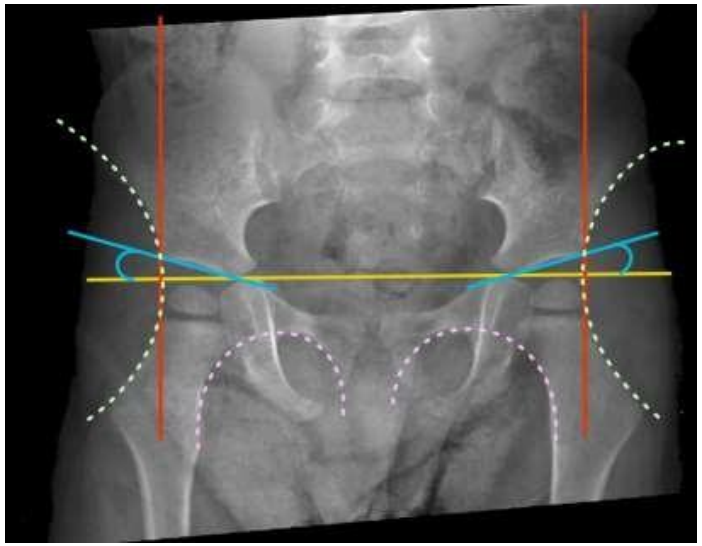


سنوات (2)

DDH – MCQs

❖The red line is سنوات (1)

a. Shenton line
b. H line
c. Perkins line
d. Acetabular line
e. Roof index line

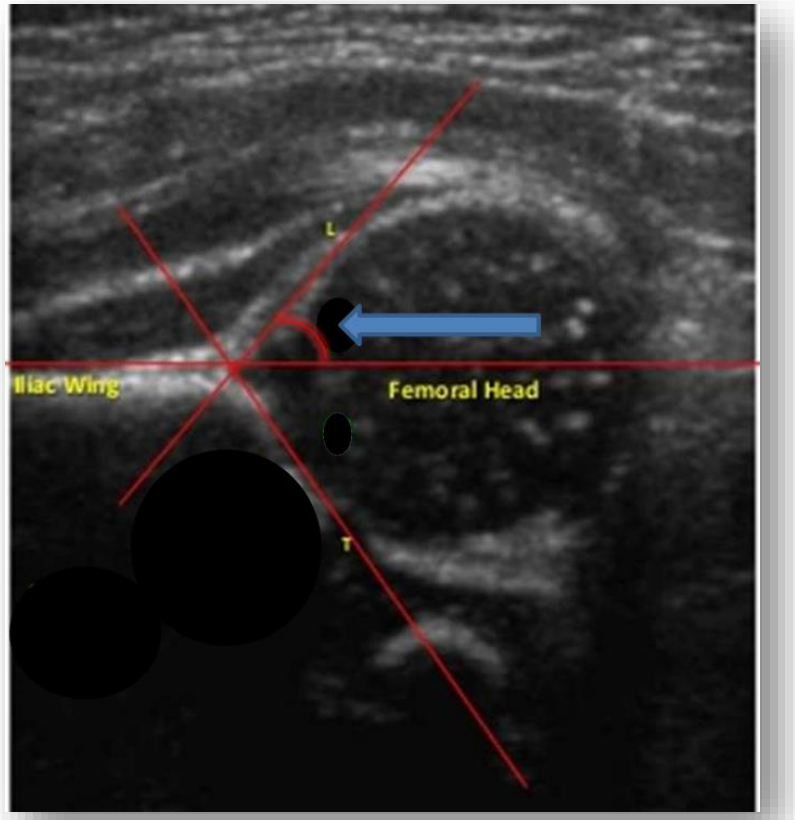


❖The name of the line is سنوات (2)

a. Shenton line
b. H line
c. Perkins line
d. Acetabular line
e. Roof index line

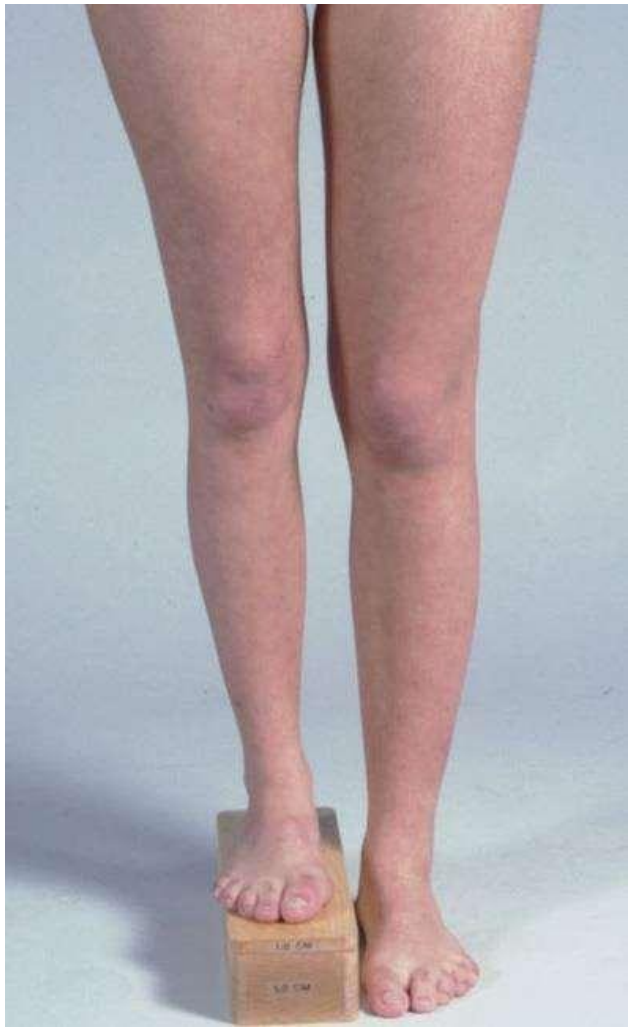
One of the following is true

a. Alpha Angle is bigger than 60
b. Alpha Angle is less than 55
c. Beta angle is bigger than 60
d. Beta angle is less than 55 (Archive anwser)

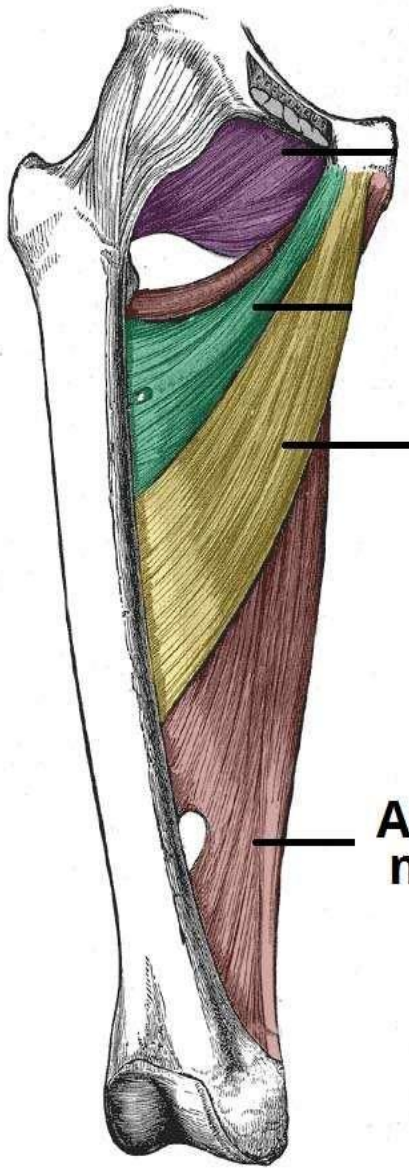


Lower limb discrepancy

- **What is your diagnosis ?**
  - Lower limb discrepancy (shortening)
- **What are possible causes ?**
  - DDH
  - SCFE
  - Neck of femur fracture

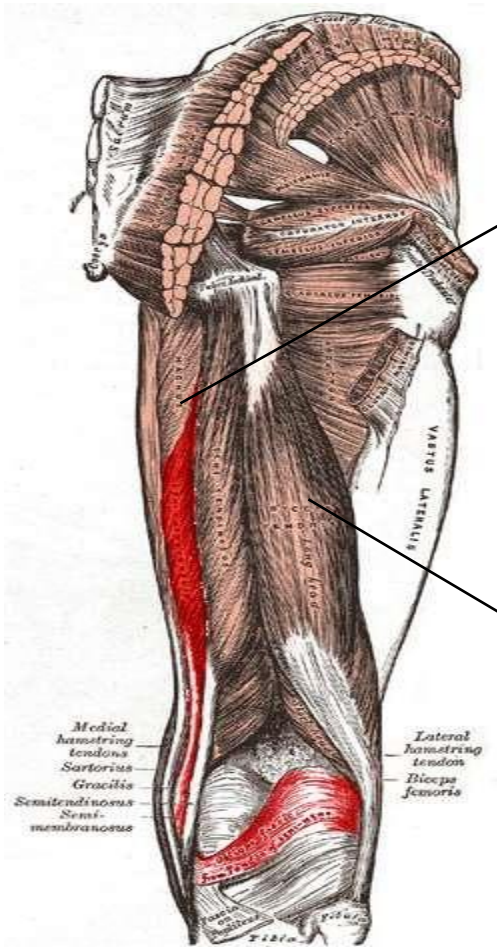



Thigh



Adductor longus 1

Adductor magnus 2



3

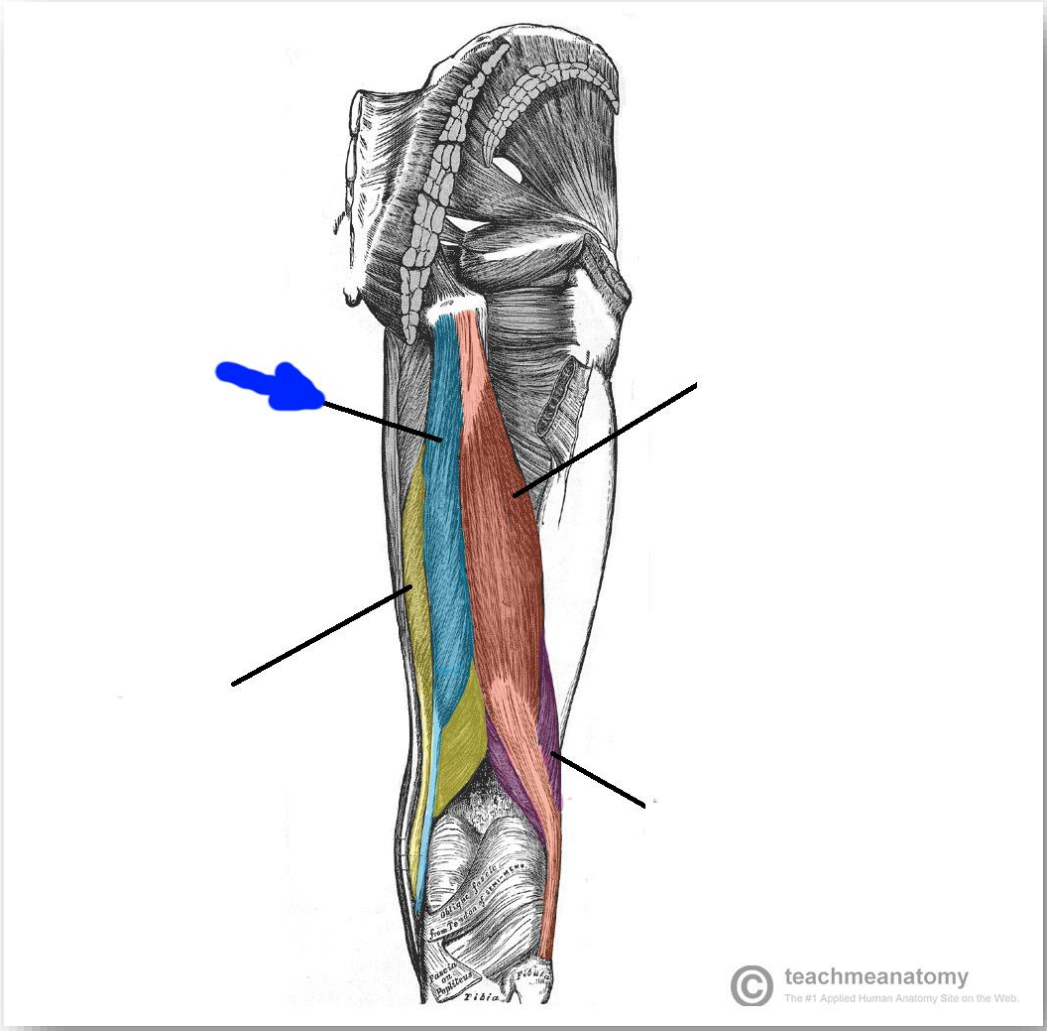
semi membrane

4

rectus femoris

What is the pointed muscle ?

a. Biceps femoris
b. Semimembranosus
c. Semitendinosus
d. Gastrocnemius
e. Vastus lateralis



Femoral shaft fracture

❖ Epidemiology

- Age: bimodal distribution, based on exposure to causative force
  - High-energy trauma associated: common in younger population (< 25 years)
  - Low-energy trauma associated: common in older population (> 65 years)
- Sex: ♂ > ♀

❖ Etiology

- High-impact trauma: motor vehicle accidents, pedestrian-versus-vehicle accidents, falls, gunshot wounds
- Low-impact injuries associated with pathological fractures: fall from standing (height > 1 m)
- Stress fractures (rare): seen in long distance runners

Winquist-Hansen classification

- Type 0: no comminution, simple transverse or oblique
- Type I
  - Small butterfly fragment
  - Minimal to no comminution
- Type II: butterfly fragment with at least 50% of the circumference of the cortices of the two major fragments intact
- Type III: butterfly fragment with 50-100% of the circumference of the two major fragments comminuted
- Type IV
  - Segmental comminution
  - All cortical contact is lost

Femoral shaft fracture

- **Diagnostics**
  - Plain x-ray
  - CT and MRI if a tumor, infection, or other pathological process is suspected
- **Management**
  - Stabilization, analgesia, and open fracture management
  - Splinting and traction
  - Surgery (definitive treatment)
    - Intramedullary rod via an interlocking nail (antegrade nailing): treatment of choice
    - External fixation with conversion to intramedullary nail within 2–3 weeks

Complications

- Shock
- Fat embolism (closed fractures)
- Vascular injuries
- Thromboembolism
- Infection (open fractures)
- Delayed union & non-union
- Malunion
- Joint stiffness due to soft tissue adhesion .

A 64 yrs old osteoporotic women after falling down

- **What is your diagnosis ?**
  - Proximal femur shaft fracture
- **What is your management ?**
  - Open reduction internal fixation

Femoral shaft fracture

- **What is your diagnosis ?**
  - Midshaft femur fracture
- **What is your management ?**
  - Surgery


Knee

Supracondylar fracture of the femur

- **Clinical findings**
  - The knee is swollen & deformed, movement is too painful to be attempted.
  - The tibial pulses should always be palpated.
- **X-ray**
  - The fracture is just above the femoral condyles & is transverse or comminuted, the distal fragment is usually tilted backwards.
  - x-ray the entire femur to exclude proximal fracture or dislocated hip .
- **Treatment**
  - If slightly displaced: skeletal traction
  - If fails open reduction with internal fixation
- **Complications**
  - Joint stiffness
  - Nonunion
  - Osteoarthritis

What Muscle cause this fracture ?

a. Gastrocnemius
b. Hamstring
c. Sartorius
d. Quadriceps

SUPRACONDYLAR FRACTURES OF THE FEMUR

Supracondylar fractures of the femur are seen (a) in young adults, usually as a result of high-energy trauma, and (b) in elderly, osteoporotic individuals. Direct trauma is the usual cause. The fracture line is just above the condyles, but it may branch off distally between them. The pull of the gastrocnemius attachments may tilt the distal fragment backwards.

Patient come to clinic after 9M post-surgery suffering from pain

- **What is your diagnosis ?**
  - Nonunion supracondylar fracture
- **Risk factors**
  - Use of tobacco or nicotine in any form
  - Older age
  - Severe anemia
  - Diabetes
  - A low vitamin D level
  - Hypothyroidism
  - Poor nutrition
  - Infection

These are nonspecific factors that increase the risk of nonunion

Condylar fractures

- **Clinical findings**
  - One or both condyles of the femur maybe fractured, the knee is swollen & the doughy feel of a hemarthrosis.
- **X-ray**
  - One condyle may be fractured & shifted upward, a supracondylar fracture maybe present
- **Treatment**
  - Accurate reduction is important
  - Open reduction & internal fixation are often employed
- **Complications**
  - Stiffness of the knee
  - Osteoarthritis

Patellar fractures

❖**Classification**: 3 types

- An undisplaced crack across the patella, which is probably due to direct blow
- A comminuted or stellate fracture, due to a fall or a direct on the front of the knee
- A transverse fracture with a gap between the fragments, this is an indication traction injury due to forced, passive flexion of the knee while the quadriceps muscle is contracted

❖**Clinical features**

- The knee is painful & swollen, sometimes the gap can be felt (loss of extension mechanism)

Most important factor to detect the mechanism of fracture

- Intact extensor mechanism

Patellofemoral Dislocation – Risk factors

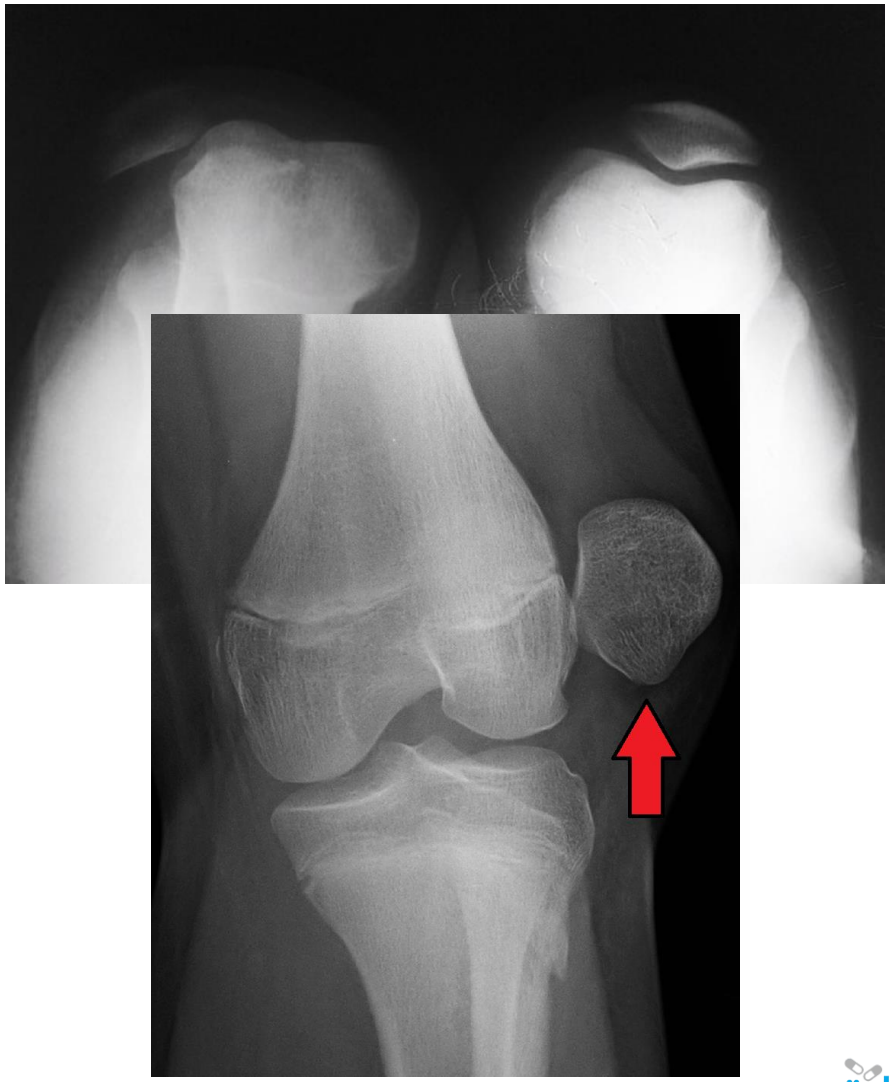
- **General factors**
  - ligamentous laxity (Ehlers-Danlos syndrome)
  - Previous patellar instability event
  - "miserable malalignment syndrome" (a term named for the 3 anatomic characteristics that lead to an increased Q angle)
    - femoral anteversion
    - genu valgum
    - external tibial torsion / pronated feet
- **Anatomical factors**
  - patella alta causes patella to not articulate with sulcus, losing its constraint effects
  - trochlear dysplasia
  - lateral femoral condyle hypoplasia

Patellofemoral Dislocation

- **Mechanism of injury**
  - Noncontact twisting injury with the knee extended and foot externally rotated
    - Patient will usually reflexively contract quadriceps thereby reducing the patella
  - Direct blow: less common
    - Ex. Knee to knee collision in basketball, or football helmet to side of knee
- **Symptoms**
  - Complaints of instability, anterior knee pain
- **Physical exam**
  - Acute dislocation usually associated with a large hemarthrosis
  - Medial sided tenderness (over MPFL)
  - Patellar apprehension (passive lateral translation results in guarding and a sense of apprehension)

Patellofemoral Dislocation

- **Imaging**: X- ray
- **Treatment**
  - Nonoperative: (NSAIDS, activity modification, and physical therapy)
  - Operative
    - MPFL repair
    - MPFL reconstruction with autograft vs allograft
    - Fulkerson-type osteotomy (anterior and medial tibial tubercle transfer)
    - lateral release
    - trochleoplasty



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Patient with recurrent patellar dislocation

How do you test it

a. Anterior drawer test
b. Cross over test
c. Patellar apprehension test
d. Apply's test
e. Lachman test

Patellofemoral Dislocation

❖**What test can be used to diagnose this injury ?**

a. Anterior drawer test
b. Cross over test
c. Patellar apprehension test
d. Apply's test
e. Lachman test

❖**All the following are risk factors for this condition EXCEPT:**

a. Genu varus (genu valgus is the risk factor)
b. Femoral anteversion
c. External tibial torsion / pronated feet
d. Trochlear dysplasia
e. Lateral femoral condyle hypoplasia

All the following are true except

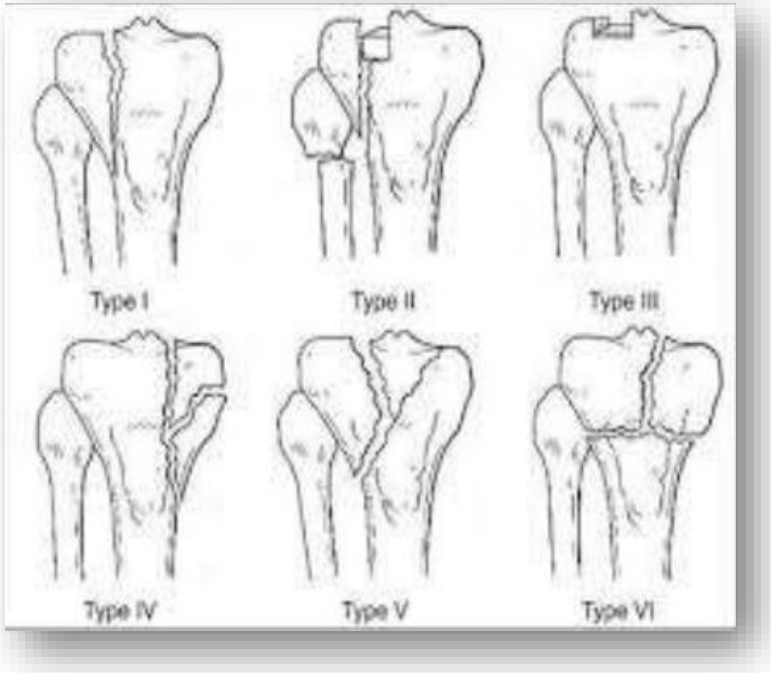
a. Genu Valgus
b. Genu Varus
c. Increase risk of patellofemoral Dislocation
d. Commonly seen in rickets

Tibial plateau fractures

- **Etiology**
  - RTA
  - Falls from a height in which the knee is forced into valgus or varus
- **Clinical features**
  - Usually affects the lateral condyle of the tibia, sometimes medial or bilateral
  - The patient is nearly always an adult
  - The joint is swollen & has doughy feeling of a hemarthrosis
  - Tenderness over the fracture

Classification

- ❖Type 1: Simple of the lateral condyle
- ❖Type 2: Split of the lateral condyle with more central depression
- ❖Type 3: Depression of the lateral condyle with intact rim
- ❖Type 4: Fracture of medial condyle
- ❖Type 5: Both condyles with central portion still connected
- ❖Type 6: Condylar + supracondylar fractures



Tibial plateau fractures

- **X-ray**
  - Multiple views are needed.
  - Tomography
- **Treatment**: Depends on the type.
- **Complications**
  - Compartment syndrome
  - Valgus or varus deformity
  - Joint stiffness
  - Osteoarthritis

History of falling down from 2nd floor

- Diagnosis:
  - Tibial plateau fracture
- Mechanism of fracture
  - Valgus falling down

  - If lateral condyle fractured: Valgus falling down
  - If medial condyle fractured: Varus falling down
  - If both fractured: Straight legs

Osgood Schlatter's Disease

(Tibial Tubercle Apophysitis)

- **Definition**: Osteochondrosis or traction apophysitis of tibial tubercle
- **Epidemiology**
  - Young adolescence complaing of ant. Knee pain mainly after exercise
  - Male > female
  - Male 12-15 y
  - Female 8-12
- **Physical exam**
  - Enlarged tibial tubercle
  - Tenderness over tibial tubercle
  - **Provocative test**: pain on resisted knee extension
- **X-ray**

Osgood Schlatter's Disease

- **Treatment**
  - Nonoperative
    - NSAIDS, rest, ice, activity modification
    - Cast immobilization x 6 weeks
  - Operative
    - Ossicle excision
      - Refractory cases (10% of patients)
      - In skeletally mature patients with persistent symptoms

The most sensitive test for this patient is

a. Lachman test
b. Posterior drawer test
c. Joint Line tenderness
d. MacMurray's test
e. Provocative test

a. Lachman test
b. Posterior drawer test
c. Joint Line tenderness
d. MacMurray's test
e. Tibial tuberosity tenderness

20 years old male patient complaining of knee pain

- **What disease could have caused the appearance shown here ?**
  - Osgood Schlatter disease
- **Where is the abnormality ?**
  - Secondry tibial tuberosity ossification center
- **Most common age for Osgood-schlatter is**
  a. 6
  b. 10
  c. 14

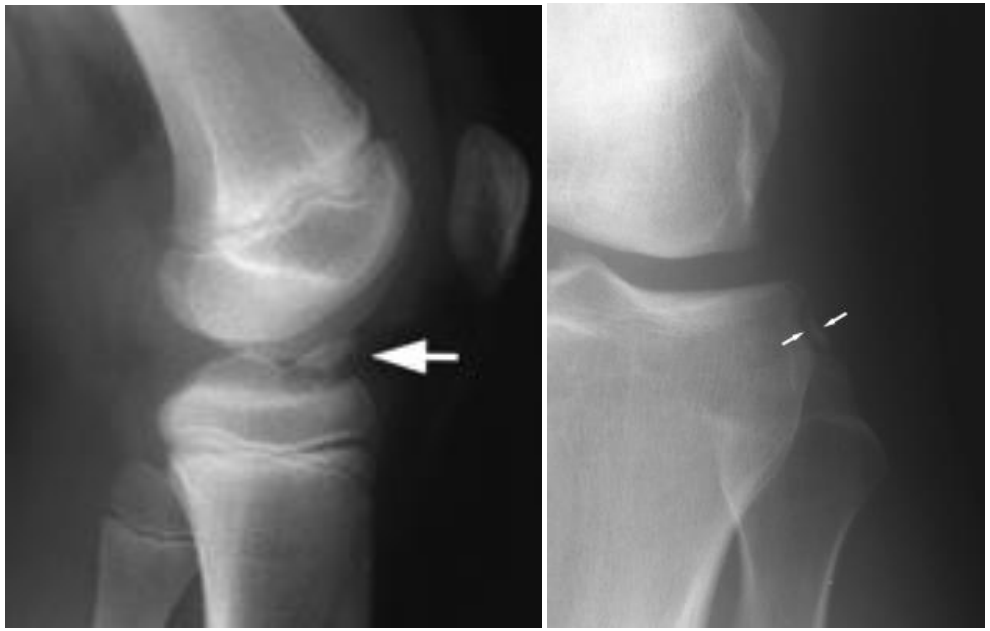
Ligaments & Menisci Injuries

Anterior cruciate Ligament

- **Function**: prevents anterior translation of the tibia relative to the femur
- **Anatomy**: intrasynovial, intracapsular
  - Origin: lateral femoral condyle
  - Insertion: anterior and between the intercondylar eminences of the tibia
  - Structure
    - anteromedial (tight in flexion and loose in extension)
    - posterolateral (tight in extension, loose in flexion)
- **Blood supply**: direct artery → when injured immediate hemarthrosis
- **Innervation**: for proprioception
- **Mechanism of injury**: Non-contact pivoting injury (most common), Blow to the lateral aspect of the knee
- **Symptoms**: Pian, Swelling, Felt a pop, Giving way

Anterior cruciate Ligament

- **Examination**: Lachman test, Anterior drawer test, Pivot shift test
- **Imaging**
  - X-rays: can be positive sometimes (Avulsion fracture)
  - MRI: Gold standard



Treatment

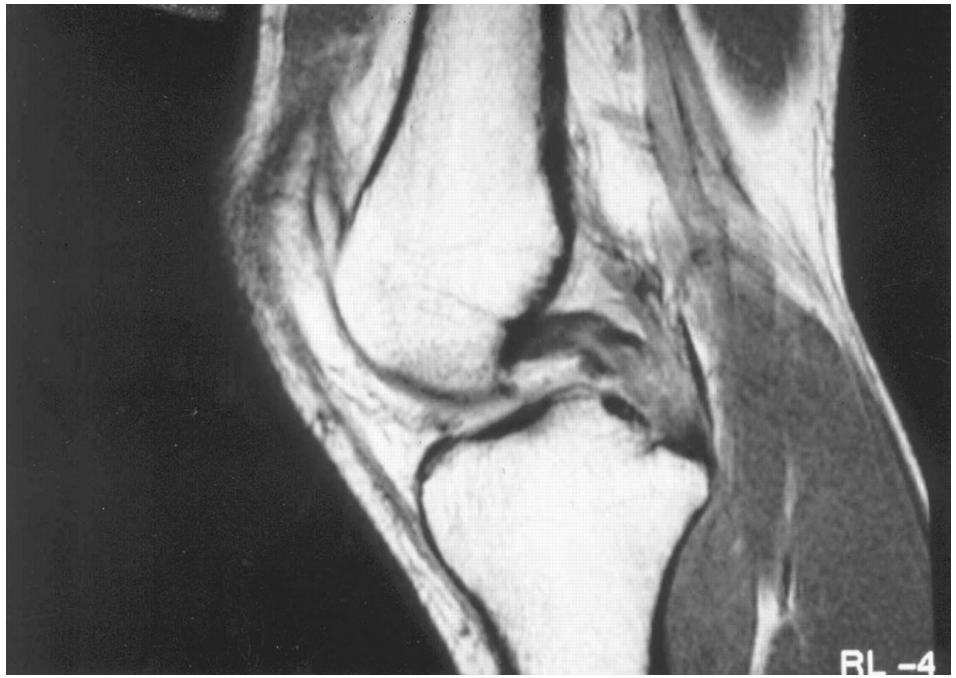
- **Non-Operative**: Physical therapy & lifestyle modifications; doesn't decrease the risk of meniscal tear
- **Operative**: Indications:
  - must have full motion of knee restored following injury (unless meniscal tear causing mechanical block)
  - lack of pre-operative motion risk factor for post-operative arthrofibrosis
  - younger, more active patients (reduces the incidence of meniscal or chondral injury)
  - children (activity limitation is not realistic)
  - older active patients (age >40 is not a contraindication if high demand athlete)
  - partial/single bundle tears with clinical and functional instability
  - prior ACL reconstruction failure

Posterior Cruciate Ligament

- **Function**: Prevents posterior translation of the tibia relative to the femur
- **Anatomy**: extrasynovial but intracapsular
  - **Origin**: medial femoral condyle
  - **Insertion**: tibial sulcus
  - **Structure**: two bundles
    - anterolateral
    - posteromedial
- **Blood supply**: direct artery → when injured immediate hemarthrosis
- **Innervation**: for proprioception
- **Mechanism of injury**: Direct blow to proximal tibia with a flexed knee (Dashboard injury), Noncontact hyperflexion with a plantar-flexed foot, Hyperextension injury
- **Symptoms**: posterior knee pain, instability (often subtle or asymptomatic in isolated PCL injuries)

Posterior Cruciate Ligament

- **Examination**: Posterior drawer test
- **Imaging**
  - X-rays: can be positive sometimes (Avulsion fracture)
  - MRI: Gold standard



Treatment

- **Nonoperative**: protected weight bearing & rehab
  - **Indications**: isolated Grade I (partial) and II (complete isolated) injuries
  - **Modalities**: quadriceps rehabilitation with a focus on knee extensor strengthening
- **Operative**: PCL repair of bony avulsion fractures or reconstruction
  - **Indications**
    - Combined ligamentous injuries
    - Isolated grade II or III injuries with bony avulsion
    - Isolated chronic PCL injuries with a functionally unstable knee

Meniscal tear

❖Mechanism of injury

- An acute twisting injury from impact during a sport (usually, the foot stays fixed on the ground and the rest of body rotates)
- Getting up from a squatting or crouching position
- Loading the knee from a fixed position

❖Symptoms

- Pain localizing to medial or lateral side
- Mechanical symptoms (locking and clicking), especially with squatting
- Delayed or intermittent swelling

❖Examination

- Joint Line tenderness is the most sensitive physical examination finding.
- Mcmurray's test
- Apply grinding test
- Thessaly test

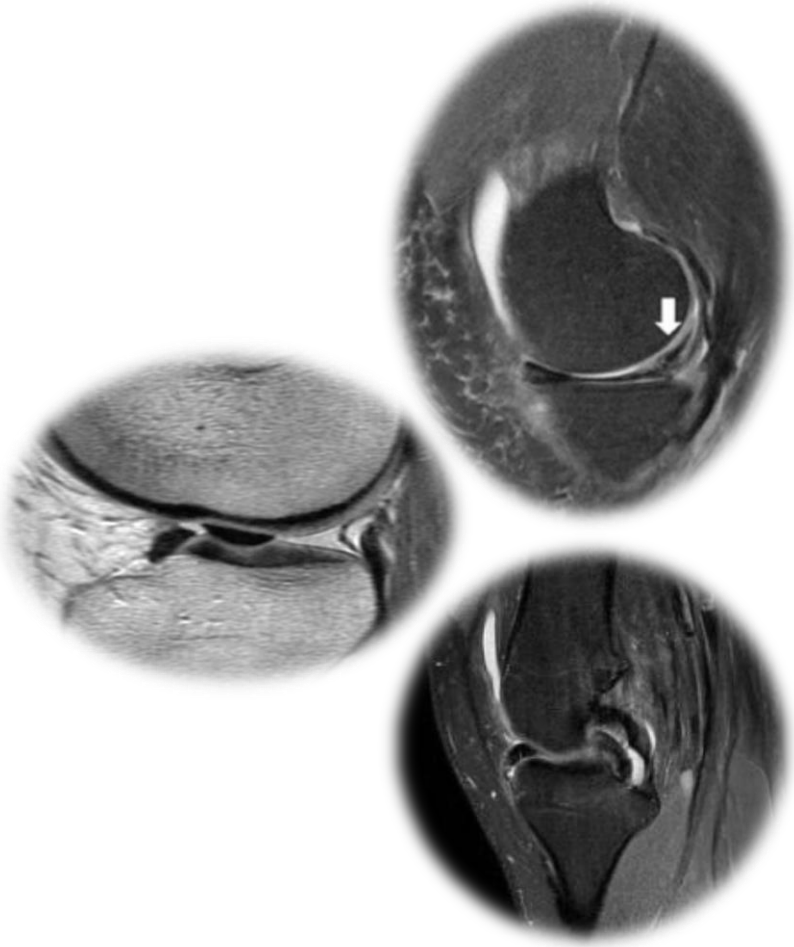
Meniscal tear

❖Classification

- Location
  - red zone (outer third, vascularized)
  - red-white zone (middle third)
  - white zone (inner third, avascular)
- Position (anterior, middle, posterior third, root)
- Size
- Pattern

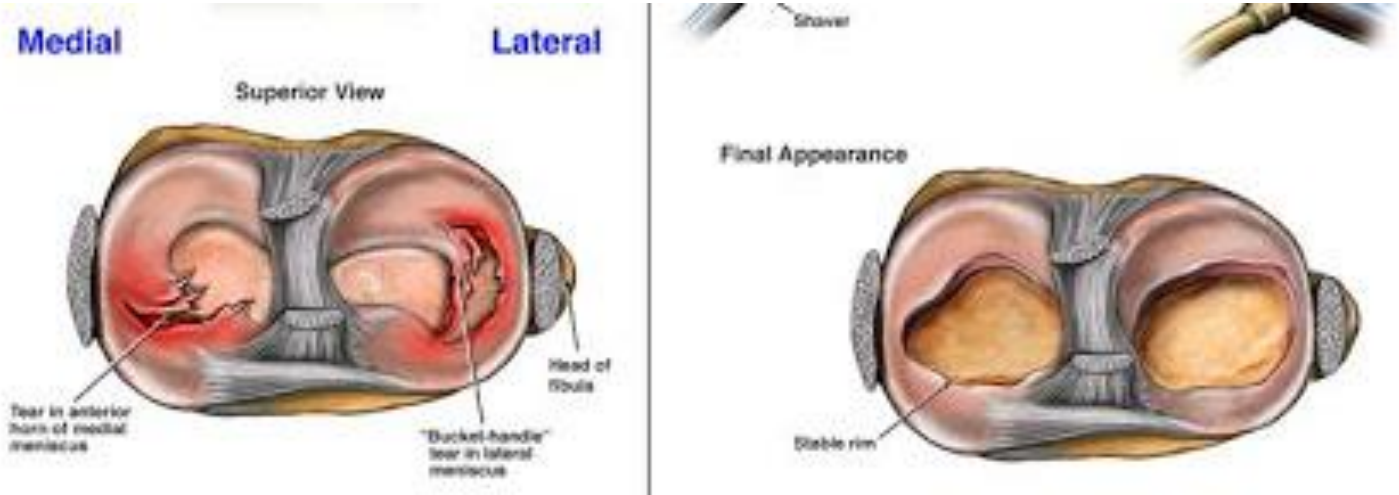
❖Imaging

- MRI (Most sensitive diagnostic test, but also has a high false positive rate)



Meniscal tear – Treatment

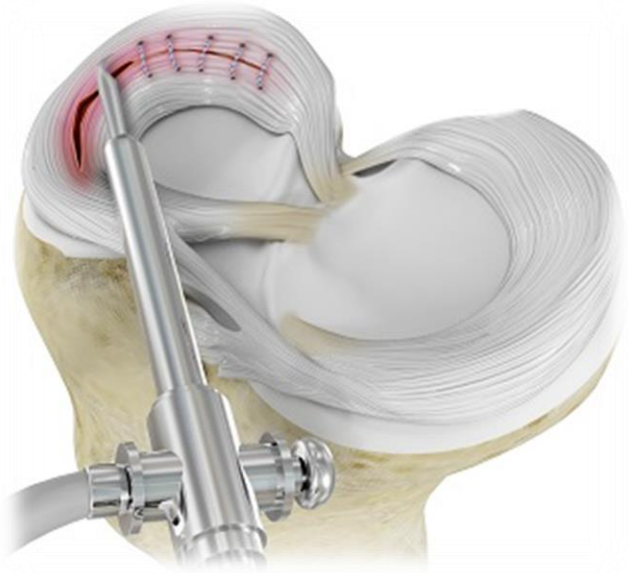
- **Nonoperative**: Rest, NSAIDs, Rehabilitation
  - Indicated as first line treatment for degenerative tears
  - Outcomes
    - Improvement in knee function following physical therapy
    - "Noninferior" when compared to arthroscopic partial meniscectomy
- **Partial meniscectomy**
  - Indications
    - Tears not amenable to repair (complex, degenerative, radial tear patterns)
    - Repair failure >2 times
  - Outcomes: >80% satisfactory function at minimum follow-up

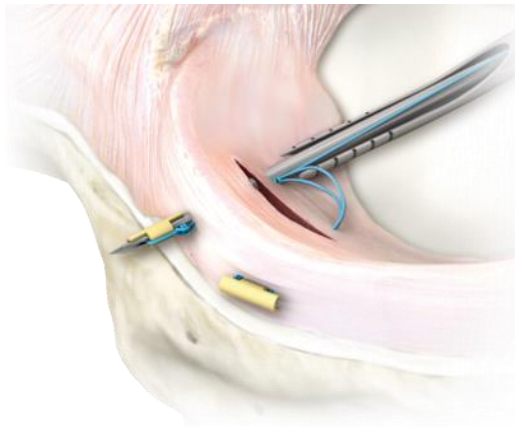


Meniscal tear – Treatment

❖ Meniscal Repair

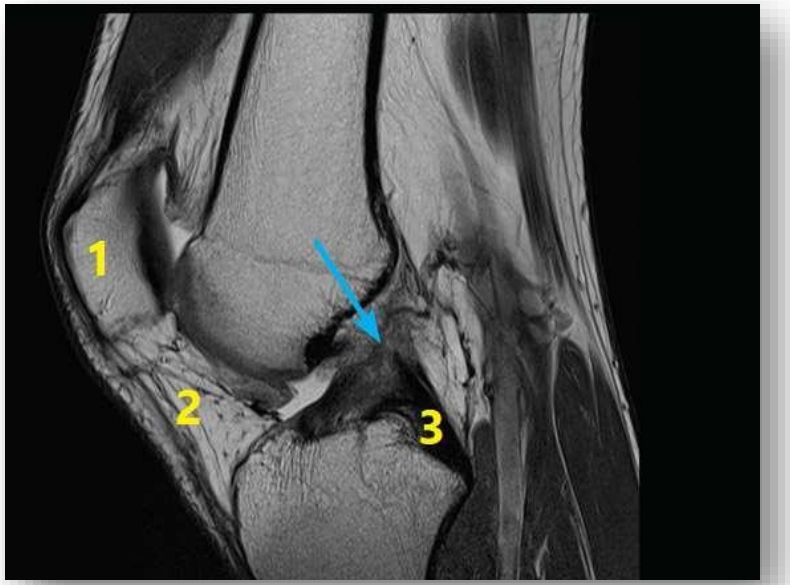
- Indications
  - Peripheral in the red-red zone (vascularized region)
  - Vertical and longitudinal tear
  - rather than radial, horizontal or degenerative tear
  - bucket handle meniscus tear.
  - Root tear
  - Acute repair combined with ACL reconstruction
- Outcomes: 70-95% successful





What is the name of theses structure ?

1. patella
2. patellar tendon
3. posterior cruciate ligment



Test used for diagnosis of this injury

a. apprehension test
b. Lachman test
c. MacMurray test
d. Provocative test
e. Posterior drawer test

Patient with meniscal tear, the most sensitive test is

a. apprehension test
b. Lachman test
c. MacMurray test
d. Provocative test
e. Posterior drawer test

All are examination of ACL injury except

a. Lachman
b. MacMurray
c. Pivot
d. KT -1000
e. Anterior drawer test

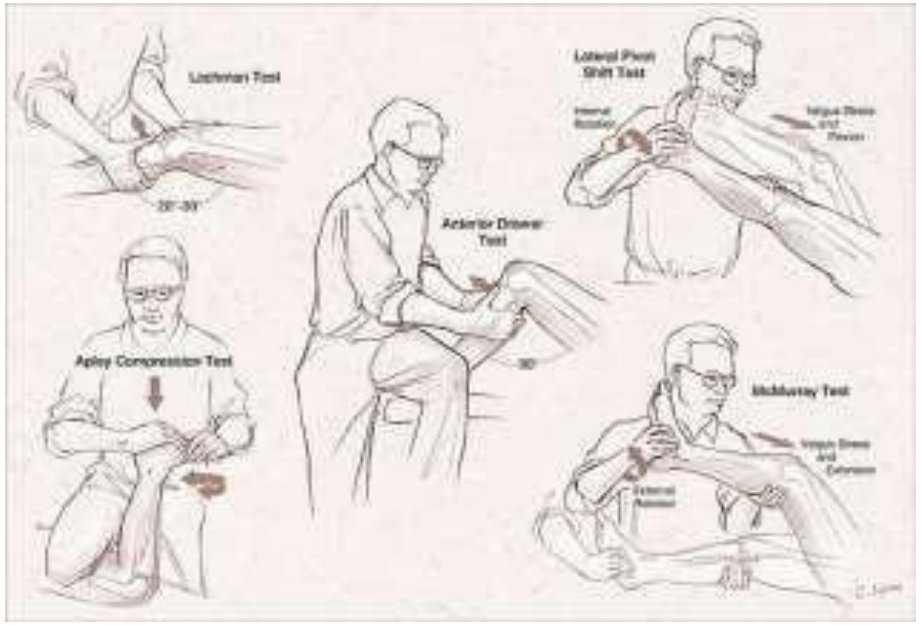
Patient came with this injuries after 6 month

What is the main complain ?

a. Pain (very severe)
b. Swelling
c. Felt a POP
d. Giving way

All the following tests done in the supine position except

a. Apley's test
b. Lachman test
c. Anterior drawer test
d. MacMurray test



MacMurray test for the medial meniscus

a. Full flexion, external rotation, valgus stress and then extension
b. Extension, internal rotation, valgus stress then extension
c. Full flexion ,external rotation, varus stress the extension

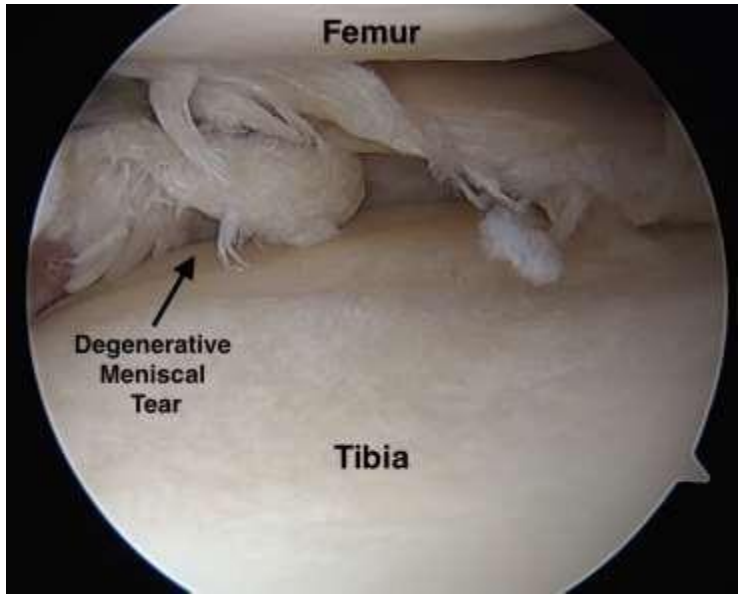
Ligaments & Menisci Injuries

One of these is the most accurate physical examination test to this case (meniscal tear)

a. Apley's distraction test

b. Joint Line tenderness

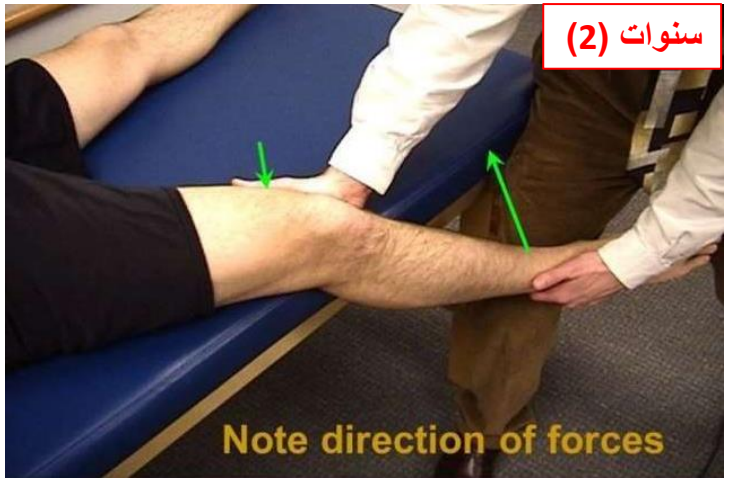
c. Lachman test



Ligaments & Menisci Injuries

- **This test is**
  - Valgus stress test
- **The ligament examined is**
  - Medial collateral ligament

- **This test is**
  - Varus stress test
- **The ligament examined is**
  - Lateral collateral ligament



Patient suspected to have ACL tear

❖**What is the test preformed in the picture ?**

- According to the picture, Lachman test procedure(flexion 30 degrees and pulling the tibia anteriorly)

❖**What is not true about this tear ?**

a. MacMurray test positive

b.

c.

d.

e.

Ligaments & Menisci Injuries

- **What is the name of this sign**
  - Sag sign
- **What is the injured ligament**
  - PCL
- **Test for the injured structure in the picture is**
  - Posterior drawer test

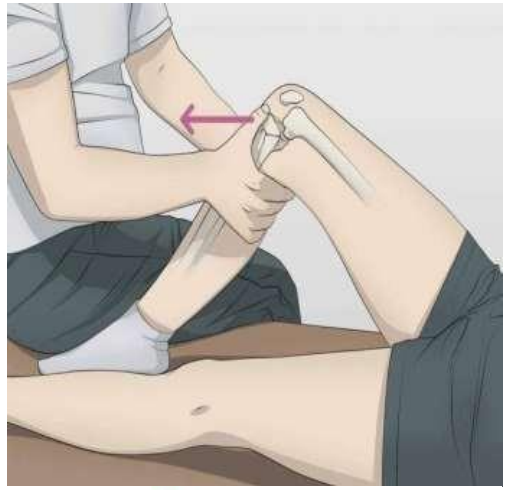
Ligaments & Menisci Injuries

- **The sign shown in the red circle indicates what ?**
  - ACL tear (Segond fracture, pathognomic)
- **Most common sensitive test to diagnose**:
  - Lachman

- **What pathology can you see in this image ?**
  - Meniscal tear (double PCL sign)

Ligaments & Menisci Injuries

- **What is the examined ligament ?**
  - ACL
- **What is the attachment of the structure examined ?**
  - Medial border of lateral femoral condyle



Ligaments & Menisci Injuries

- Patient came to ER With knee pain 1 day duration and the TM was 39. Aspiration from joint is shown in the second photo
- Write 2 possible causes
  1. ACL tear
  2. Hemarthrosis
  3. Hemophilia

All the following can cause this except

a. Clergyman bursa
b. Backers' cyst

Will Graham: A 24-Year-Old Youth Pastor With Posterior Left Knee Swelling and Pain

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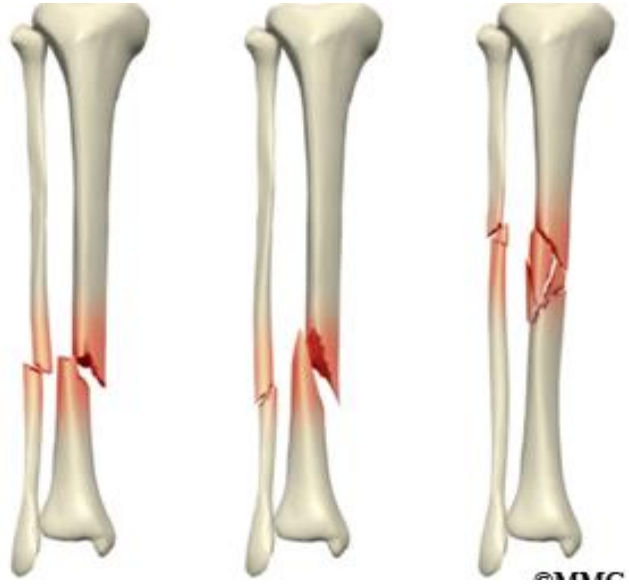
Leg

Tibial fractures

- **Epidemiology**: the most common type of long bone fractures
- **Etiology**: usually caused by direct trauma
- **Classification**
  - Tibial plateau fracture (discussed earlier)
  - Isolated tibia fracture
    - Open or closed
    - Displaced or nondisplaced
    - Proximal or shaft
  - Isolated fibula fracture
  - Combined tibia and fibula fracture



- **Clinical features**
  - High risk of open fracture (and consequently infection) given minimal soft tissue surrounding the tibia and fibula

Diagnostics

- Clinical examination: peripheral perfusion, motor function, and sensation
- X-rays: knee and ankle (anteroposterior and lateral views)
  - Even when no obvious fracture is detected, tibial plateau fractures may cause lipohemarthrosis. This is visible as a fat-fluid level on x-ray.
- MRI: can be useful to assess injuries to the meniscus and the ligaments associated with tibial plateau fractures.
- Joint aspiration: can be performed
  - Bloody effusion (hemarthrosis) with fatty spots indicates an osteochondral fracture.

Management

❖Conservative treatment

- Isolated fibula fractures: splinting and partial weight bearing
- Nondisplaced proximal tibial fractures: hinged knee brace and no weight bearing for 6 weeks
- Nondisplaced tibial shaft fractures: long leg cast (if the long leg cast fails to ensure proper healing, then surgical treatment is indicated)

❖Surgical treatment

- Indication: open or displaced tibial shaft fractures
- Open fractures require urgent irrigation and debridement
- Open reduction and internal fixation with plate, screw, or intramedullary nail
- External fixation may be used, especially for complex fractures.

Complications

- High risk of compartment syndrome in any of the compartments, given that the tibia is surrounded by the anterior, lateral, and deep posterior compartments of the lower leg
- Fat embolism
- Peroneal nerve injury (foot drop)
- Deep vein thrombosis
- Nonunion
- Post-traumatic arthritis

Isolated fibula fracture

- **Which nerve is affected in this injury ?**
  - Common peroneal nerve
- **Nerve injury associated with this fracture will result in the loss of what ?**
  - Loss of ankle dorsiflexion

Common peroneal nerve

- **After knee surgery patient came with this condition, what is your diagnosis ?**
  - Drop foot
- **Name of injured nerve**
  - Common peroneal nerve

Toddler fracture

- **Definition**: a nondisplaced isolated fracture of the distal tibial shaft, usually following acute trauma (e.g., falling, tripping), causing rotation of the body around a fixed foot (oblique or spiral fracture)
- **Epidemiology**: commonly seen in children between nine months and three years of age
- **Mechanism of injury**: trauma (e.g., low energy fall from a chair or table, tripping while running)
- **Clinical features**
  - Irritability
  - Abnormal gait (limping or inability to bear weight)
  - Localized tenderness over the distal tibial shaft

Toddler fracture

- **Diagnostics**
  - Often goes undetected due to subtle clinical and radiographic findings
  - Imaging
    - AP, lateral, and oblique x-ray
    - MRI and/or CT: indicated in cases of prolonged symptoms and suspicion of infection (e.g., osteomyelitis)
- **Management**
  - Above knee cast 4-6 weeks.
  - Weight bearing as tolerated.
  - Heals completely in 6-8 weeks.

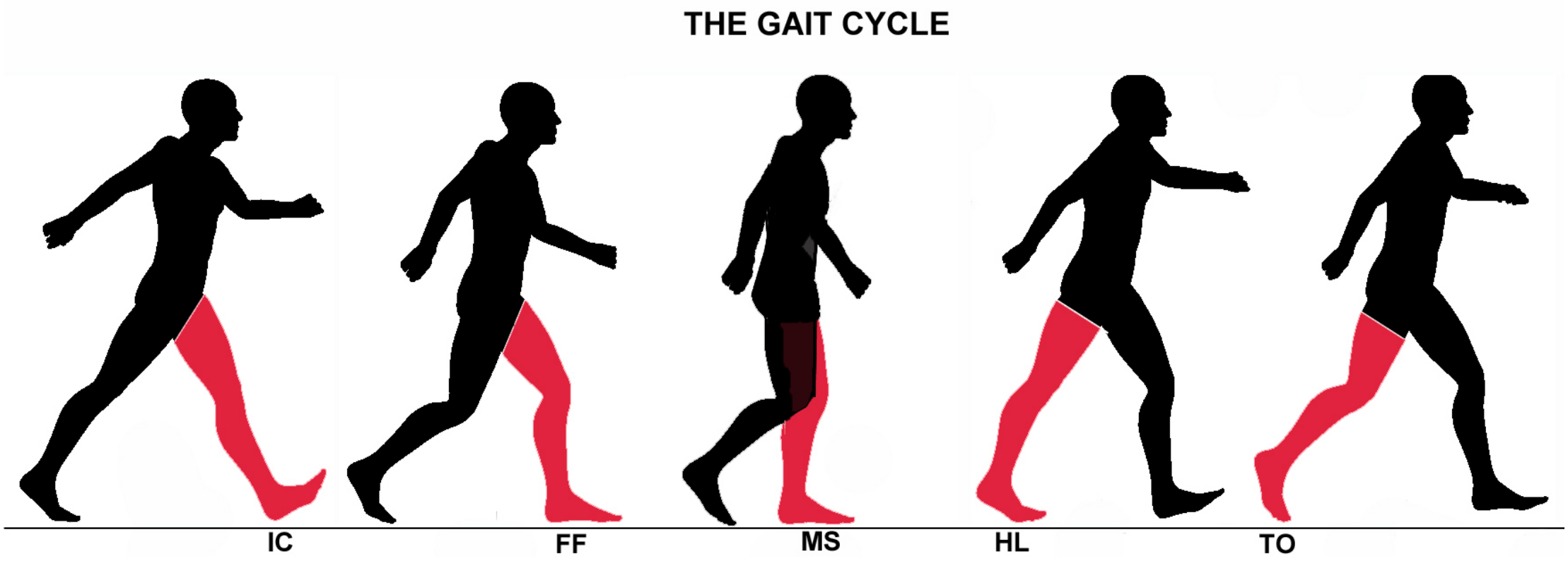
The management for this fracture

a. Cast above knee
b. Cast bellow knee
c. Closed reduction and wires
d. Nail fixation
e. Plate fixation

Ankle

Gait cycle consist of 2 phases what are they ?

1. Stance phase
2. Swing phase



Ankle fractures

- **Etiology**: Supination or pronation trauma (“twisted ankle”)
- **Classification**
  - Isolated medial or lateral malleolar fracture; Usually stable
  - Posterior malleolus fracture (refers to the posterior tibia); Usually unstable
  - Bimalleolar fracture (both medial and lateral malleolus); Mostly unstable
  - Trimalleolar fracture (medial, lateral and posterior malleolus); Always unstable
  - **Special forms**
    - Avulsion of a bony fragment from the posterior tibial margin (Volkmann triangle)
    - **Pilon fracture**: fracture of the distal tibia that involves the tibial part of the talocrural joint and is frequently associated with fibular fractures

What is your diagnosis ?

a. Pilon fracture
b. Tuft fracture
c. Tibial plateau fracture
d. Avulsion fracture
e. Posterior malleolus fracture

Ankle fractures

❖Clinical features

- Local pain, swelling and hematoma
- Tenderness, especially in the area of the malleoli, the syndesmosis, and the posterior aspect of the ankle joint
- Restricted range of movement

❖Diagnostics

- 3-view plain x-ray: anteroposterior (AP), lateral and oblique view
  - Evaluate articular surfaces
  - Compare joint spaces between talus and medial malleolus, talus and lateral malleolus, and talus and tibial plafond
  - Check for breaks in the ring of the ankle joint and for bony fractures

Ankle fractures

❖ Management

- **Initial management**: rest, ice, compression, and elevation
- **Conservative treatment**
  - Indications: stable fractures (isolated/nondisplaced malleolar fractures)
  - Short leg cast for 4–6 weeks
- **Surgical treatment**: to ensure normal alignment of bone and cartilage to prevent ankle arthritis and to regain functionality
  - Indications: unstable/displaced fractures, open ankle fractures, and cases of neurovascular damage
  - Technique: reposition and internal or external fixation with metal plates and/or screws

❖ Complications

- Damage to the peroneal nerve or saphenous nerve

History of twisting injury

- **What is your diagnosis ?**
  - Ankle sprain
- **What is the most common injured ligament ?**
  a. Anterior tibiofibular ligament
  b. Posterior talofibular ligament
  c. Anterior talofibular ligament
  d. Calcaneonavicular ligament
  e. Tibionavicular ligament
- **Second most common**
  - Calcaneofibular

Ankle fractures – Pediatrics

❖Triplane Fractures

- Triplane Fractures are traumatic ankle fractures seen in children 10-17 years of age characterized by a complex Salter-Harris IV fracture pattern in multiple planes
- Diagnosis can be made with plain radiographs of the ankle. CT scan may be required to further characterize the fracture pattern and for surgical planning
- Treatment is closed reduction and casting or surgical fixation depending on the patient age and degree of fracture displacement

Ankle fractures – Pediatrics

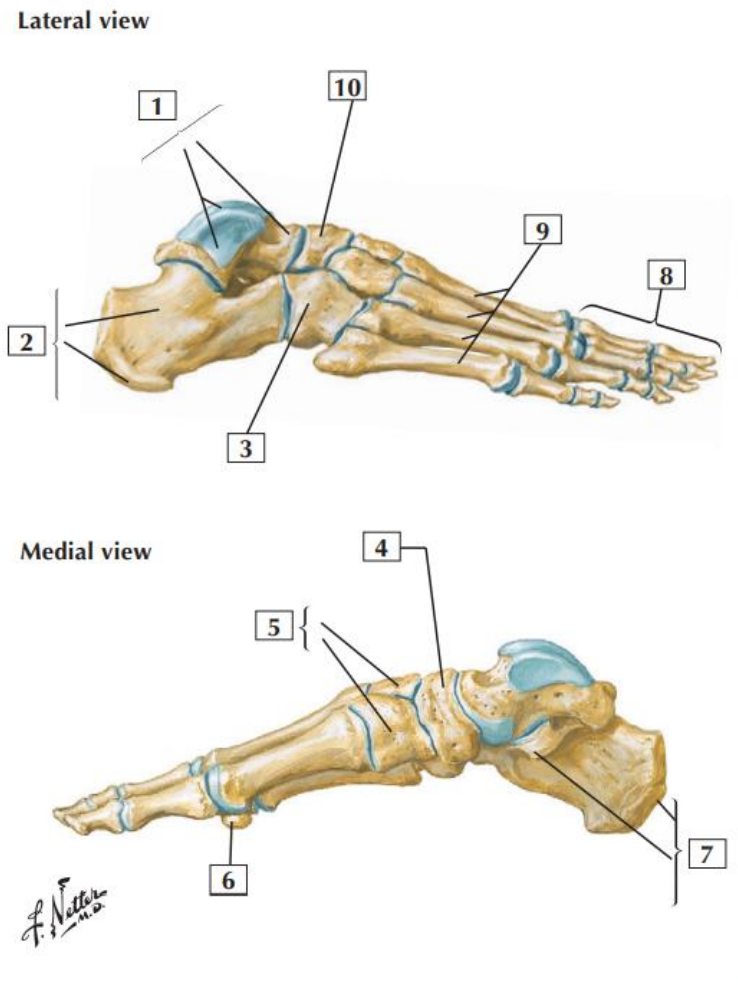
❖Tillaux fracture

- Tillaux Fractures are traumatic ankle injuries in the pediatric population characterized by a Salter-Harris III fracture of the anterolateral distal tibia epiphysis.
- Diagnosis can be made with plain radiographs of the ankle. CT scan may be required to further characterize the fracture pattern and for surgical planning.
- Treatment is closed reduction and casting if < 2mm displacement or operative management if > 2mm displacement.

Foot

Bones of Foot

1. Talus (Head; Trochlea)
2. Calcaneus (Body; Tuberosity)
3. Cuboid
4. Navicular
5. Cuneiform bones
6. Sesamoid bone
7. Calcaneus (Tuberosity; Sustentaculum tali)
8. Phalanges
9. Metatarsal bones
10. Navicular



Bones of Foot

What is the name of this bone

a. Cuneiform
b. Capitation
c. Navicular
d. Cuboid
e. Hamate

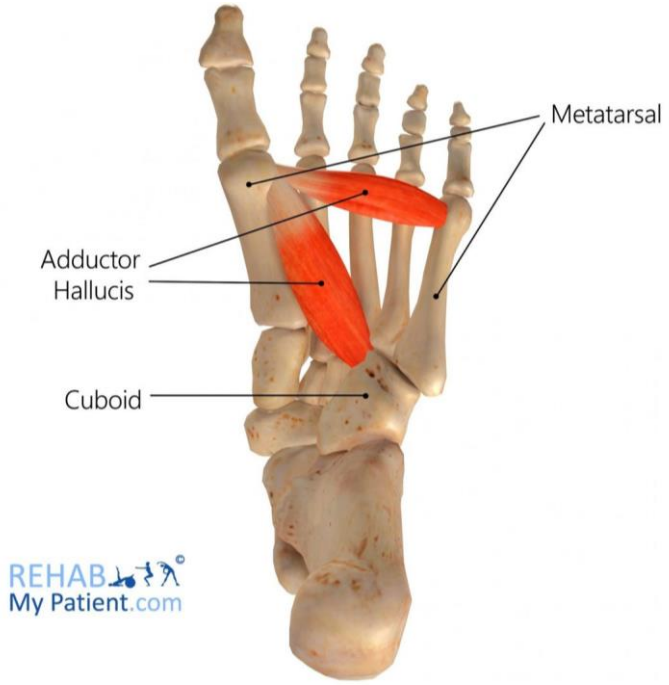
Not the same picture

What is the name of these bones

1. Cuboid
2. Navicular bone

Anatomy question

- Name of the muscle
  - Adductor hallucis



Talus fractures

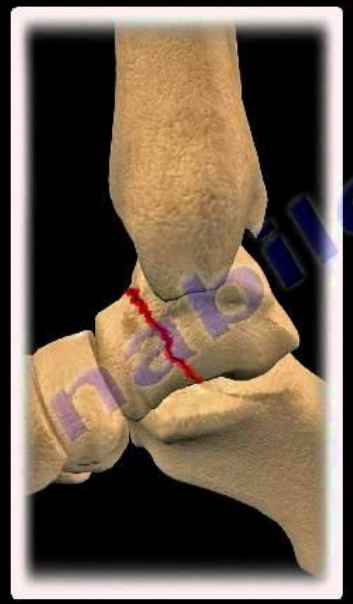
- **Epidemiology**: Rare, due to considerable power needed
- **Etiology**
  - High energy trauma: fall from a height, motor vehicle collision
  - Axial loading: sports injuries (esp. snowboarder's ankle)
- **Imaging**
  - Plain x-ray series
    - AP, lateral, and mortise views of the ankle
    - AP, lateral, and oblique views of the foot
    - Canale view: used when there is a high suspicion of talar neck fractures or if CT imaging is unavailable
  - CT scan (confirmatory test): used to assess articular involvement and characterize fracture

Talus Fracture, Types

Type I

Non-displaced

15% AVN



Type II

Fracture with subtalar dislocation or subluxation

50% AVN

Type III

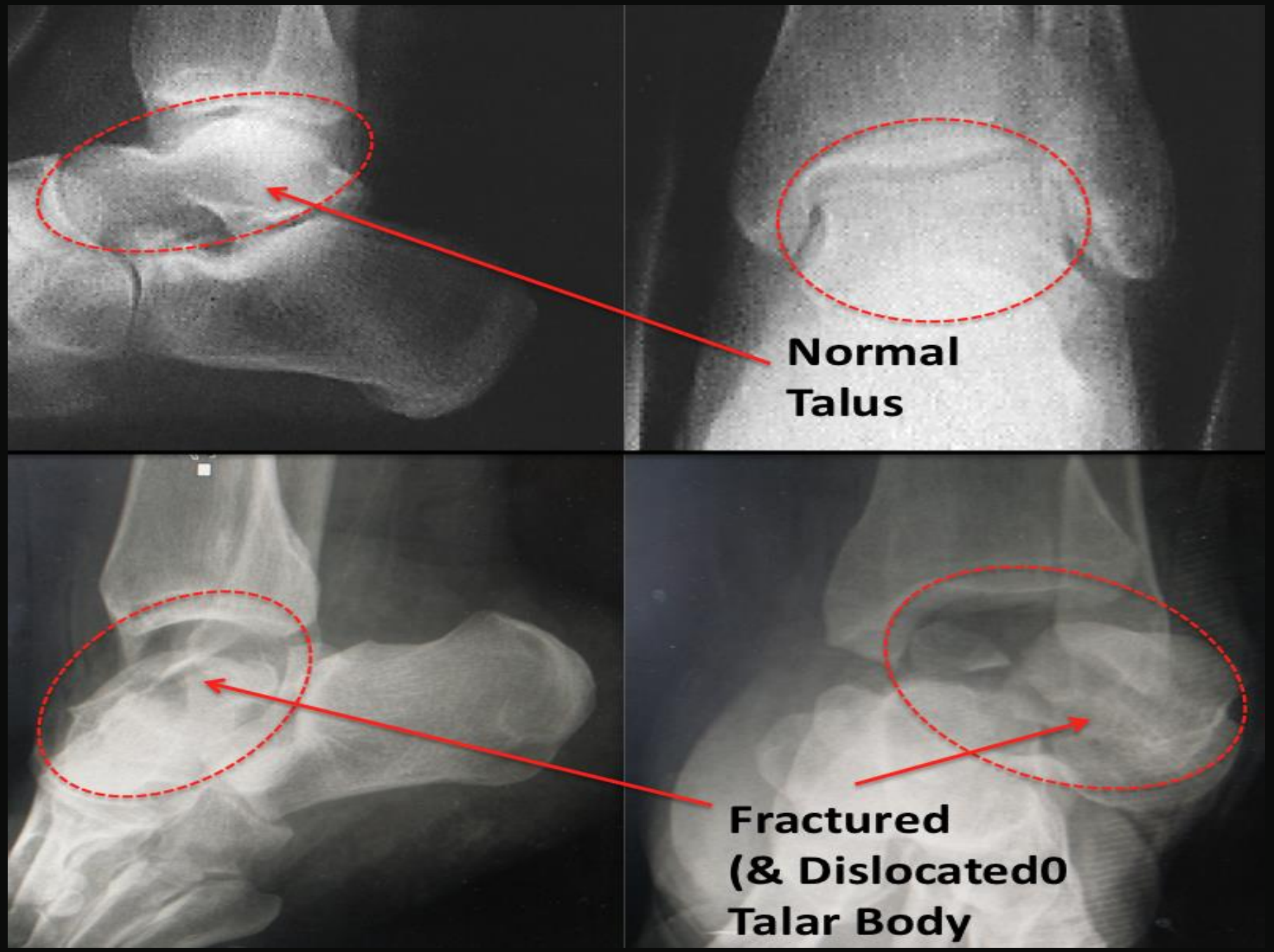
Fracture with subtalar and Tibiotalar dislocation

90% AVN

Type IV

Fracture with subtalar and Tibiotalar dislocation and Talonavicular subluxation

90 - 100% AVN


Normal
Talus
Fractured
(& Dislocated0
Talar Body

Management

❖Conservative

- Technique: non-weight-bearing, short leg cast usually for 6–8 weeks (talar neck fractures up to 12 weeks)
- Indications: stable or nondisplaced fractures
- Other
  - Pain management (NSAIDs, opioids, local anesthetics)
  - Physical therapy

❖Surgical

- Procedure: open reduction and internal fixation
- Indications
  - Open fractures
  - Displaced fractures (> 2 mm)
  - Comminuted fractures
  - Neurovascular injury
  - Associated dislocation

❖Complications

- Avascular necrosis.
- Joint stiffness
- Osteoarthritis

Talus fractures

- What type of fracture is shown in this image?
  - Talus neck fracture

Calcaneum fractures

- **Etiology**: Falling (often from a ladder) onto one or both heels
- **Clinical features**
  - Spine, pelvis & hip must be checked
  - The foot is painful, swollen & bruised, the heel may look broad & squat
  - Ankle movement is possible, but the subtalar joint can not be moved
- **X-ray**
  - Crack features can be missed unless special views are obtained.
  - Bohler's angle: flattening of the tuber-joint angle.
  - Intra-articular features may need CT scan.
  - You should x-ray the pelvis & spine as well

Calcaneum fractures

❖Treatment

- Admission so that the foot & leg can be elevated, treated with ice bags until swelling subsides.
- Undisplaced treated with close reduction.
- If displaced, needs internal fixation.

❖Complication

- Broadening of the heel
- Talocalcaneal stiffness & osteoarthritis

What is the most common delayed function loss with this fracture ?

a. Planter flexion
b. Supination and adduction
c. Dorsiflexion
d. Inversion and Eversion
e. Abduction

Not the same picture, but it was calcaneus bone fracture

Mid-tarsal & tars metatarsal fractures

❖Etiology

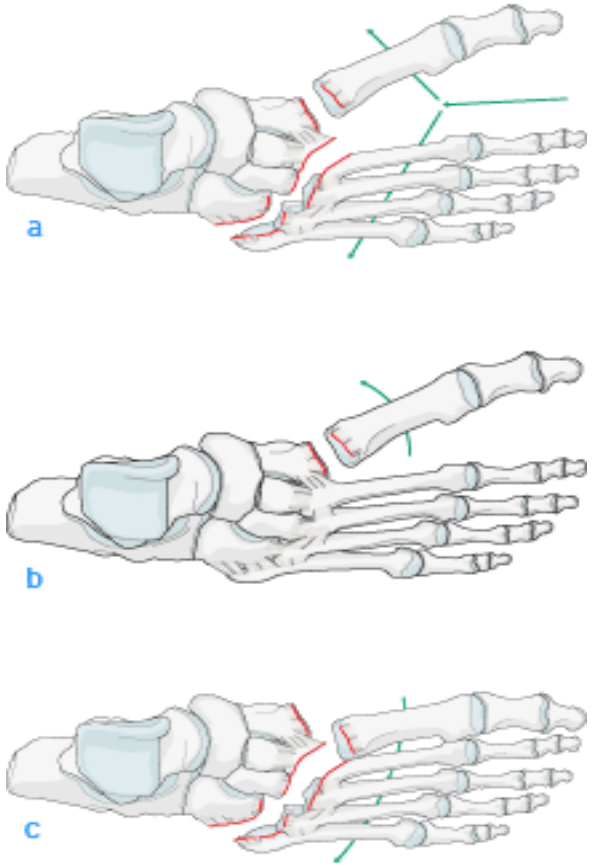
- Falls in which the foot is twisted

❖Clinical features

- Crushing injuries are worse, because of accompanied severe soft tissue damage, bleeding into facial compartments may cause ischemia of the foot.
- Foot is swollen & bruised.
- Pain on moving the forefoot.
- Examine for signs of ischemia

❖X-ray

- Multiple views are required to show the extent of the injury



Treatment

- ❖Ligamentous strains: bandages.
- ❖Undisplaced fractures: elevate foot for 4 days, then below knee cast.
- ❖Fracture dislocation: reduce fracture under GA & maintain fixation.

Lisfranc fracture

- **What is the management of this deformity ?**
  - ORIF (Open reduction internal fixation)

5th Metatarsal avulsion fracture

❖Which of the following muscles is responsible for this avulsion fracture

a. Posterior tibialis muscle
b. Peroneus brevis
c. Peroneus longus
d. Planter fascia
e. Anterior tibialis muscle

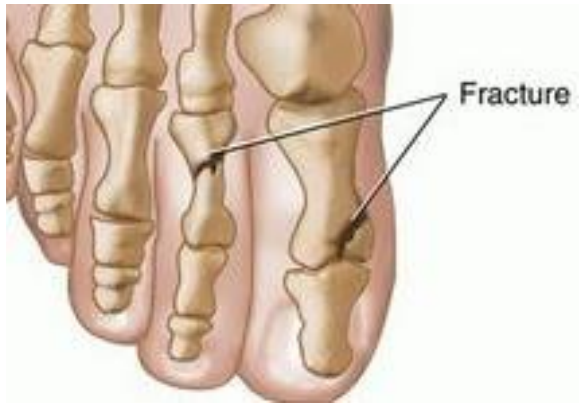
Fractured toes

❖Etiology

- Heavy object falling on the toes may fracture phalanges.

❖Clinical features

- If the skin is broken it must be covered with a sterile dressing.
- The fracture is disregarded & the patient encouraged to walk in suitably mutilated boot.



Common foot disorders

Achilles tendinitis

- **Definition**: overuse injury of the Achilles tendon
- **Etiology**: athletes/individuals who have recently increased their exercise intensity
- **Clinical features**: pain and tenderness **2–6 cm above** the insertion of the Achilles tendon, may come on gradually, or rapidly
- **Management**
  - Rest
  - Stretching and later strengthening of the calf muscles
  - Switching to a different, less strenuous sport
  - Icing
  - Physical therapy, ECSW
  - Anti-inflammatory medication.
  - Wearing a shoe with a built-up heel to take tension off Achilles tendon

Achilles tendon rupture

❖Epidemiology

- Most common in people that are active in sports or recreational activity
- More common in males, 30-50 years old

❖Clinical features

- A ripping or popping sensation is felt, and often heard, at the back of the heel.
- The typical site for rupture is at the vascular watershed about 4 cm above the tendon insertion.
- Plantarflexion of the foot is usually inhibited and weak
- There is often a palpable gap at the site of rupture; bruising comes out a day or two later

Patient with a trauma history

سنوات (4)

❖ **What is your diagnosis ?**

- Ruptured Achilles tendon

سنوات (1)

❖ **Muscles of the affected structure are**

- Superficial posterior muscles

سنوات (2)

❖ **Which of the following is not associated with Achilles tendon tear ?**

a. Positive squeeze test
b. Palpable gap at the site of rupture
c. Compromised dorsiflexion of the foot

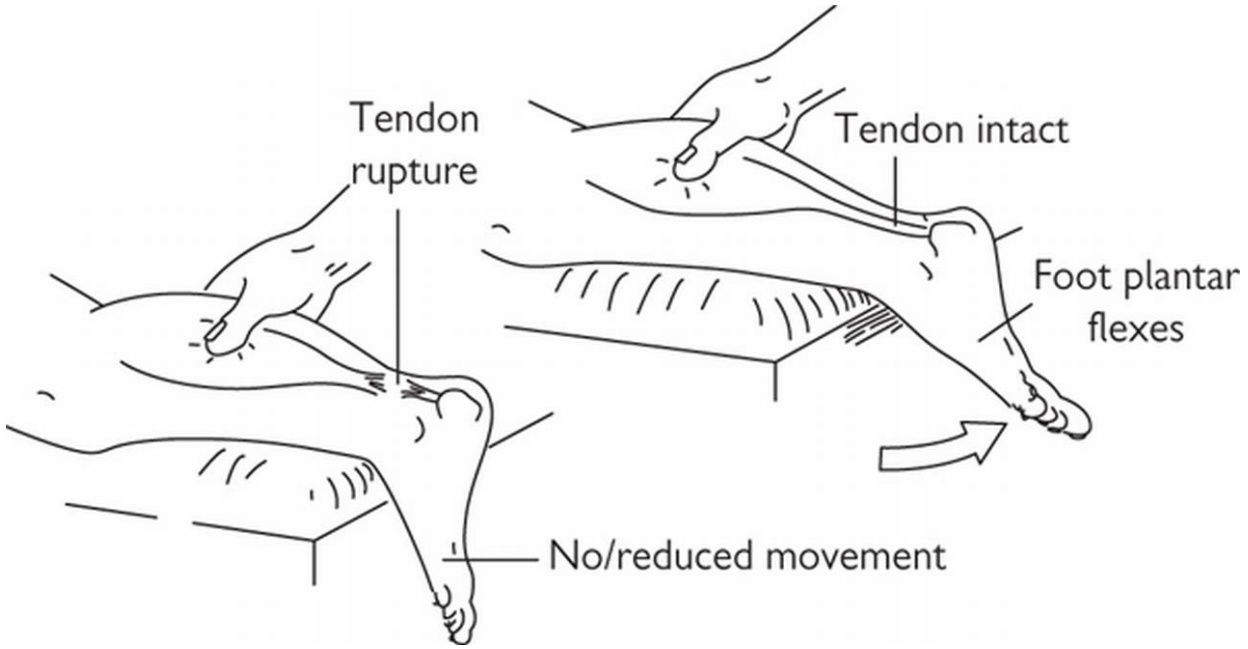
سنوات (1)

❖ **Management**

- Achilles tendon rupture repair

Achilles tendon rupture

- **Diagnosis**
  - The calf squeeze test (Thompson's or Simmond's test)
- **Management**
  - Conservative; cast with the foot in plantar flexion
  - Surgical; direct repair of achillis tendon



Retrocalcaneal bursitis

❖Definition

- Retrocalcaneal bursitis is inflammation of the bursa between the anterior aspect of the Achilles and posterior aspect of the calcaneus.

❖Clinical features

- Haglund deformity an enlargement of the posterosuperior tuberosity of the calcaneus.
- Pain localized to anterior and 2 to 3 cm proximal to the Achilles tendon insertion
- Fullness and tenderness medial and lateral to tendon
- Pain with dorsiflexion
- Bony prominence at Achilles insertion

❖Management

- **Nonoperative**: Activity modification, shoe wear modification, physical therapy, NSAIDs.
- **Operative**: Retrocalcaneal bursa excision and resection of Haglund deformity.

Tarsal Tunnel Syndrome

❖Pathophysiology

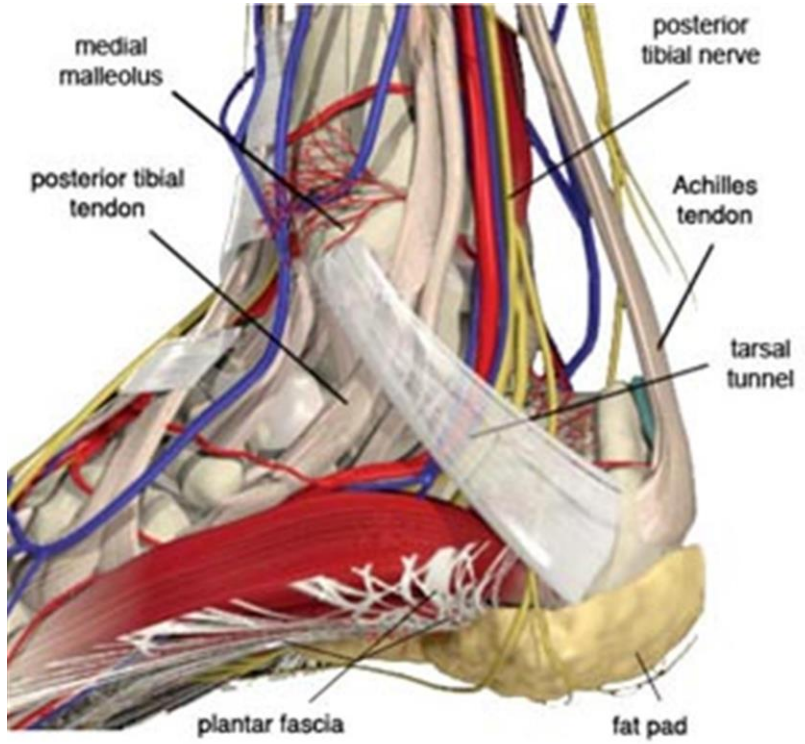
- Compressive neuropathy caused by compression of the tibial nerve.

❖Clinical features

- Pain with prolonged standing or walking; often vague and misleading medial foot pain
- Sharp, burning pain in the foot.
- Numbness and intermittent paresthesias

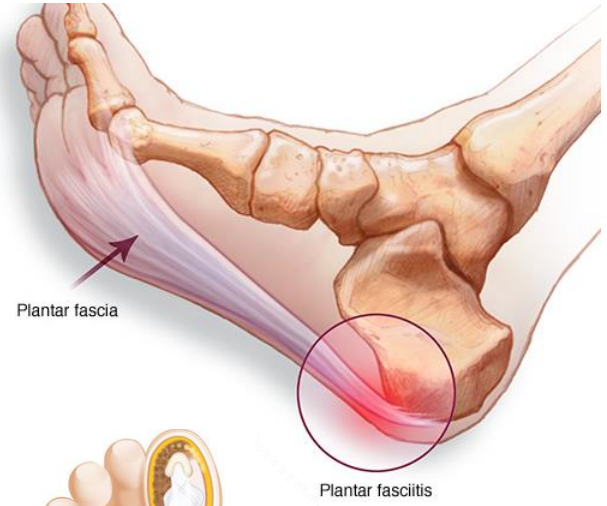
❖Management

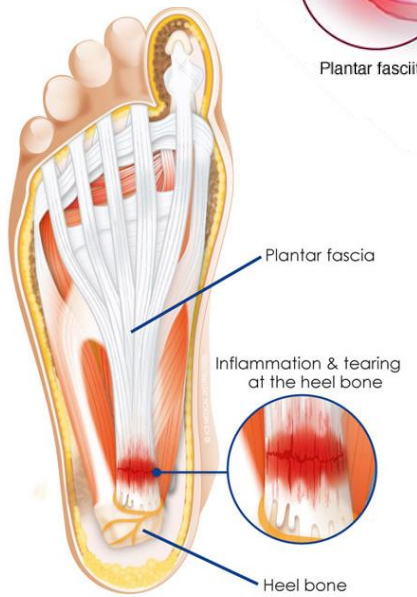
- Nonoperative: Lifestyle modifications, bracing, and NSAID medications
- Operative; surgical release of tarsal tunnel.



Plantar fasciitis

- **Definition**: inflammation of the plantar aponeurosis
- **Etiology**
  - Unknown
  - Risk factors include:
    - Foot deformities: pes planus, pes cavus
    - Training errors: excessive training, sudden changes in training intensity, inappropriate equipment
    - Occupations associated with long periods of standing, jumping, and weight-bearing
    - Obesity
- **Pathophysiology**
  - A degenerative condition that may or may not be associated with inflammatory changes in the tissues.
  - There may be micro-tears in the fascia, and the fascia thickens





Plantar fasciitis

❖Clinical features

- Pain of the heel and sole of the foot
- Pain worsens after periods of inactivity (e.g., Morning pain, standing after prolonged sitting) and prolonged weight-bearing.

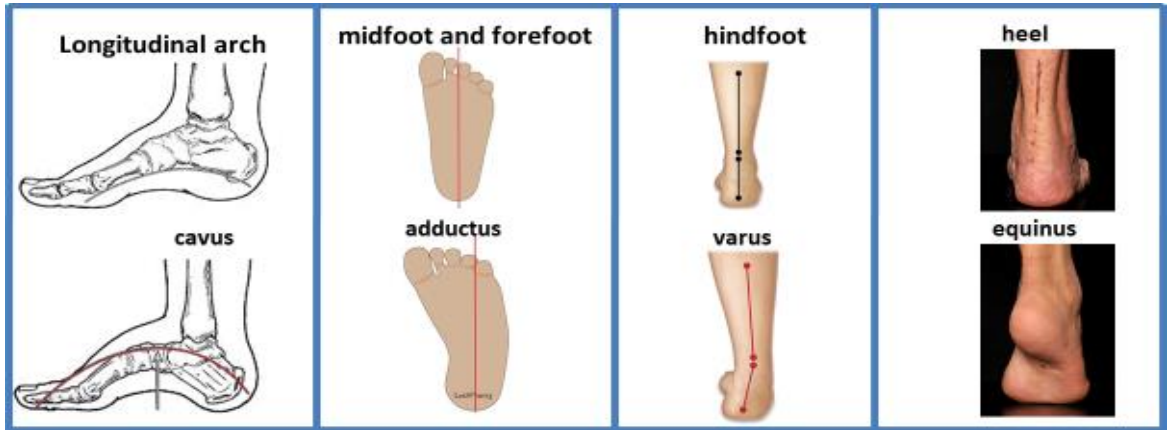
❖Diagnostics

- Point tenderness along the plantar fascia (anteromedial aspect of the heel)
- Ultrasound: plantar fascia thickening, edema at the insertion at the calcaneus
- X-ray: may show bony outgrowth from the calcaneal tuberosity (heel spur)

❖Treatment

- Plantar foot and calf stretching exercises
- Heel shoe inserts
- Avoid aggravating movements (e.g., running)
- NSAIDs, glucocorticoid injection

Club foot (Congenital Talipes Equino Varus)



❖ Deformity

- Hindfoot equinus and varus
- Midfoot cavus
- Forefoot adductus
- Limited dorsiflexion

❖ Mechanism

- Dominant posterior musculature, especially tibialis posterior, weak peroneus muscles
- Shortened Achilles tendon

❖ Diagnostics

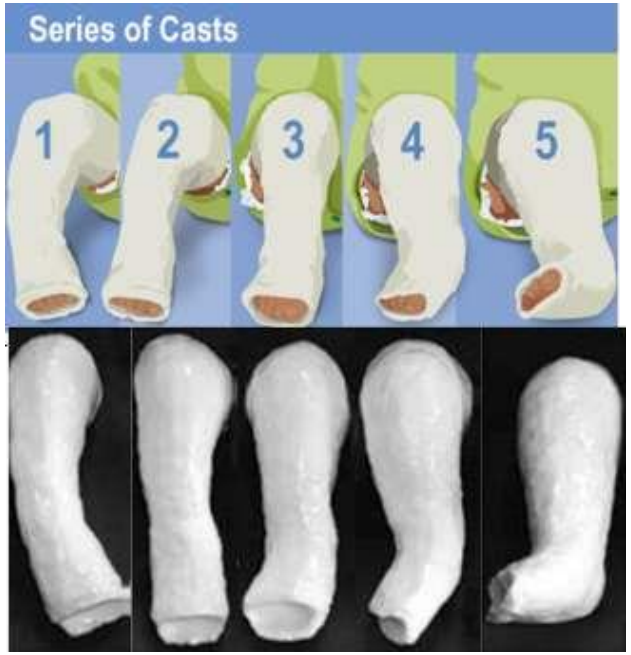
- Clinical diagnosis (prenatal detection via ultrasound possible)
- X-ray (can confirm clinical diagnosis): long axis of talus and calcaneus are parallel

Club foot – X-ray

- **AP view**: Talocalcaneal angle (kite's) is < 20°
- **Lateral view**:
  - Talocalcaneal angle of < 35° and flat talar head (normal is around 40°)
  - Taken with the foot in forced dorsiflexion

Club foot – Treatment

- Manual repositioning and serial casting
  - Treatment phase: main components of the deformity are always corrected in the following order:
    - **C**: Cavus
    - **A**: Adductus
    - **V**: Varus
    - **E**: Equinus
  - The Maintenance Phase: To prevent recurrence
    - Bracing (abduction foot orthosis), Physiotherapy
- If manual repositioning is unsuccessful: surgical release of contractures and correction of bone alignment
- If not corrected early, 2ry growth changes occur in the bones & these are permanent (In late relapsed cases)



Ponseti method

Club foot

سنوات (2)

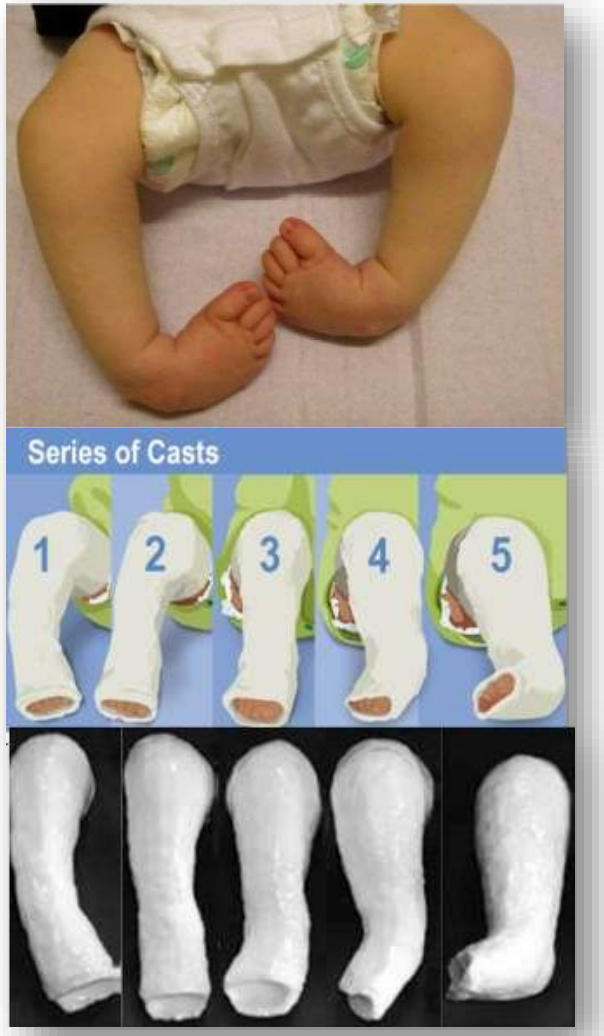
- **What is your diagnosis ?**
  - Club foot

سنوات (1)

- **What is the first treated deformity with this modality of treatment ?**
  - Cavus

معدل (1)

- **What is the recurrence rate with this treatment modality ?**
  - High



One of these is a feature of this picture

a. Pes cavas
b. Pes planus
c. Abductus
d. Valgus

One of the following is not related to this deformity

a. Cavus
b. Adductus
c. Equines
d. Varus
e. Pes planus

What is the deformity in forefoot?

a. Cavus
b. Adductus
c. Equines
d. Varus
e. Pes planus

This method is used for the treatment of

a. Pes cavus
b. Pes planus
c. Club foot
d. Infantile flat foot

All the following regarding this deformity are true except

a. last step of management is varus

Which of the following is wrong about pes caves ?

a. On X ray diagnosis by the angel between calcaneus and navicular bone

Not the same pic

Flat foot (pes planus)

- **The term ‘flatfoot’ applies when**
  - The apex of the arch has collapsed
  - The medial border of the foot is in contact (or nearly in contact) with the ground
  - The heel becomes valgus
  - The foot pronates at the subtalar-midtarsal complex
- **Flat feet can produce**
  - Tendonitis
  - Arthritis
  - Plantar fasciitis
  - Bunions & Hammertoes
  - Corns and callosities

Physiological Flat Foot

Standing on tip toe to differentiate between physiological and pathological flat feet

Flexible Flat Foot

- Appears a normal stage in development
- It usually disappears after a few years when medial arch development is complete, sometimes though it persists into adult life
- The arch can often be restored by simply dorsiflexing the great toe (jack's test) and during this maneuver the tibia rotates externally
- Many of the children with flexible flat-foot have ligamentous laxity and there may be a family history of both flat-feet, and joint hypermobility
- Usually there is no symptoms
- **Management**: stretching exercise and shoes inserts (medial arch support)

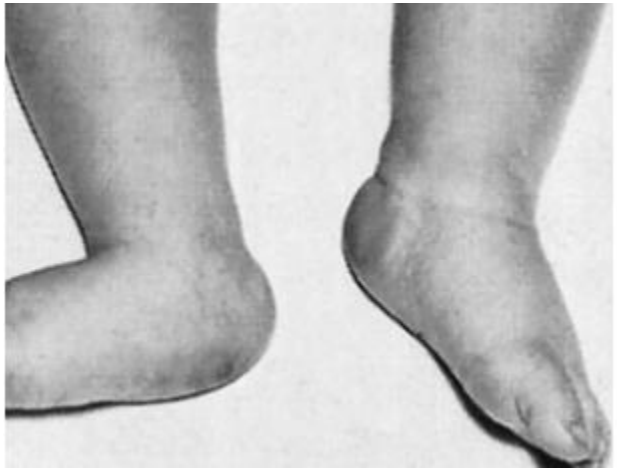
Infantile Flat Foot

(congenital vertical talus / congenital convex pes valgus)

- It's a rare neonatal condition usually affects both feet
- The foot is turned outwards (valgus) and the medial arch is not only flat, but it also actually curves the opposite way from the normal, the appearance of a "rocker-bottom" foot
- The talus points almost vertically towards the sole; the forefoot is abducted, pronated and dorsiflexed, with subluxation of the talonavicular joint
- Passive correction is impossible

Infantile Flat Foot

- The x-ray features are characteristic :
  - Talus point into the sole of the foot
  - The navicular bone is dislocated dorsally into the neck of talus
- It is important to repeat the lateral x-ray with the foot maximally plantarflexed; in congenital vertical talus the appearance will be unchanged, whereas in flexible flatfoot the dorsally subluxated navicular returns to the normal position
- The only effective treatment is by operation, ideally before the age of 2 years



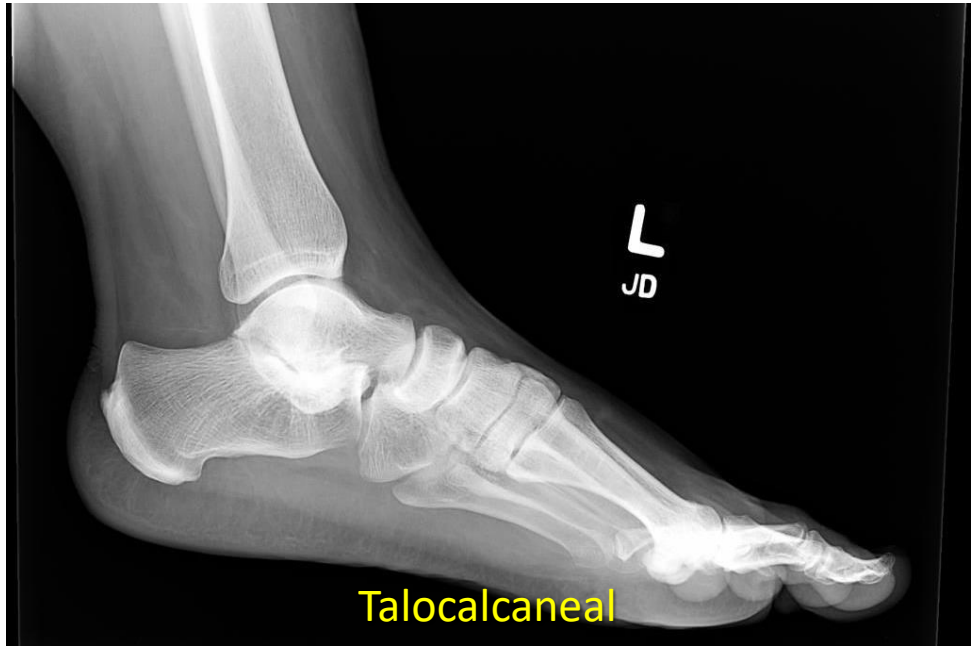
Tarsal Coalition

Rigid Flat Foot

- Structural anomaly between two or three tarsal bones causing a rigid flatfoot
- **Classification**
  - Congenital (most common)
  - Acquired (trauma, degenerative and infections)
- **Pathoanatomic classification**
  - Fibrous coalition (syndesmosis)
  - Cartilagenous coalition (synchondrosis)
  - Osseous coalition (synostosis)
- **Symptoms**
  - Asymptomatic
    - Most coalitions are found incidentally
    - 75% of people are asymptomatic
  - Pain worsened by activity

Rigid Flat Foot

- **Age of onset**
  - Calcaneonavicular (most common) usually 8-12 years old
  - Talocalcaneal usually 12-15 years old
- **Management**
  - Nonoperative
    - observation, shoe inserts and immobilization with casting, analgesics.
  - Operative
    - coalition resection with interposition graft, +/- correction of associated foot deformity or arthrodesis



Acquired (Adult) Flat Foot

❖ Etiology

- Posterior Tibial Tendon Dysfunction (most common cause)
  - more common in women often presents in the sixth decade
- Inflammatory arthritis, such as rheumatoid arthritis
- ligament injuries, fractures and dislocations of the bones in the midfoot; Lisfranc injury
- Diabetic Collapse (Charcot Foot)

Acquired Flat Foot

❖Risk Factors

- Obesity
- Hypertension
- Diabetes
- Increased age
- Corticosteroid use
- Seronegative inflammatory disorders

❖Management

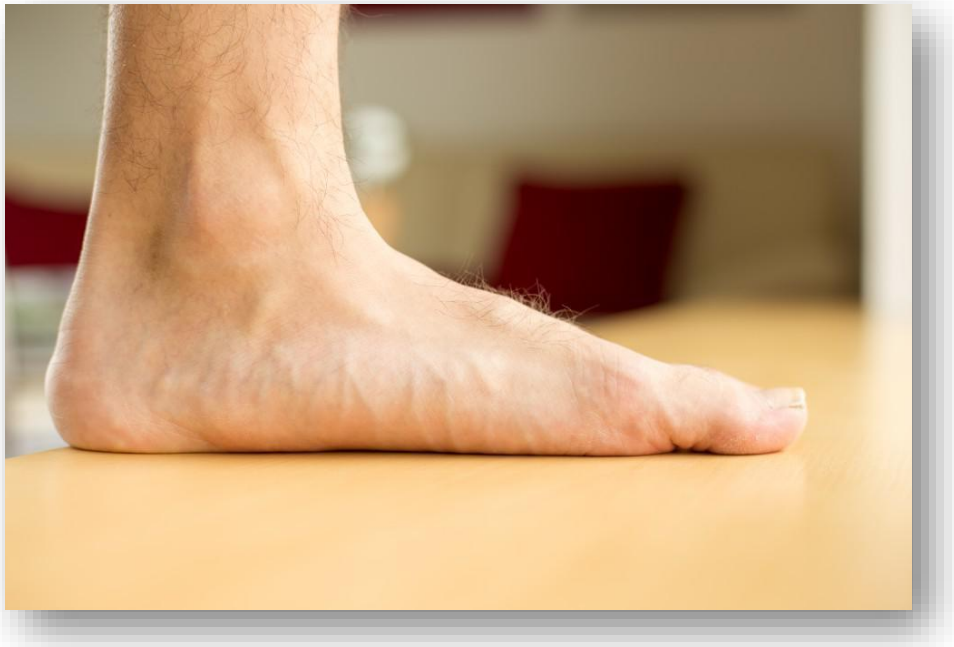
- Non operative; Ankle foot orthosis.
  - Immobilization in walking cast/boot.
  - Custom-molded in-shoe orthosis.
- Operative
  - Tenosynovectomy
  - Tendon Transfer
  - Arthrodesis

What is the muscle affected in this case ?

a. Gastrocnemius muscle
b. Plantaris muscle
c. Posterior tibialis muscle
d. Semitendinosus muscle
e. Semimembranosus muscle

Which of the following is not a cause of this deformity

a. Posterior Tibial Tendon Dysfunction
b. Talocalcaneal
c. Claw foot
d. Calcaneonavicular
e. Congenital vertical talus



Toe deformities

1. Hallux Valgus

- **Definition**: Varus angulation of the first metatarsal, predisposes to lateral angulation of the big toe in people wearing shoes and most of all in those who wear high-heeled shoe
- **Epidemiology**
  - Most common forefoot deformity
  - ♀ > ♂
  - Positive family history in over 60 % of cases
- **Etiology**: multifactorial
  - Biomechanical instability
  - Poorly fitting shoe wear
  - Arthropathies (e.g., rheumatoid arthritis)
  - Connective tissue disorders (e.g., Ehlers-Danlos syndrome)
  - Neuromuscular diseases (e.g., multiple sclerosis)

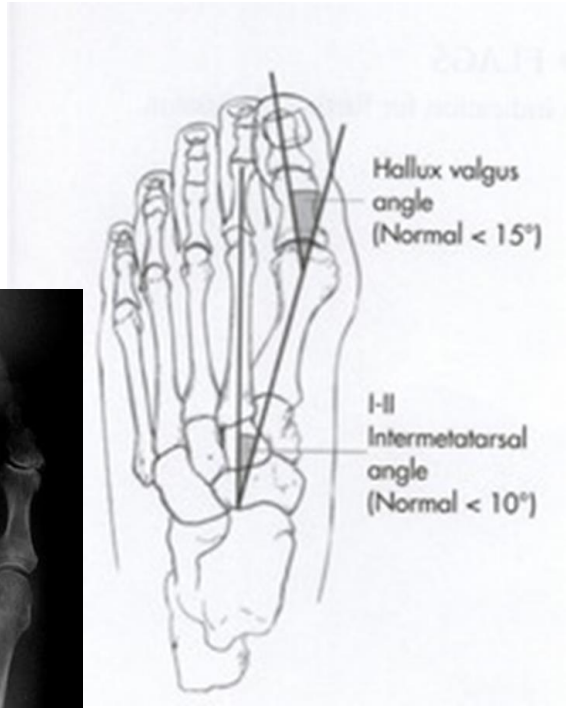
Toe deformities

1. **Hallux Valgus**
   - **Clinical features**: usually bilateral
     - Pain and inflammation (over the bunion)
     - Secondary osteoarthritis in the first metatarsophalangeal joint
     - Can lead to deviation of the remaining digits resulting in hammer and claw toes
   - **Diagnostics**
     - Inspection
     - X-ray of the feet

   - **Treatment**
     - Conservative therapy
       - Special shoes and inlays
       - Orthoses
       - Pain management with NSAIDs and corticosteroid injections
     - Corrective surgery is indicated if conservative therapy fails to relieve symptoms.

Hallux Valgus – X-ray

- **Technique**: Should be taken with the patient standing to show the degree of metatarsal and hallux angulation.
- **Findings**: The first metatarsophalangeal joint may be sublaxed, or it may look osteoarthritic.
- **Interpretation**: Lines are drawn along the middle of the first and second metatarsals and the proximal phalanx of the great toe
  - Normally the intermetatarsal angle is less than 10 degrees
  - The valgus angle at the MTP joint less than 15 degrees.



Hallux valgus

- **What is your diagnosis ?**
  - Hallux valgus
- **Risk factors**
  - Wearing high-heeled shoes
  - Genetic

According this deformity one of the following is false

a. The big toe in valgus
b. 1st metatarsal is in varus position
c. Prominence caused by head of 1st metatarsal and bursa
d. Talocalcaneous angle is used for diagnosis
e. Usually, bilateral

ممكن يجي السؤال نفسه لكن الإجابة الخطأ مختلفة فركزوا

Toe deformities

2. Hammer toe

- **Definition**: a deformity of the lesser toes characterized by PIP flexion, DIP extension, and neutral MTP
- **Epidemiology**: most common deformity of the lesser toes
- **Etiology**
  - Poorly fitting shoe wear
  - Polyneuropathy (e.g., diabetes mellitus, alcoholism)
  - Friedrich ataxia
  - Rheumatoid arthritis
  - Trauma
  - Charcot-Marie-Tooth disease
- Patient present with ulcer or callosities over proximal IPJ

سنوات (1)

Name the following deformity

- Hammer toe

Toe deformities

3. Claw toe

- **Definition**: a deformity of the lesser toes characterized by MTP hyperextension with PIP and DIP flexion
- **Etiology**
  - Poorly fitting shoe wear
  - Polyneuropathy (e.g., diabetes mellitus, alcoholism)
- **Pathophysiology**
  - Caused by imbalance of the extrinsic and intrinsic muscles of the toes.

Hallux rigidus

- **Definition**: osteoarthritis of the first metatarsophalangeal joint, between the first metatarsal and the first proximal phalanx; characterized by hypertrophy of the sesamoid bones
- **Clinical features**: Presents with pain with axial loading and flexion/extension
- **X-rays** will show osteoarthritic changes
- **Management**
  - Conservative treatment
  - Operative; arthrodesis

Which of the following is the surgical treatment ?

a. Arthroplasty
b. Arthrodesis
c. Joint replacement
d. pain medication and shoe modification

Orthopedic Pathology

Osteoarthritis

Osteoarthritis

- **Definition**: a chronic disorder of synovial joints in which there is
  A. Progressive softening and disintegration of articular cartilage
  B. Accompanied by new growth of cartilage and bone at the joint margins (osteophytes)
  C. Cyst formation
  D. Sclerosis in the sub-chondral bone, mild synovitis
  E. Capsular fibrosis.
- **Epidemiology**
  - Prevalence: most common joint disorder
  - Incidence: increases with age
  - Sex: ♀ > ♂, especially in patients older than 50 years
  - Incidence rates in specific joints: knee > hip > hand

Osteoarthritis

❖ Risk factors

- Modifiable risk factors
  - Obesity
  - Excessive joint loading or overuse (mechanical stress)
- Nonmodifiable risk factors
  - Age (> 55 years)
  - Family history
  - History of joint injury or trauma
  - Anatomic factors causing asymmetrical joint stress
  - Hemophilic hemarthroses and deposition diseases that stiffen cartilage
  - Sex

Osteoarthritis

❖Classification

- Idiopathic (Primary) OA
  - No identifiable underlying cause
- Secondary OA

❖Pathophysiology

- Chronic mechanical stress on the joints and age-related decrease in proteoglycans → cartilage loses elasticity and becomes friable → degeneration and inflammation of cartilage → joint space narrowing and thickening and sclerosis of the subchondral bone

❖Clinical features

- **Symptoms:** Pain, Deformity, Stiffness, swelling
- **Signs**: Tenderness, Swelling, Muscle wasting, Deformity, Crepitus

Imaging

- The presence of at least one of the radiological signs of osteoarthritis, in addition to typical clinical features, supports the diagnosis of osteoarthritis.

- **Radiological signs of osteoarthritis**
  - Irregular joint space narrowing
  - Subchondral sclerosis: a dense area of bone (visible on x-ray) just below the cartilage zone of a joint that forms as a result of a compressive load on the joint
  - Osteophytes (bone spurs): spurs or densifications that develop on the edges of the joint, increasing its surface area
  - Subchondral cyst: a fluid-filled cyst that develops on the surface of a joint due to local bone necrosis induced by the joint stress caused by osteoarthritis

Treatment

Follow a stepwise approach to treatment:

- Start with nonpharmacological management, followed by pharmacological and/or surgical treatment if needed.
  - Nonpharmacological management: e.g., exercise and weight loss
  - Pharmacotherapy
    - First line: e.g., topical or oral NSAIDs
    - Second line: e.g., acetaminophen or intraarticular glucocorticoid injections
  - Surgical management: e.g., complete or partial joint replacement (arthroplasty) using an endoprosthesis
- Individualize treatment based on patient preferences, comorbidities, treatment goals, and available resources.
- Consider referral to physical therapy or occupational therapy.

Surgical management

- **Arthroscopy**
  - **Indications**: patients with meniscus or cartilage damage, or femoroacetabular impingement
  - **Procedures**: debridement and lavage
- **Osteotomy**:
  - Realigns joints to relieve pain and potentially delay disease progression
  - **Indication**: young patients (typically ≤ 60 years of age) with single compartment arthritis
  - **Procedures**: tibial osteotomy for varus alignment; femoral osteotomy for valgus deformity
- **Arthrodesis**
  - **Indication**: patients with advanced, therapy-resistant osteoarthritis of the wrist and/or ankle
  - **Procedure**: surgical fusion of the two bones that form the joint in a functional position; can be performed arthroscopically
- **Arthroplasty**
  - **Indication**: patients who have experienced inadequate relief using conservative measures
  - **Procedure**: complete or partial replacement of a joint using an endoprosthesis
  - **Risks**: infection, blood clot (e.g., deep vein thrombosis, pulmonary embolism), dislocation, implant failure

Osteoarthritis

- **What is your DDx ?**
  - Osteoarthritis
- **Mention 4 findings ?**
  1. Loss of joint space
  2. Osteophyte
  3. Subchondral sclerosis
  4. Subchondral cyst
  5. Bone fusion

65 Y/O patient with osteoarthritis, the chief complain is

a. Deformity
b. Loss of joint movement
c. Mechanical pain
d. Muscle wasting
e. Swelling

What is the mechanisms of this feature

a. **Osteophytes**: Progressive softening and disintegration of articular cartilage

b. **Osteophytes**: new growth of cartilage and bone at the joint margins

c. **Subchondral cyst formation**: due to increased water permeability of synovial fluid

d. **Sclerosis in the sub-chondral bone**: to lessen the load on bone to avoid fracture

What is the pathophysiology of this feature

a. Progressive softening and disintegration of articular cartilage
b. Due to increased water permeability of synovial fluid
c. Increase the surface area
d. Tear in the cartilage
e. Increase water content in cartilage

In osteoarthritis, the pointed arrow resembles

a. Sclerosis in the sub-chondral bone
b. Subchondral cyst
c. Osteophytes
d. Capsular fibrosis

Pathophysiology of the defect seen in the picture is

a. Increase water content in cartilage
b. Increase water permeability
c. Progressive softening and disintegration of articular cartilage
d. New growth of cartilage and bone at the joint margins
e. Sclerosis in the sub-chondral bone

Pt with osteoarthritis, what is the deformity shown in the X-ray

a. Increase water content in cartilage
b. Progressive softening and disintegration of articular cartilage
c. Joint space narrowing
d. New growth of cartilage and bone at the joint margins
e. Sclerosis in the sub-chondral bone

All presentations are true for this case, except

a. Joint line tenderness
b. Genu Varus
c. Widening of joint space
d. Swelling and effusion
e. Osteophyte and stiffness

Which of these symptoms won’t be associated with this picture ?

a. Genu Varus
b. Loss of sensation on the medial leg
c. Joint line tenderness
d. Swelling and effusion
e. Osteophyte and stiffness

Hip osteoarthritis

The initial management for this patient who presented with right intermittent dull hip pain:

a. Hip arthrodesis
b. Hip Osteotomy
c. Hip replacement
d. Analgesia and lifestyle modification
e. Open reduction and internal fixation

Hip osteoarthritis

Long case history of old man 65 years with 2 years history of pain in the hip not responding to analgesia and interfering with his daily life, management ?

a. Hip arthrodesis
b. Hip Osteotomy
c. Hip replacement
d. Analgesia and lifestyle modification
e. Open reduction and internal fixation

Gout

The most likely diagnosis

a. Rheumatoid arthritis
b. Osteomalacia
c. Pseudogout
d. Gout

Which of the following is incorrect about osteoarthrosis

a. Gouty tophi

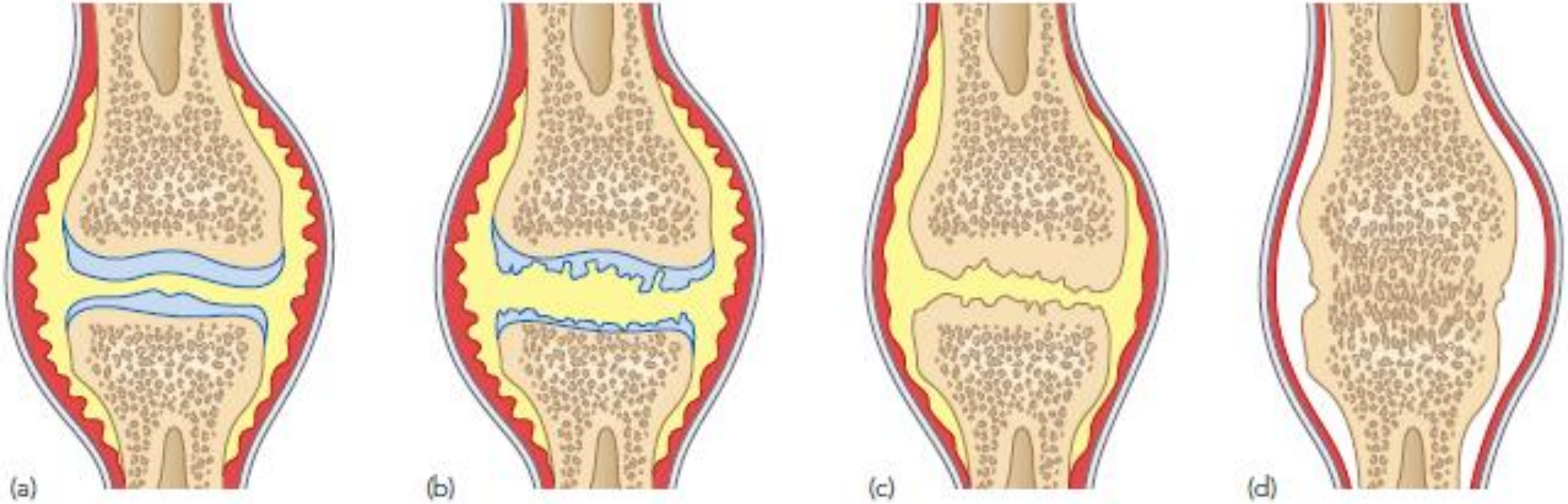
Septic Arthritis

كتبت فقط أهم النقاط عن الموضوع

Septic arthritis

- **Causative organisms**: (Most common causes)
  - Staphylococcus aureus (Most common in adults and children > 2 years)
  - Streptococci
  - N. gonorrhea (Most common in sexually active young adults (♀ > ♂))
  - Gram-negative rods esp. E. coli and P. aeruginosa (Immunosuppressed state, trauma, elderly, IV drug use)
- **Routes of spread**
  - Hematogenous spread (most common)
    - From a distant site (e.g., abscesses, wound infection, septicemia)
    - Disseminated infection (e.g., gonorrhea)
  - Direct contamination
    - Iatrogenic (e.g., joint injection, arthrocentesis , arthroscopy)
    - Trauma (e.g., open wounds around the joint, penetrating trauma)
  - Contiguous spread (e.g., septic bursitis, osteomyelitis)

Pathology



2.5 Acute suppurative arthritis – pathology In the early stage (a), there is an acute synovitis with a purulent joint effusion. (b) Soon the articular cartilage is attacked by bacterial and cellular enzymes. If the infection is not arrested, the cartilage may be completely destroyed (c). Healing then leads to bony ankylosis (d).

Clinical features

- Acute onset
- Classical triad of fever, joint pain, and restricted range of motion
- Arthritis
  - Usually, monoarticular
  - Most affected joints: knees (followed by hip, wrists, shoulders, and ankles)
  - Joints are swollen, red, warm, and painful

Diagnostics

- Any red, painful joint with a reduced range of motion should be considered infectious until proven otherwise. The absence of fever does not rule out a diagnosis of septic arthritis
- All patients should do
  - Arthrocentesis with synovial fluid analysis and culture (gold standard)
    - Skin or subcutaneous infection (e.g., cellulitis) surrounding the affected joint is an absolute contraindication due to the risk of introducing pathogens into the joint
  - Blood cultures in patients with fever or acute onset of symptoms
  - Laboratory studies (Inflammatory markers may be normal in septic arthritis)
  - X-rays of the affected joint (preferred initial imaging modality (prosthetic and native joints))

Treatment

- The first priority is to aspirate the joint and examine the fluid.
- Treatment is then started without further delay and follows the same lines as for acute osteomyelitis.

1. **Antibiotics**
   - Intravenous antibiotics (3rd Generation Cephalosporins will cover both Gram-positive and Gram-negative organisms.) should be started as soon as joint fluid and blood samples have been taken for culture.
   - Once the bacterial sensitivity is known the appropriate drug is substituted.
   - Intravenous administration is continued for several weeks and is followed by oral antibiotics for a further 2 or 3 weeks.
2. **Splintage**
   - The joint must be rested either on a splint or in a widely split plaster. At the hip, the joint should be held abducted and 30 degrees flexed.

Synovial fluid analysis

	NORMAL	Non-Inflammatory	Inflammatory	Septic	Hemorrhagic
Clarity	Transparent	Transparent	Translucent	Opaque	Bloody
Colour	Clear	Yellow	Yellow	Dirty/Yellow	Red
Viscosity	High	High	Low	Variable	Variable
WBC/mm3	<200	200-2,000	2000-10,000 (up to 100,000)	>80,000	200-2,000
PMNs %	<25%	<25%	>50%	>75%	50-75%

Depending on the clinical scenario, synovial fluid is analysed for:

- Cell count and differential
- Crystals
- Culture and sensitivity (if septic arthritis suspected)
- Cytology (if malignancy suspected)

Treatment

3. Drainage

- Under anesthesia, pus is drained, and the joint washed out.
- This is best done by open operation, but in a superficial joint it can be achieved by repeated needle aspiration and irrigation or, in the case of the knee, by arthroscopy.
- Once the patient's general condition is good and the joint is no longer inflamed, gentle and gradually increasing movements are encouraged. But if articular cartilage has been destroyed, the aim is to keep the joint immobile in the optimum position while ankylosis is awaited.

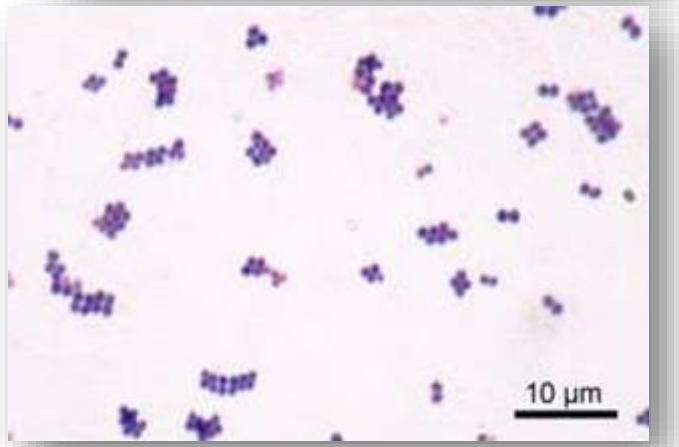
Septic arthritis

- This patient had a high fever and elevated ESR, and on doing synovial fluid analysis, had a WBC count of 140000.

- **What is the best next step of management ?**
  a. Arthrotomy

Septic arthritis

- This patient present with acute knee pain, blood investigation revealed elevated CRP and uric acid, Joint aspiration is shown on the second image
- **What is your management for this patient ?**
  a. Elevation, ICE and compression
  b. Incision and drainage
  c. Start IV antibiotics
  d. Start NSAIDs and colchicine
  e. Above Knee cast



Septic arthritis

- Patient came to ER With knee pain 1 day duration and the temperature was 39

- **What is your diagnosis ?**
  - Septic arthritis
- **What is your management ?**
  - Surgery (Arthrotomy or Arthroscopy)

- Child feverish 39.5

- **The most common emergent DDx ?**
  - Septic hip
- **What is your management ?**
  - Surgery (Arthrotomy or Arthroscopy)

Osteomyelitis

LOW YIELD

Osteomyelitis

- **Definition**: Infection of the bone
- **Hematogenous osteomyelitis**
  - More common in children and adolescents
  - Incidence is increasing in adults, driven by a rise in vertebral osteomyelitis
  - **Etiology**: Caused by hematogenous dissemination of a pathogen
- **Exogenous osteomyelitis**: more common in adults
  - **Etiology**: caused by a spread of bacteria (typically multiple pathogens) from the surrounding environment
    - Posttraumatic
    - Contiguous: spread of infection from adjacent tissue
    - Secondary to infected foot ulcer in patients with diabetes
    - Iatrogenic (e.g., postoperative infection of a prosthetic joint implant)

LOW YIELD

Most common pathogens causing osteomyelitis

Pathogens	Commonly affected groups
Staphylococcus aureus	• Children and adults • Individuals that recreationally use IV drugs • Patients with vertebral lesions • Patients with prosthetics • Diabetic patients with foot ulcers and pressure ulcers
Staphylococcus epidermidis	Patients with prosthetics
Streptococci	• Diabetic patients with foot ulcers and pressure ulcers • Neonates and infants
Pseudomonas aeruginosa	• Persons who inject drugs • Plantar puncture wounds (especially if wearing rubber-soled footwear)
Salmonella	Patients with sickle cell anemia
Klebsiella	Patients with UTIs
Pasteurella multocida	Bites from dogs and cats
Fungi (e.g., Candida)	• Immunocompromised patients • Individuals that recreationally use IV drugs

LOW YIELD

The classical changes and progression

- **Inflammation;** earliest change, The intraosseous pressure rises, causing intense pain and obstruction of blood flow.
- **Suppuration;** By the second day pus appears in the medulla and forces its way along the Volkmann canals to the surface, where it forms a subperiosteal abscess. It then may undergo spreading along the shaft, to re-enter the bone at another level, or bursts out into the soft tissues.
- **Necrosis;** The rising intraosseous pressure, vascular stasis, infective thrombosis and periosteal stripping increasingly compromise the blood supply, by the end of 1 week there is usually evidence of necrosis.
- **New bone formation;** New bone forms from the deep layer of the periosteum (Cambium), Involucrum may be seen.
  - If the infection persists, pus may discharge through perforations (cloacae) in the involucrum and track by sinuses to the skin surface; the condition is now established as a chronic osteomyelitis.
- **Resolution;** If the infection is controlled and intraosseous pressure released at an early stage.

LOW YIELD

Osteomyelitis

	Acute Osteomyelitis	Subacute Osteomyelitis	Chronic Osteomyelitis
Duration	< 2 weeks	2-6 weeks	> 6 weeks
Clinical features	fever, malaise, localized joint pain with redness and swelling .	mild symptoms and Pain is the most common symptom. **Night pain that is relieved with aspirin is frequently reported.	recurrent bouts of pain, redness and tenderness at the affected site, healed and discharging sinuses
imaging findings	no findings on x-ray on mri there is marrow edema	Brodie's abscess	bone rarefaction , dense sclerosis , sequestrum , involucrum
Treatment	if marrow edema only then IV antibiotic and bed rest . if edema+pus then drainage+IV antibiotic .	same as acute	always surgery
NOTES	**mcc is staph aureus	**DDX are osteoid osteoma and non ossifying fibroma if Dx is in doubt do an open biopsy . **mcc is staph aureus.	**nowadays it more frequently follows an open fracture or operation. *mcc is S. epidermidis

LOW YIELD

Complications

- **Spread**: infection may spread to the joint (septic arthritis) or to other bones (metastatic osteomyelitis).
- **Pathological fracture**: occasionally the bone is so weakened that it fractures at the site of infection or operative perforation.
- **Growth disturbance**: if the physis is damaged there may later be shortening or deformity.
- **Persistent infection**: treatment must be prompt and effective. ‘Too little too late’ may result in chronic osteomyelitis.

Patient present with sinus discharging

- **What is the most common organism causing this condition ?**
  - Staphylococcal


Osteoporosis

Osteoporosis

❖ Definition

- **Osteoporosis**: loss of trabecular and cortical bone mass which leads to bone weakness and increased susceptibility to fractures
- **Osteopenia**: decreased bone strength but less severe than osteoporosis

❖ Epidemiology

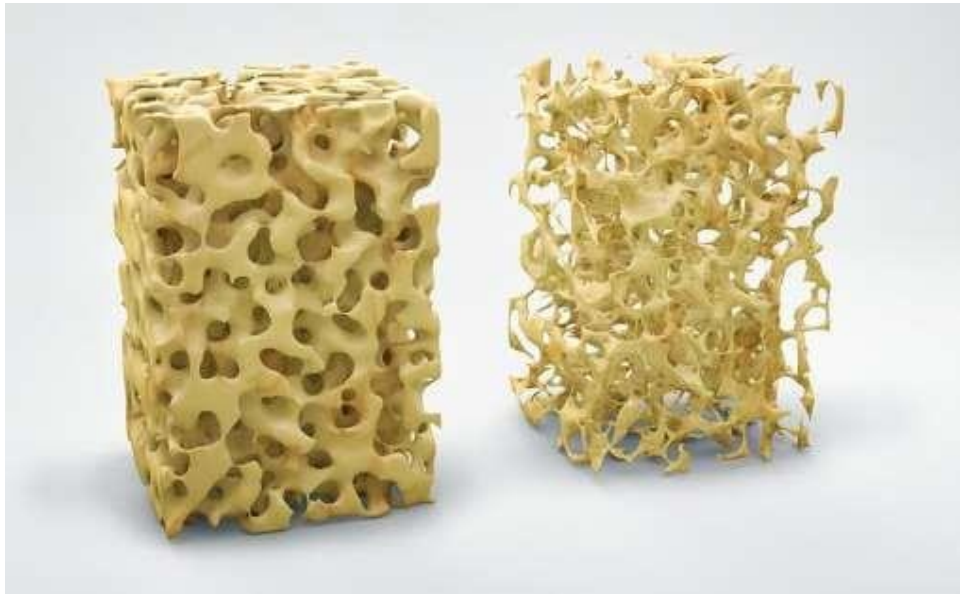
- Sex: ♀ > ♂ (~ 4:1)
- Age of onset: 50–70 years

❖ Etiology:

- Women are predominantly affected by primary osteoporosis
- Men are mostly affected by secondary osteoporosis

What is the pathology ?

a. Osteomalacia
b. Osteomyelitis
c. Rickets
d. Osteoporosis



Primary osteoporosis (most common)

- **Type I (postmenopausal osteoporosis)**: postmenopausal women
  - Estrogen stimulates osteoblasts and inhibits osteoclasts.
  - The decreased estrogen levels following menopause lead to increased bone resorption.
- **Type II (senile osteoporosis)**: gradual loss of bone mass as patients age (especially > 70 years)
  - Osteoblast activity decreases, leading to less osteoid production.
- **Idiopathic osteoporosis**
  - Idiopathic juvenile osteoporosis
  - Idiopathic osteoporosis in young adults
    - Osteoporosis that primarily affects the vertebra and is seen in individuals under 50 years of age. Typical risk factors are the same as for postmenopausal osteoporosis.

Secondary osteoporosis

- Drug-induced/iatrogenic
  - Most commonly due to systemic long-term therapy with corticosteroids
- Endocrine/metabolic:
  - Hypercortisolism, hypogonadism, hyperthyroidism, hyperparathyroidism, renal disease
- Multiple myeloma

Additional risk factors

- Excessive alcohol consumption
- Cigarette smoking
- Immobilization or inadequate physical activity
- Malabsorption (e.g., celiac disease), malnutrition (e.g., diet low in calcium and vitamin D), anorexia
- Low body weight
- Family history of osteoporosis
- Personal history of fracture

Clinical features

- Mostly asymptomatic
- **Fragility fractures**: pathological fractures that are caused by everyday-activities (e.g., bending over, sneezing) or minor trauma (e.g., falling from standing height)
  - Common locations of major osteoporotic fractures:
    - Vertebral (most common) > femoral neck > distal radius (Colles fracture) > other long bones (e.g., proximal humerus)
  - Vertebral compression fractures
    - Commonly asymptomatic but may cause acute back pain and possible point tenderness without neurological symptoms

Radiographic features

- Decreased bone density can be appreciated by decreased cortical thickness and loss of bony trabeculae in the early stages in radiography.
- Bones like the vertebra, long bones (proximal femur), calcaneum and tubular bones are usually looked at for evidence of osteoporosis. Nevertheless, dual energy x-ray absorptiometry (DEXA) is the gold standard of diagnosing osteoporosis

Normal

Bone looks less white (darker) and trabecular lines are more prominent

Diagnostics – Approach

- Assess **BMD** and **estimate the risk of major osteoporotic fracture**.
- **The diagnosis is confirmed if any of the following diagnostic criteria for osteoporosis are fulfilled.**
  - T-score ≤ -2.5 standard deviations (SDs) on dual-energy x-ray absorptiometry (DXA)
  - History of a major osteoporotic fragility fracture (regardless of BMD)
- **Once confirmed**:
  - Consider screening all patients for common causes of secondary osteoporosis.
  - Evaluate high-risk patients for vertebral fractures. (They are common in patients with osteoporosis, asymptomatic in up to two-thirds of cases, and associated with a high risk of future fractures)
- Consider bone turnover markers (BTMs) to assess fracture risk and monitor treatment response.

Bone mineral density (BMD) assessment

- Indications
  - Evaluation of suspected osteoporosis
  - Screening for osteoporosis in asymptomatic high-risk individuals
- Preferred modality: dual-energy x-ray absorptiometry
- DEXA measures BMD at the lumbar spine and hip/femoral neck using two x-ray beams. Findings are represented in terms of BMD scores that compare results to a reference population.

BMD scores	
Postmenopausal women and men > 50 years of age	• BMD is calculated using the T-score. • **T-score ≤ -2.5 SD indicates osteoporosis** • T-score -1 to -2.5 SD indicates osteopenia • T-score ≥ -1 SD is normal
All other individuals	• BMD is calculated using the Z-score. • Z-score < -2 indicates BMD likely lower than expected for age

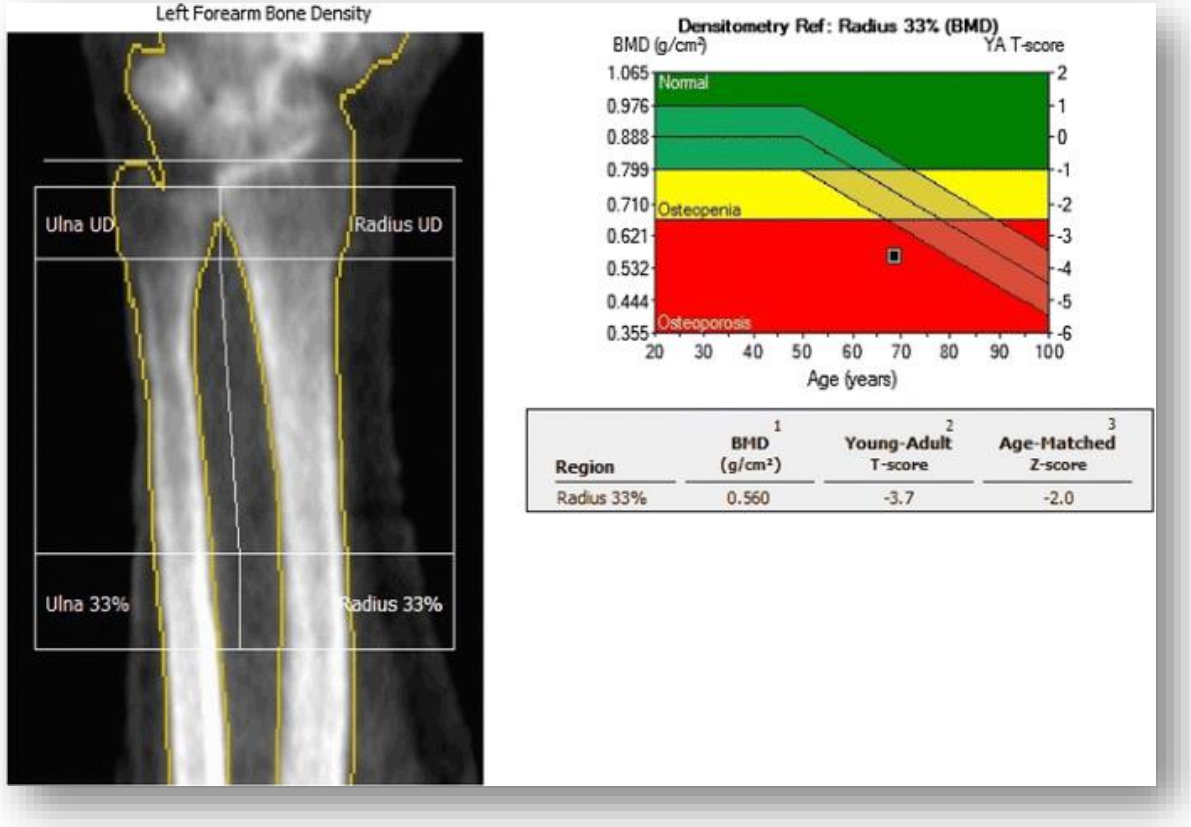
37 female come to clinic with DEXA scan report

What is the next step ?

a. History and physical examination

b. send to gynecologist

c. send to endocrinologist



DEXA Scan

40 years old female patient comes to the clinic with a DEXA scan,

her mean z score = -0.5

t score = -2

كان مع السؤال صورة الفحص
الي بالاحمر من الفحص

a. Normal study
b. Osteoporosis
c. Osteopenia
d. Osteomalacia
e. Osteoarthritis

Vertebral compression fracture

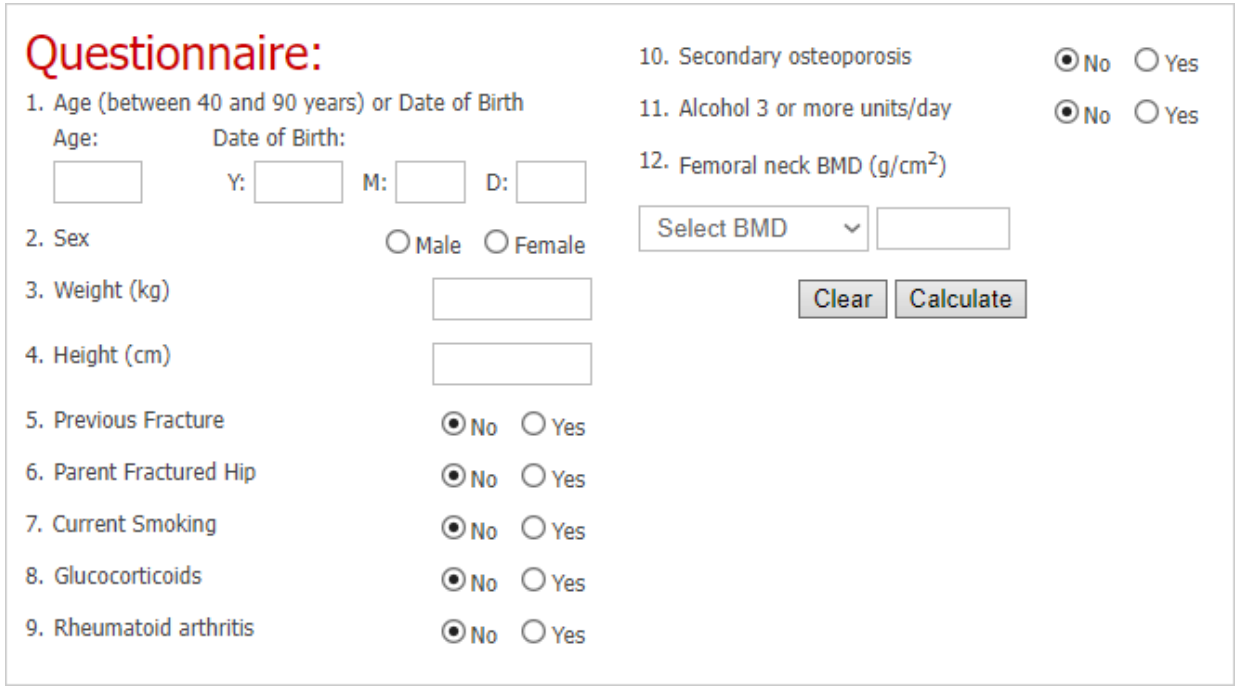
65 years old patient felt a back pain from leaning forward presented with shown image, What investigation we should do for follow up ?

a. DEXA scan
b. SPECT scan
c. Tumor markers

الصورة من عندي

Fracture risk assessment

- Several calculators are used to estimate fracture risk during the diagnostic workup or screening for osteoporosis. (e.g., FRAX®, Garvan, and the American Bone Health fracture risk calculator)
- FRAX (commonly used): estimates the 10-year probability of a major osteoporotic fracture



Laboratory studies

- Consider screening all patients with newly diagnosed osteoporosis for common causes of secondary osteoporosis.
- Routine studies
  - CBC, CMP, PTH, phosphate, and serum 25-hydroxyvitamin D
  - 24-hour urine to measure calcium, creatinine, and sodium levels
- Additional studies
  - Evaluate for specific etiologies of secondary osteoporosis as guided by clinical assessment (e.g., celiac antibodies, TSH, myeloma screen).
  - Consider BTMs to assess fracture risk and monitor treatment response.

Treatment – Approach

- All patients: Optimize bone health.
  - Optimize calcium and vitamin D intake.
  - Encourage physical activity, including strength (resistance) and balance training.
  - Avoidance or minimization of tobacco use, excessive alcohol consumption, and glucocorticoid use
- Older patients: Assess for and manage risk factors for falls.
- Start pharmacotherapy in the following situations:
  - Diagnostic criteria for osteoporosis fulfilled (Treatment)
  - Patients with osteopenia at increased risk of major osteoporotic fracture in the next 10 years (Prevention)

Bisphosphonates

- **Indications**: preferred initial treatment in all patients
- **Mechanism of action**: inhibition of osteoclasts, which are involved in bone resorption
- **Agents**; The following are approved for both prevention and treatment of osteoporosis:
  - Alendronate, Risedronate, and Zoledronic acid
- **Adverse effects**:
  - Osteonecrosis of the jaw
  - Atypical femoral fractures
  - Esophagitis
  - Hypocalcemia

Non-bisphosphonates

❖General indications:

- Alternative first-line agents in patients with contraindications to bisphosphonate therapy
- Second-line agents in those who do not tolerate or improve with bisphosphonates or are unable to tolerate bisphosphonate therapy (e.g., due to adverse effects)

❖Other specific indications:

Drug	Specific use	MOA	A/Es
Denosumab	Patients with impaired renal function	Monoclonal antibody against RANK-L	• Hypocalcemia • Osteonecrosis of the jaw
Teriparatide	• Alternative for patients at high or very high risk of fracture • Treatment of glucocorticoid-induced osteoporosis	Recombinant human parathyroid hormone	• Hypercalcemia • Increase risk for osteosarcoma
Raloxifene	Can be used in patients at increased risk of breast cancer	Selective estrogen receptor modulator	Increased risk of venous thromboembolism

Osteomalacia & Rickets

Osteomalacia and rickets

- **Vitamin D-dependent forms (most common)**
  - **Etiology**
    - Vitamin D deficiency, Defective vitamin D metabolism
  - **Pathophysiology**
    - Hypocalcemia → defective bone matrix mineralization
    - Hypocalcemia → ↑ PTH levels → ↓ phosphate levels → impaired mineralization
- **Vitamin D-independent forms (rare)**
  - **Etiology**
    - Renal tubular defects, Phosphate deficiency, Drugs (e.g., Bisphosphonates)
  - **Pathophysiology**
    - Phosphate deficiency → ↓ phosphate blood levels → defective bone matrix mineralization

Clinical features - Osteomalacia

- Bone pain and tenderness
- Pathologic fractures
- Waddling gait and difficulty walking
- Myopathy
  - Muscle weakness
  - Spasms
  - Cramps
- Bone deformity only in very severe cases of osteomalacia
- Symptoms of hypocalcemia

Clinical features - Rickets

- Only occurs in children
- Bone deformities
  - Bending of primarily the long bones
  - Distention of the bone-cartilage junctions
    - Rachitic rosary: bead-like distention of the bone-cartilage junctions in the ribs
    - Marfan sign: distention of the epiphyseal plate of the distal tibia with widening and cupping of the metaphysis gives the impression of a double medial malleolus on inspection and palpation of the ankle
  - Craniotabes: softening of the skull
  - Deformities of the knee, especially genu varum
- Increased risk of fracture
- Harrison groove: depression of the thoracic outlet due to muscle pulling along the costal insertion of the diaphragm
- Late closing of fontanelles
- Impaired growth

Imaging

Imaging findings in osteomalacia and rickets		
	Osteomalacia	**Rickets**
Bone mineral density	• ↓	
Cortices	• Thinned	

Other findings	• Looser zones (**pseudofractures**): transverse bands of radiolucency indicating defective calcification of osteoid
	• Milkman syndrome
	  ◦ Multiple, almost symmetrical pseudofractures in the cortex of bones
	  ◦ Visible as radiolucent bands with decreased density on x-ray
	  ◦ Ribs, pubic rami, iliac bones, neck of femur, radii and ulnae, and scapula are predominantly affected.
		• Growth plates in the metaphysis of the long bones are less defined and show cupping, stippling, and fraying
		• Wide epiphysis
		• In severe cases, Looser zones and fractures
		• Chest X-ray: prominent costochondral junctions (see Rachitic rosary above)
		• Evidence of bone deformities (see "Clinical features" above)

What are the names of the following deformities ?

Rachitic rosary

Harrison sulcus

Craniotabes

What are the names of the following deformities ?

Coxa vara

Genu vara

Looser fracture

Labs and Treatment

❖Laboratory tests

- ↓ Calcium and ↓ phosphate
- ↑ Alkaline phosphatase and ↑ PTH

❖Treatment

- Vitamin D deficiency: administration of vitamin D
  - Also indicated in infants who are exclusively breastfed
  - The healing of both osteomalacia and rickets requires adequate daily intake of calcium.
- Defective vitamin D metabolism or vitamin D-independent forms: treatment of underlying disease

Rickets

سنوات (1)

❖ **Nutritional lab finding in rickets children**

a. High parathyroid hormone

سنوات (2)

❖ **Mention two investigations**

- Vitamin D
- level PTH
- level KFT

One of these sentences is wrong about this case

a. Ca+2 level is normal or low
b. Bowing of long bone
c. Low vit D level
d. Thickening of physis and cortex
e. Serum alkaline phosphate is high

What is incorrect about the disease shown in this X-ray ?

a. Cortex thinning
b. Thickening of physis
c. Ca levels are decreased
d. It is due to vitamin D deficiency
e. Serum alkaline phosphate is low

نفس الصورة جاء عليها خيارات مختلفة بالأرشيف فقط مذكور الجواب فجمعتهم على بعض وكتبت السؤال بالإضافة انه أخر خيارين جبتهم من السؤال السابق فالسؤال ممكن يجي أي وحدة منهم الغلط والباقي صح

The most common cause of this fracture

a. Significant trauma
b. Malignancy
c. Over activity
d. Benign tumor
e. Vit. D deficiency

Looser fracture

Bone Tumors

Introduction to Bone Tumors

❖Diagnosis and Approach

1. **Precise History and physical examination**
   - Pain (most common symptom), Lumpy swelling, Local tenderness, Constitutional symptoms, Pathological fracture, Exclude conditions that can mimic tumors
2. **Blood investigations**
   - CBC, CRP, ESR, alkaline phosphate , LDH
3. **Imaging**
   - **X-ray**: first imaging modality, Chest x-ray for metastasis
   - **CT scan**
     1. To rule out mets. (Chest, abdomen, pelvis)
     2. When cortical involvement is questionable
     3. Intraarticular tumors
   - **MRI**: Surrounding soft tissue involvement, Mets. If CT is insignificant
   - **Radionuclide scanning with 99mTc-HDP**: Sites of small tumors

Introduction to Bone Tumors

❖**Diagnosis and Approach**

4. Biopsy (Definitive diagnosis)
5. Treatment
   - Benign
     - Benign, symptomatic or enlarging tumors: Complete local excision
   - Malignant
     - Chemotherapy, Radiotherapy, Amputation versus limb salvage procedures
     - Prognosis: Overall stage of disease, Presence of metastasis, Skip (discontinous) lesions within the same bone, Histologic grade, Tumor size.

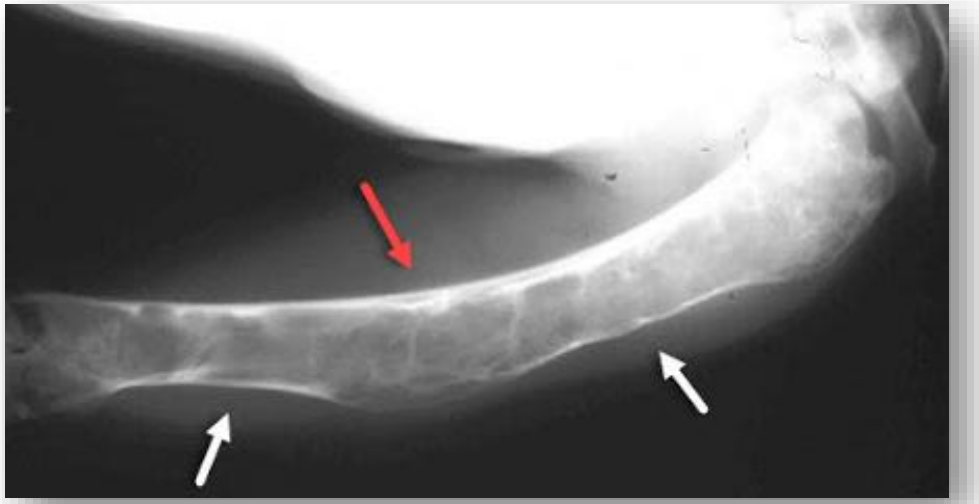
Enneking System

Stage	Grade	Site
IA	Low G1	Intracompartmental T1
IB	Low G1	Extracompartmental T2
IIA	High G2	Intracompartmental T1
IIB	High G2	Extracompartmental T2
IIIA	Any grade with regional or distal metastases	Intracompartmental T1
IIIB	Any grade with regional or distal metastases	Extracompartmental T2

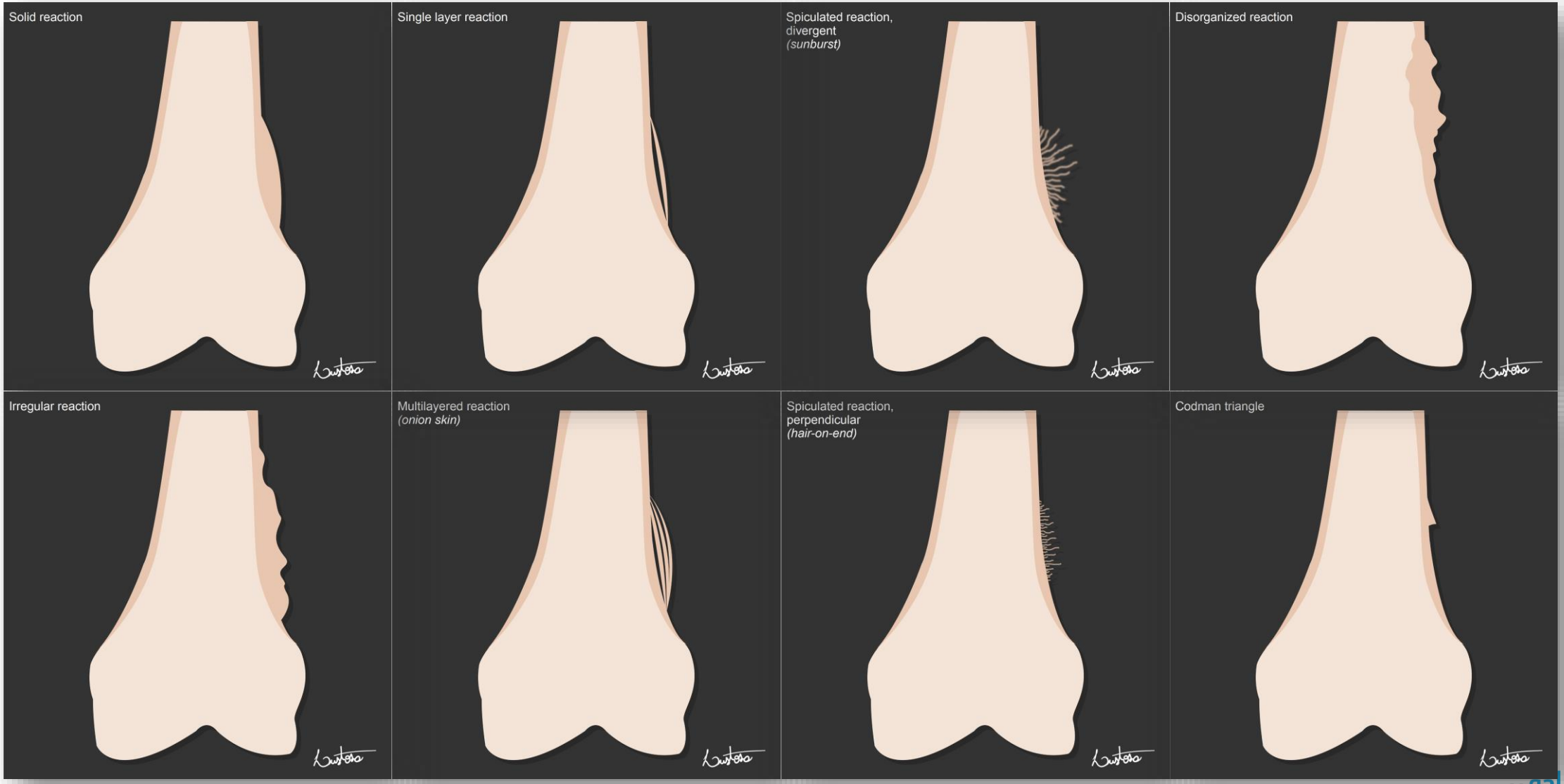
Malignant tumours are classified as IA, IB, IIA, and IIB depending on degree of spread.
Adapted from Enneking WF. A system of staging musculoskeletal neoplasms. Clin Orthop Relat Res *1986;**204**:9–24.*

Radiological findings

- **Radiological findings that indicate benign bone tumor**
  - Well defined localized, with sclerotic margins
  - No cortical disruption (Cortical thinning)
  - No periosteal reaction
  - Bone deformity is a sign of benign lesions (long-term, slow process)



Periosteal reaction of malignant tumors



All of the following are feature of bone malignancy except

a. Thinning of the cortex
b. Codman's triangle
c. Sunburst appearance
d. Cortical destruction
e. Periosteal reaction

Bone tumors

Benign

- Non-ossifying fibroma (fibrous cortical defect)
- Fibrous dysplasia
- Osteoid osteoma
- Chondroma (enchondroma)
- Osteochondroma (cartilage capped exostosis)
- Chondroblastoma
- Simple bone cyst
- Aneurysmal bone cyst
- Giant-cell tumor

Malignant

- **Primary Osseous**
  - Osteosarcoma
  - Chondrosarcoma
- **Primary Non-osseous**
  - Ewing's sarcoma
  - Multiple Myeloma / Plasmacytoma
  - Non-Hodgkin's Lymphoma
- **Metastatic bone disease**

Benign

Non-ossifying fibroma (fibrous cortical defect)

- The commonest benign lesion of bone.
- **Clinical features**: asymptomatic and is almost always encountered as an incidental finding on x-ray.
- **Usual sites** are metaphysis of long bones.
- **X-rays**: The appearance is unmistakable. There is an oval radiolucent area in or adjacent to the cortex.
- **Predominant tissue**: Although it looks cystic on x-ray, it is a solid lesion consisting of unremarkable fibrous tissue.
- As the bone grows it heals spontaneously, it may enlarge and cause pathological fracture.
- **Treatment**: except for a pathological fracture treatment is conservative and follow up.

Benign

Fibrous dysplasia

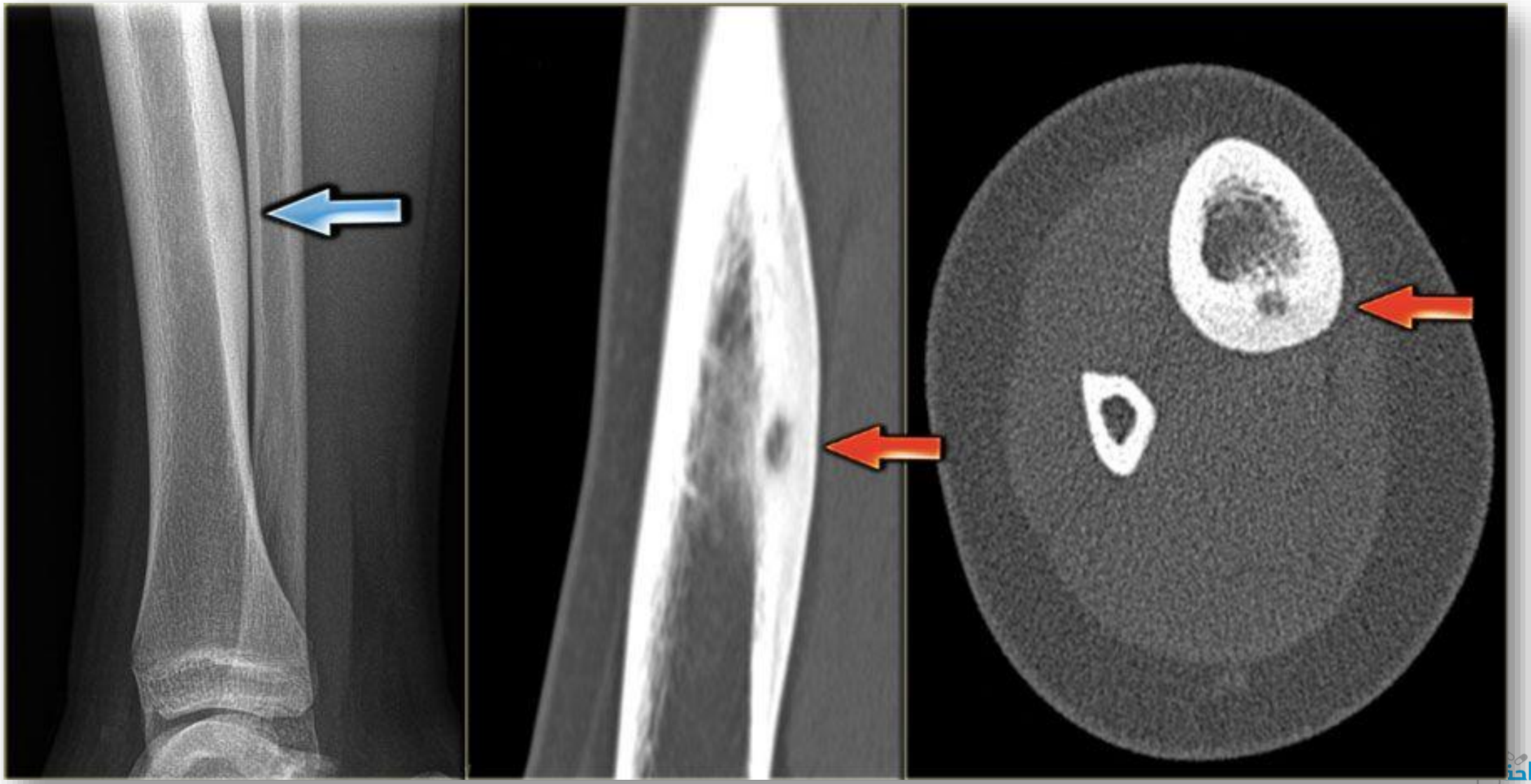
- Developmental disorder
- **Clinical features**: The weight-bearing bones may be bent, and one of the classic features is the 'shepherd's crook' deformity of the proximal femur
- **Site**: The condition may affect one bone (monostotic), one limb (monomelic) or many bones (polyostotic)
- **X-rays**: Cyst-like areas in the metaphysis or shaft have a hazy (so-called ground-glass)
- **Predominant tissue**: Areas of trabecular bone are replaced by fibrous tissue, osteoid and woven bone.
- **Pathology**: The histological picture is of cellular fibrous tissue with patches of woven bone and scattered giant cells.

Osteoid osteoma

- **Clinical features**: the leading symptom is pain which is sometimes sever, usually relieved by aspirin not by rest.
- It is small (usually less than 1 cm) round or oval in shape and encased in dense bone. Usually in patient under 30 years, and over one half of cases occur in the femur or tibia.
- **X-rays**: The important feature is a tiny radiolucent area, the so called 'nidus'
- **Predominant tissue**: Benign tumor consisting of osteoid and newly formed bone
- **DDx**: small Brodie's abscess (may need biopsy).
- **Treatment** : complete removal of the nidus or Radiofrequency ablation

Benign

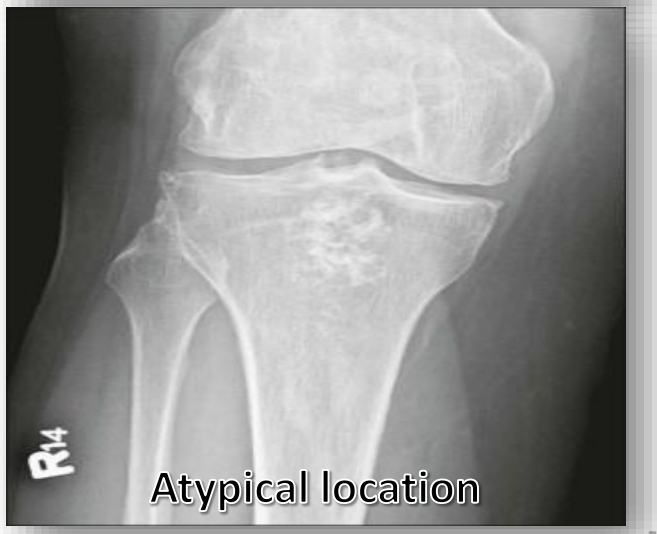
Osteoid osteoma



Benign

Chondroma (enchondroma)

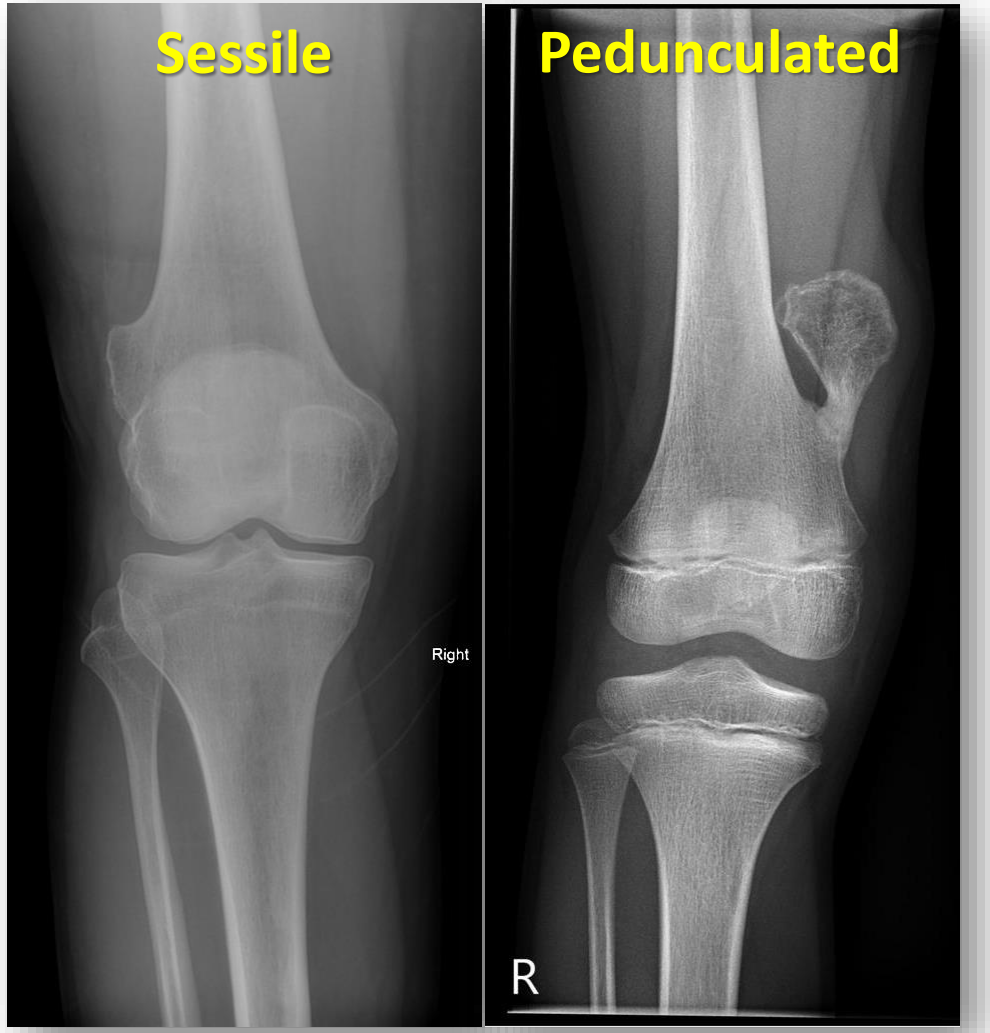
- **Clinical features**: Chondromas are usually asymptomatic and discovered incidentally on x-ray or after a pathological fracture.
- **Pathology**: The tensional tissue is indistinguishable from normal hyaline cartilage, but there is often a central area of degeneration and calcification.
- **Treatment**: Painful or enlarging or if it presents as a pathological fracture, it should be removed as thoroughly as possible with curettage, the defect is filled by bone graft
- There is a small risk of malignant transformation, suspect in adults if
  - 1.Onset of pain 2.Enlargment of the lesion 3.Cortical erosions
  - if these features are present treat as a low-grade malignancy



Benign

Osteochondroma (cartilage capped exostosis)

- **Clinical features**: The patient is usually a teenager or young adult when the lump is first discovered. The exostosis may go on enlarging up to the end of the normal growth period for that bone; any further enlargement after that is suggestive of malignant change.
- **Treatment**: If the tumor causes symptoms, it should be excised; if, in an adult, it has recently become bigger or painful then operation is urgent, for these features suggest malignancy, even if the histology looks 'benign'.



Benign

Chondroblastoma

- **Clinical features**: The presenting symptom is aching and tenderness adjacent to the joint.
- **Site**: Is one of the very few lesions to appear primarily in the epiphysis, usually of the proximal humerus, femur or tibia.
- **Predominant tissue**: This rare tumor of immature cartilage cells
- **Treatment**
  - In children the risk of damage to the physis makes it risky to remove the lesion.
  - In adults this is not a problem; however, there is a high risk of recurrence after incomplete removal, and if this happens repeatedly there may be serious damage to the nearby joint

Simple bone cyst

- This is a true solitary or unicameral bone cyst.
- **Clinical features**: The condition is usually discovered after a pathological fracture or as an incidental finding on x-ray.
- **Site**: It appears during childhood, typically in the metaphysis of one of the long bones and most commonly in the proximal humerus or femur.
- It is not a tumour, tends to heal spontaneously and is seldom seen in adults.
- **Treatment**
  - Asymptomatic lesions in older children can be left alone but the patient should be cautioned to avoid injury which might cause a fracture.
  - 'Active' cysts (those in young children, usually abutting against the physeal plate and obviously enlarging in sequential x-rays) should be treated.

Benign

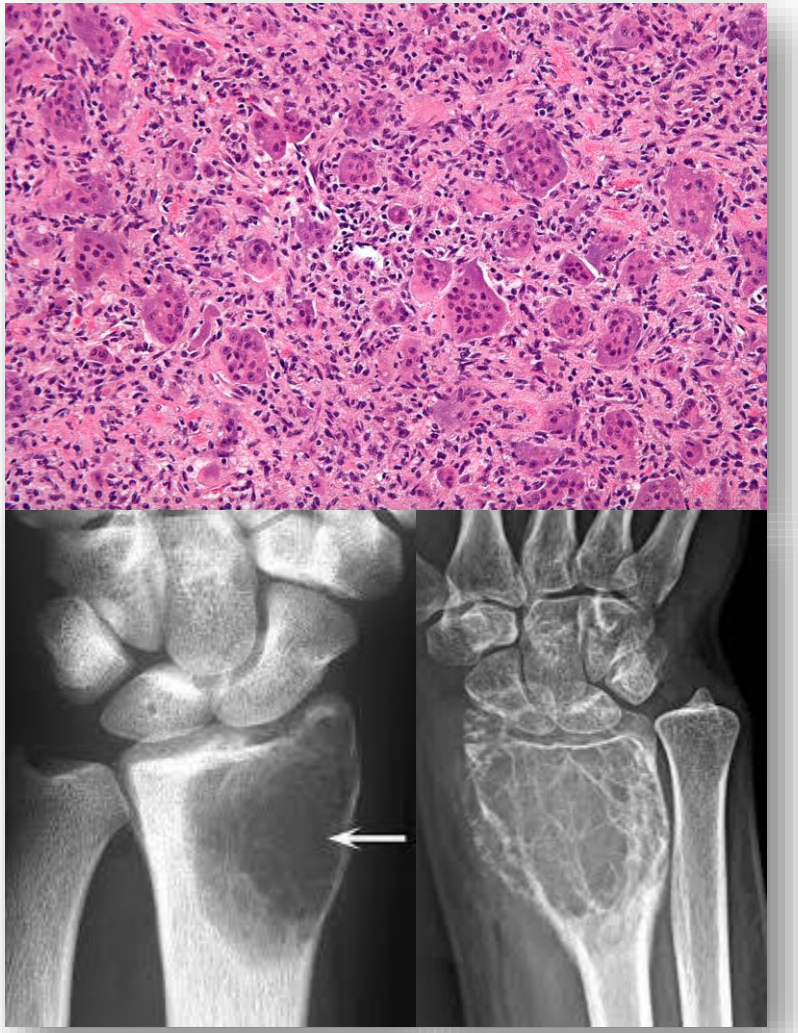
Aneurysmal bone cyst

- **Site**: Cystic tumor like lesion, occurs chiefly in the spine and metaphysis of long bones.
- Usually affects young adults, no risk of malignant transformation.
- It may expand and cause marked thinning of the cortex.
- **Predominant tissue**: Contains clotted blood and lined by a flesh membrane

Benign

Giant-cell tumor

- Giant-cell tumor is a lesion of uncertain origin that appears after the end of bone growth.
- Aggressive lesions have a poorly-defined ‘floor’ and appear to extend into the surrounding bone.
- About one-third of these tumor remain truly benign; one-third become locally invasive and one third metastasize.
- **Clinical features**: The patient is usually a young adult who complains of pain at the end of a long bone; sometimes there is slight swelling. Pathological fracture occurs in 10–15% of cases.



Malignant

Osteosarcoma

- **Etiology**
  - Primary osteosarcoma: unknown
  - Secondary osteosarcoma: Paget's disease of bone, radiation injury, bone infarction
- **Epidemiology**
  - Incidence: bimodal distribution
    - Primary osteosarcoma: puberty/adolescence
    - Secondary osteosarcoma: advanced age
  - Sex: ♂ > ♀
- The sites most commonly involved are the metaphyseal region of long tubular bones, especially the region around knee joint 50%

Malignant

Osteosarcoma

- **Clinical features**: Pain is usually the first symptom; it is constant, worse at night and gradually increases in severity. Sometimes the patient presents with a lump. Pathological fractures are rare.
- **Investigations**
  - **Labs**: ESR (raised), Serum alkaline phosphatase raised
  - **Imaging**: X-ray, CT, MRI and Radioisotope scan → skip lesions
    - Chest X-ray → done routinely
    - Pulmonary CT → (to R/O metastatic dis.)
  - Biopsy
  - Bone scan
- **Treatment**: 1.Chemotherapy, 2. Surgery, 3. Amputation
- **Prognosis**: Depends mainly on the presence of metastasis at presentation

Malignant

Chondrosarcoma

- Arise from mesenchymal cells that produce cartilage
- **Location**: Arises in the medulla of the long tubular bones, mostly in the lower limbs. The next most common sites are the pelvis, central skeleton and the ribs.
- Occur either as primary tumor or a secondary change in a pre-existing benign chondroma or osteochondroma.
- **Treatment**
  - Complete surgical excision, as these tumor doesn't respond to chemotherapy.
  - Recurrence rate is high.
  - Prognosis is related to grade of tumor (Low grade → better prognosis) and the ability to completely surgically remove it

Malignant

Ewing’s Sarcoma

- Ewing’s sarcoma is believed to arise from endothelial cells in the bone marrow.
- **Incidence**: peak at 10–15 years.
- **Primary tumor**: often diaphyses of long bones (particularly femur, tibia, fibula, and humerus) and bones of the pelvis.
- **Metastasis**: lungs, skeletal system, bone marrow

Ewing's Sarcoma

- The patient presents with pain – often throbbing in character – and swelling. Generalized illness and pyrexia, together with a warm, tender swelling and a raised ESR, may suggest a diagnosis of osteomyelitis.
- **DDx**: Osteomyelitis
- **Diagnosis**: Biopsy is Important
- **Prognosis**: The prognosis is always poor, and surgery alone does little to improve it.
- **Treatment**: Chemotherapy, surgery then radiotherapy

Multiple Myeloma / Plasmacytoma

- A malignant B-cell lymphoproliferative disorder of the bone marrow with plasma cell predominating.
- Results in bone marrow cell proliferation and increased osteoclastic activity which lead to osteoporosis and lytic lesions throughout the skeleton (myelomatosis).
- **Plasmacytoma**: is a large colony of plasma cells aggregates in one bone.
- Typical patient → 45-65 years old with weakness, bone pain backache with or without pathological Fracture.
- Also, signs of hypercalcemia (thirst, polyuria and abdominal pain) plasma proteins abnormalities, increased blood viscosity and anemia
- Late secondary features are due to renal dysfunction and spinal cord or root compression caused by vertebral collapse.

Multiple Myeloma / Plasmacytoma

- **X-ray**:
  - Multiple "punched out" defects in the skull, pelvis and proximal femur …'geographic map'
  - Crushed vertebra
  - Osteocytes lesion in a large bone metaphysis
- Multiple myeloma is one of the commonest causes of osteoporosis and vertebral compression Fracture in men >45 y.
- **Investigations**:
  - Mild anemia
  - High ESR
  - Bence-jones proteins in urine
  - Abnormal band in electrophoresis
  - Increased creatinine and calcium
  - Plasmacytosis with typical 'myeloma' cells in bone marrow puncture.
- **Most common immunoglobulin in MM**: IgG or IgA

Secondary Malignant Tumors (Metastases)

- Most Common Malignant bone tumor
- Most appears as osteolytic lesions on x-ray except for prostate tumor…appears osteosclerotic
- **The commonest sites for bone metastases**:
  - Vertebrae, proximal femur, pelvis, the proximal half of the femur and the humerus
- **Most common tumors metastasize to bones**:
  - Lung, Breast, Thyroid, Renal, Prostate
- **Bone resorption is due to**:
  - Direct action of the tumor cells
  - Tumor derived factors that stimulate osteoclast
- The commonest feature is pain

Bone Tumors

❖**What is your spot diagnosis ?**

a. Chondroma
b. Chondroblastoma
c. Simple bone cyst
d. Aneurysmal bone cyst
e. Giant cell tumor

Bone Tumors

❖**The predominant tissue in the lesion is**

a. Cartilage
b. Fibrous
c. Bone

What is the most probable diagnosis

a. Osteosarcoma
b. Chondrosarcoma
c. Chondroblastoma
d. Fibrous cortical defect
e. Osteoid osteoma

Bone Tumors

❖**What is the diagnosis ?**

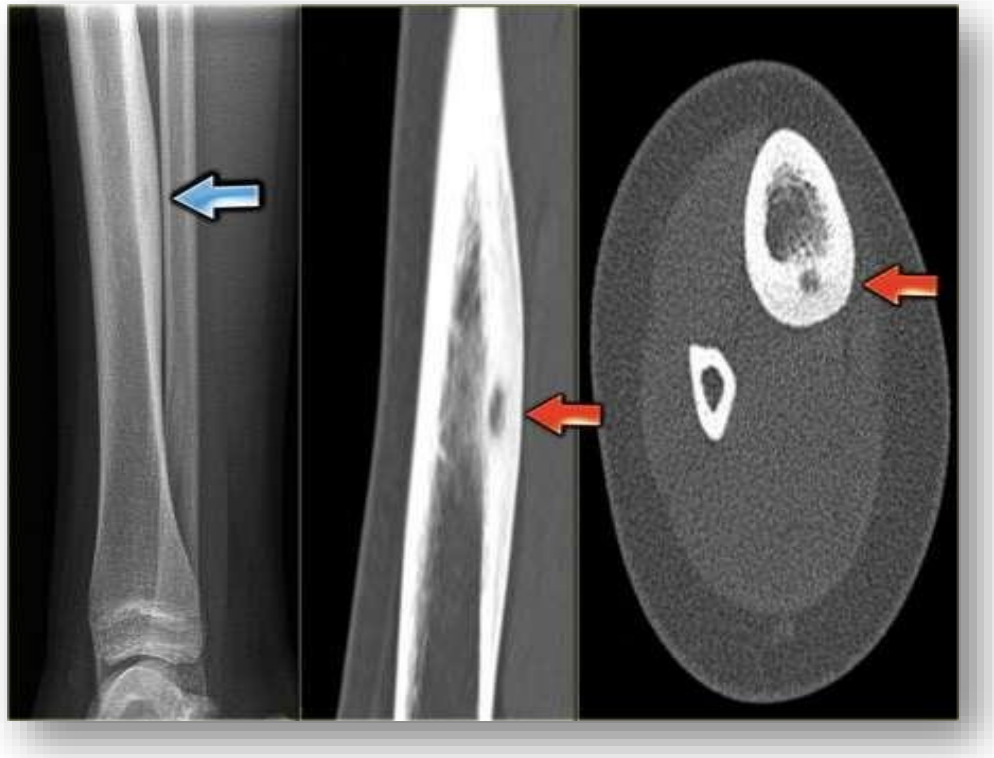
a. Osteoid osteoma
b. Fibrous cortical defect
c. Giant cell tumor
d. Chondroblastoma
e. Fibrous dysplesia

What is your management ?

a. Chemotherapy
b. Excisional surgery
c. Detailed history, physical examination, and follow up X rays
d. Detailed history, physical examination, and biopsy
e. Radiotherapy

The predominant tissue in the lesion is

a. Cartilage
b. Fibrous
c. Bone



What is your diagnosis ?

a. Simple bone cyst
b. Chondroma
c. Giant cell tumor
d. Chondrosarcoma

Bone Tumors

- **How would you describe this lesion ?**
  - Eccentric, well-defined, metaphyseal lesion, no disruption to the cortex, mostly benign
- **What is your diagnosis ?**
  - Non-ossifying fibroma
- **What is your management ?**
  - Conservative and follow up unless pathologically fractured

Bone Tumors

- 25 male patient come to your clinic suffer from pain

❖ **What is your diagnosis ?**

- Osteoid osteoma

❖ **Mention 2 features of pain**

- Relieved by NSAIDs
- Exacerbated by alcohol
- More severe at night

❖ **What is your management ?**

- complete removal of the nidus or Radiofrequency ablation

Bone Tumors

- **Describe the following lesion**
  - Eccentric metaphysical well defined mostly benign
- **What is the most common benign DDx ?**
  - Non-ossifying fibroma (NOF)
- **What is your management ?**
  - Conservative

Bone Tumors

- A case of index pain after repetitive fractures
- **What is your diagnosis ?**
  - chondroma
- **What is your management ?**
  - Curettage

Bone Tumors

- **What is your diagnosis ?**
  - fibrous dysplasia
- **What associated hormonal abnormality ?**
  - Precocious puberty

Bone Tumors

- **What is your diagnosis ?**
  - Giant cell tumor
- **What is your management ?**
  - Curettage and grafting

- 75 years old male complain of pain and decrease range of motion after acetabular fracture (caused by RTA)

- **What is your diagnosis ?**
  - Heterotopic ossification

Bone Tumors

❖**What are the differential diagnoses ?**

- Giant cell tumor
- Chondroblastoma

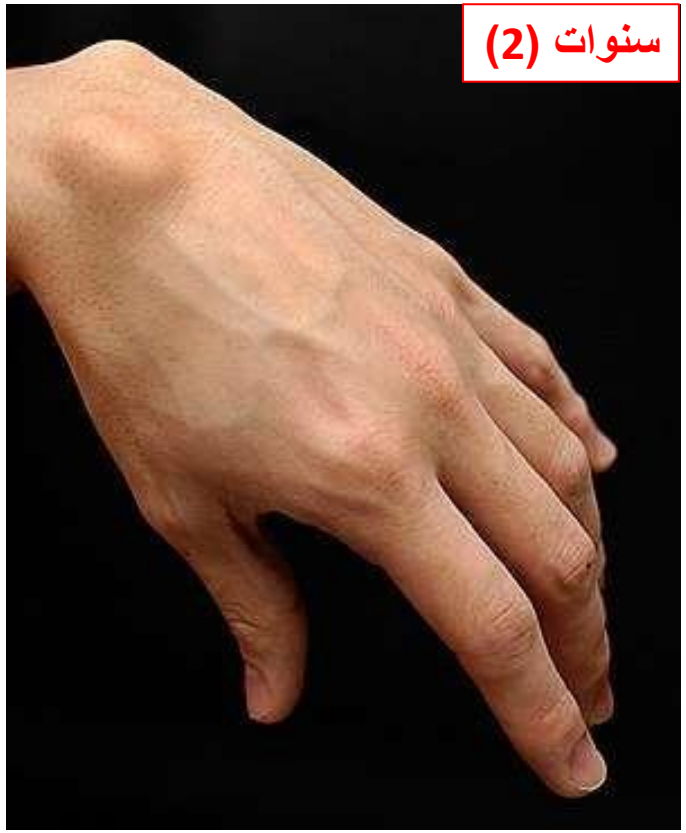
❖**Mention two radiological features found in this x-ray**

1. sun burst appearance
2. codman's triangle

What is your diagnosis for each ?

Non-ossifying fibroma

Chondrosarcoma



Ganglion cyst