

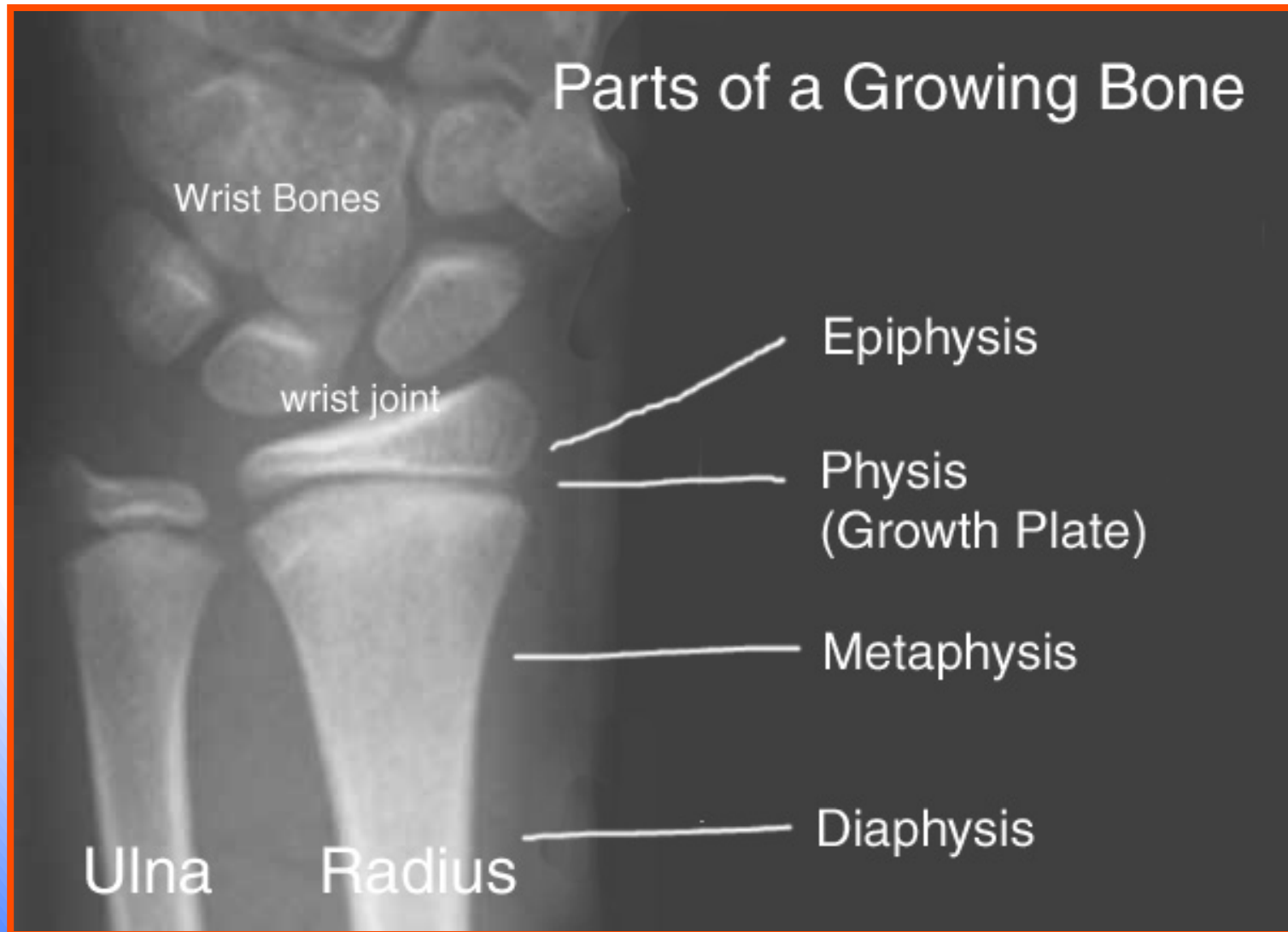
# ORTHOPEDICS

- Test questions are part of the “trauma” section
- Remember, an orthopod can do this
- It is not ALL fractures
- Ligamentous injuries, tendon problems, joint dislocations and associated injuries seem to be disproportionately important
- Part of day in / day out EM
- Focused review should suffice for the exam

# Fracture Complications

- Compartment syndrome
- Fat emboli (long bones)
- Nonunion, malunion
- Arthritis
- Avascular necrosis
- Osteomyelitis

# Anatomy of a Growing Bone



# Salter Fractures (1)

- **SALTER Mnemonic**

1 (S) = Slip through growth plate

2 (A) = Above the level of the growth plate

Assumes shaft of bone is proximal to  
epiphysis (e.g., knee joint and  
femur)

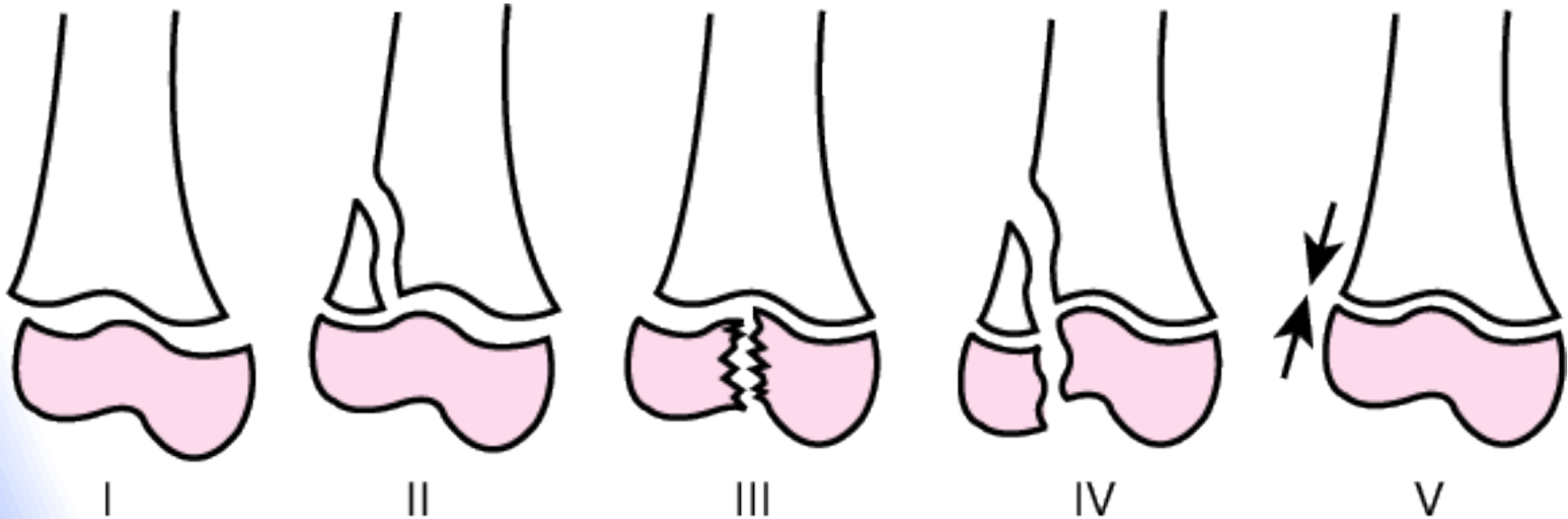
3 (L) = Lower than growth plate

4 (T) = Through the growth plate

5 (R) = Ram the growth plate



# Salter Fractures (2)



**S =**  
**S**lipped

**A =**  
**A**bove

**L =**  
**B**e**L**ow

**T =**  
**T**hrough

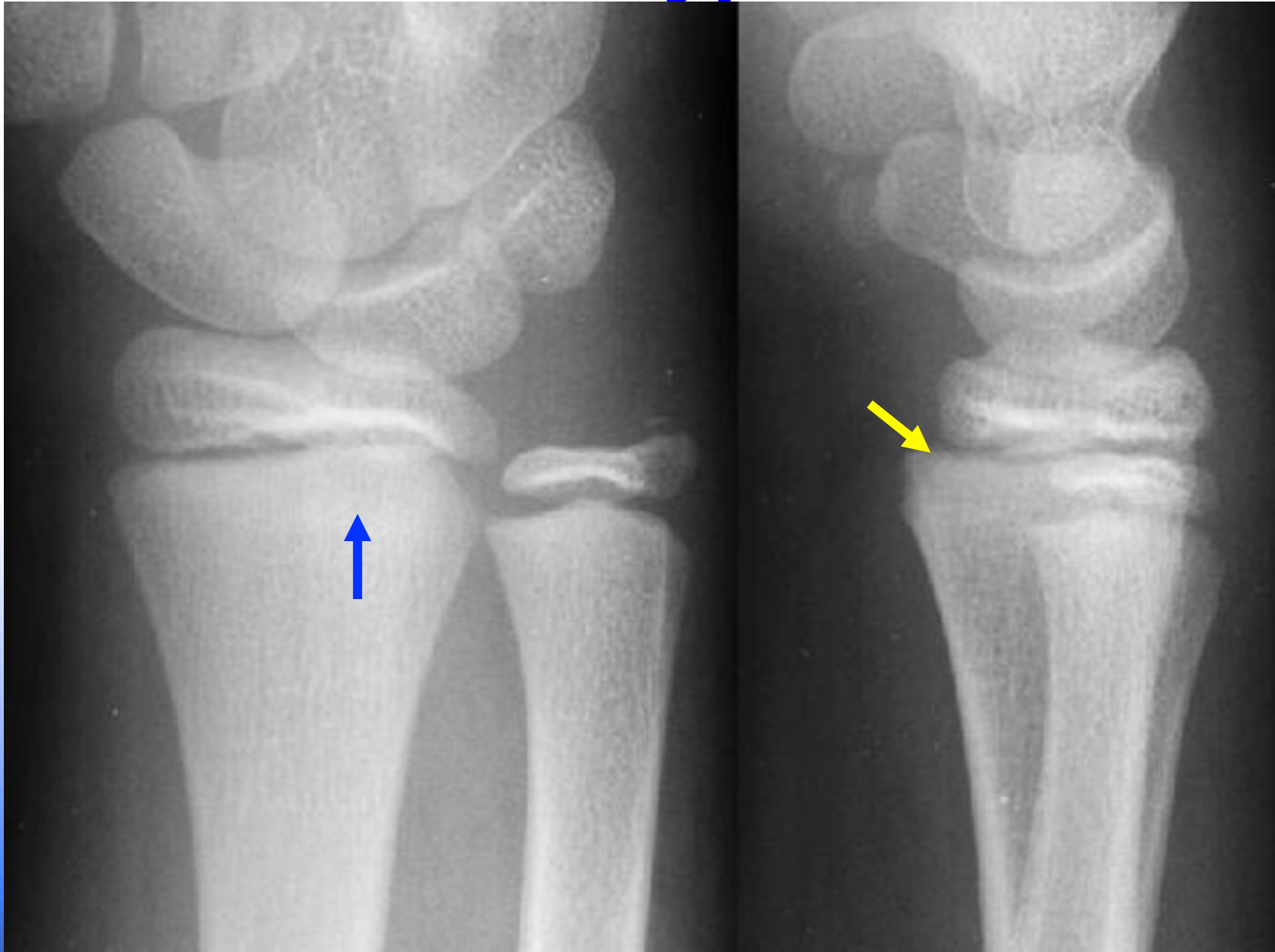
**eR =**  
**R**am

# Salter Fractures (3)

- Epiphyseal growth plate is weaker than supporting ligaments
- Long bones in children
- All involve growth plate or joint surface
- May result in growth complications
- Growth complications increase from I-V
- X-ray may be negative for types I and V
- Salter II most common

**Complication of S-IV, S-V: future growth impairment  
Crush injury (Salter V) has worst prognosis  
(no further bone growth)**

# Salter-Harris Type I Fracture



# Salter-Harris Type II Fracture



# Salter-Harris Type III Fracture



# Salter-Harris Type IV Fracture



# Salter Fracture Facts (1)

- Core concept: Physis (growth plate) is composed of cartilage cells – not visualized on X-ray) weaker than supporting ligaments
- Blood supply to the growth plate comes through the epiphysis. The worse the injury to the epiphysis, the greater the likelihood of growth disturbances
- Type I least likely to be associated with growth disturbances, type V most likely
- Most common ages: 10 to 16 (80%)
- Mostly males (due to delayed skeletal maturation compared to females and more physical activity)

# Salter Fracture Facts (2)

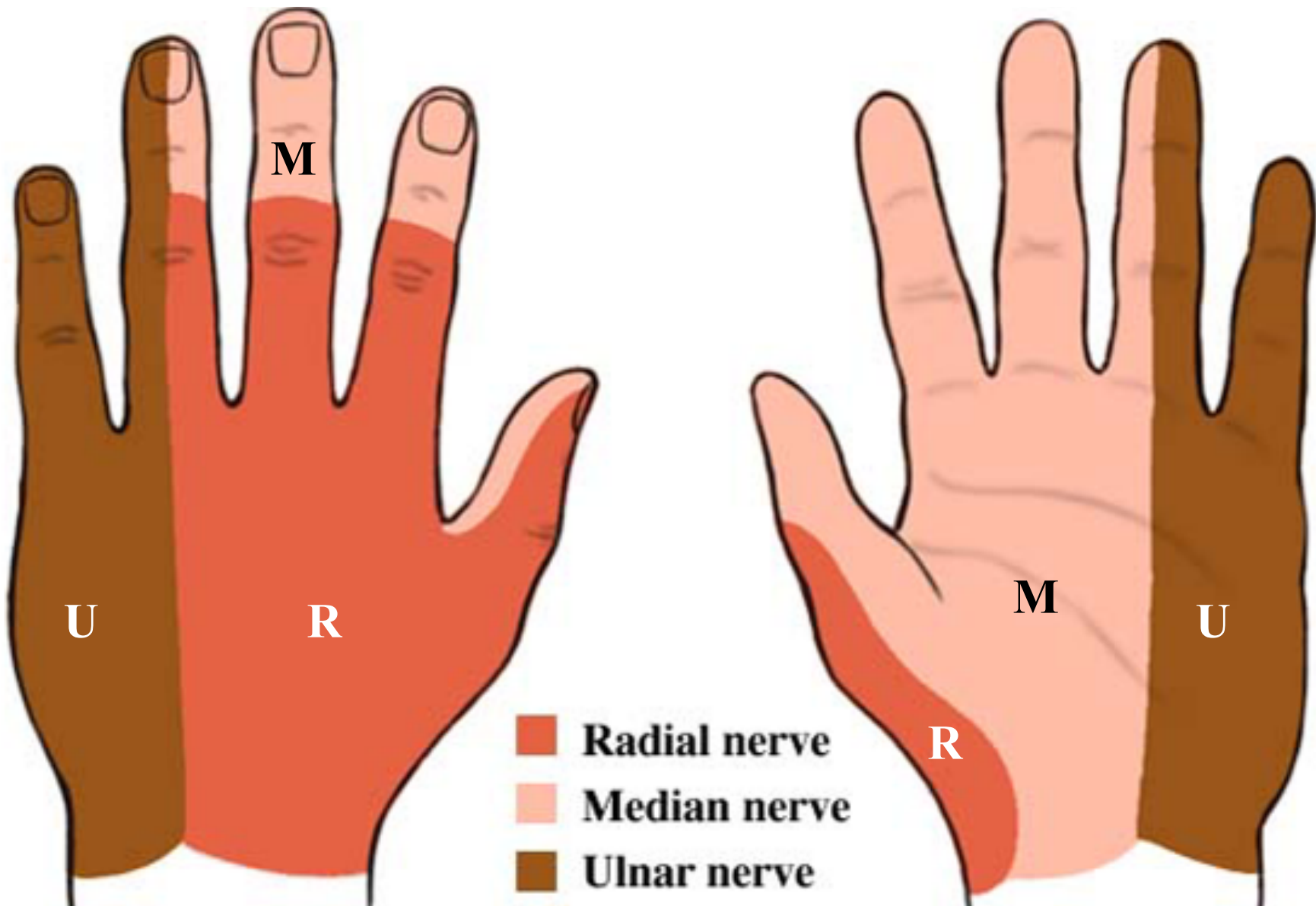
- Type I, 6%, mostly infants and toddlers
- Type II, 75%, growth problems uncommon
- Type III, 10%, growth problems related to
  - Extent of epiphyseal injury
  - Size of the fracture fragment
  - Amount of fragmentation
- Type IV, 10%, same as above, most commonly distal humerus
- Type V, 1%, usually due to crush / compression associated with severe abduction or adduction / knee & ankle most commonly





# The Hand

# Distribution of the Sensory Nerves of the Hand



# The Nerves of the Hand

	Sensory	Motor
Radial Nerve	Dorsal web space between thumb and index finger	Extension of fingers and wrist
Median Nerve	Thumb, index, long and ½ of ring finger	Thumb opposition and flexion of index and middle fingers
Ulnar Nerve	½ of ring and little finger	Finger adduction and abduction; flexion of ring and little fingers

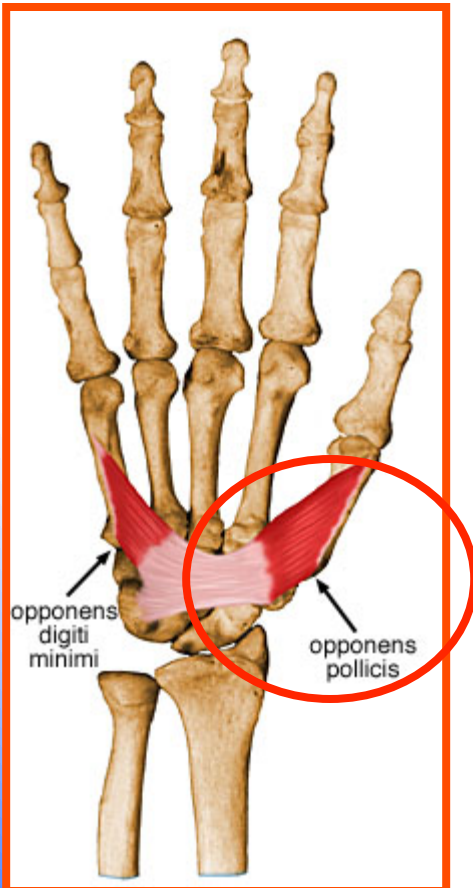
# The Million Dollar Nerve

- The recurrent median nerve
- Purely motor to the thenar muscles
- Motor exam of the thumb is complex with opposition and abduction
- Exam is difficult especially with volar 1<sup>st</sup> web space injuries

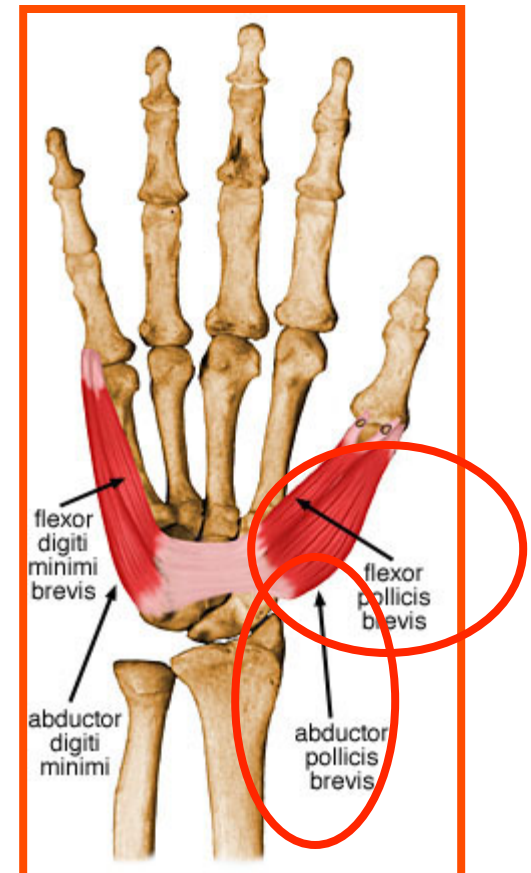
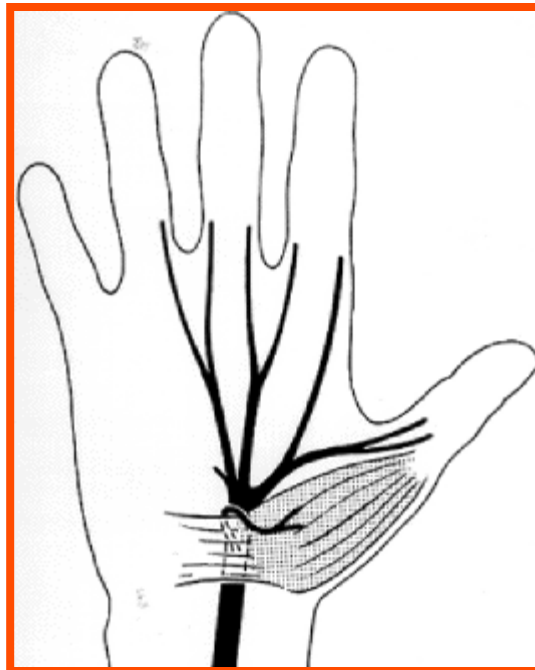
## A Pure Sensory Nerve Too

- Dorsal branch of the radial nerve is a purely sensory nerve

# Recurrent Branch of the Median Nerve



Draws 1<sup>st</sup> metatarsal laterally to oppose thumb toward the center of the palm and rotates it medially



APB - abducts thumb and helps oppose it

FPB - flexes thumb

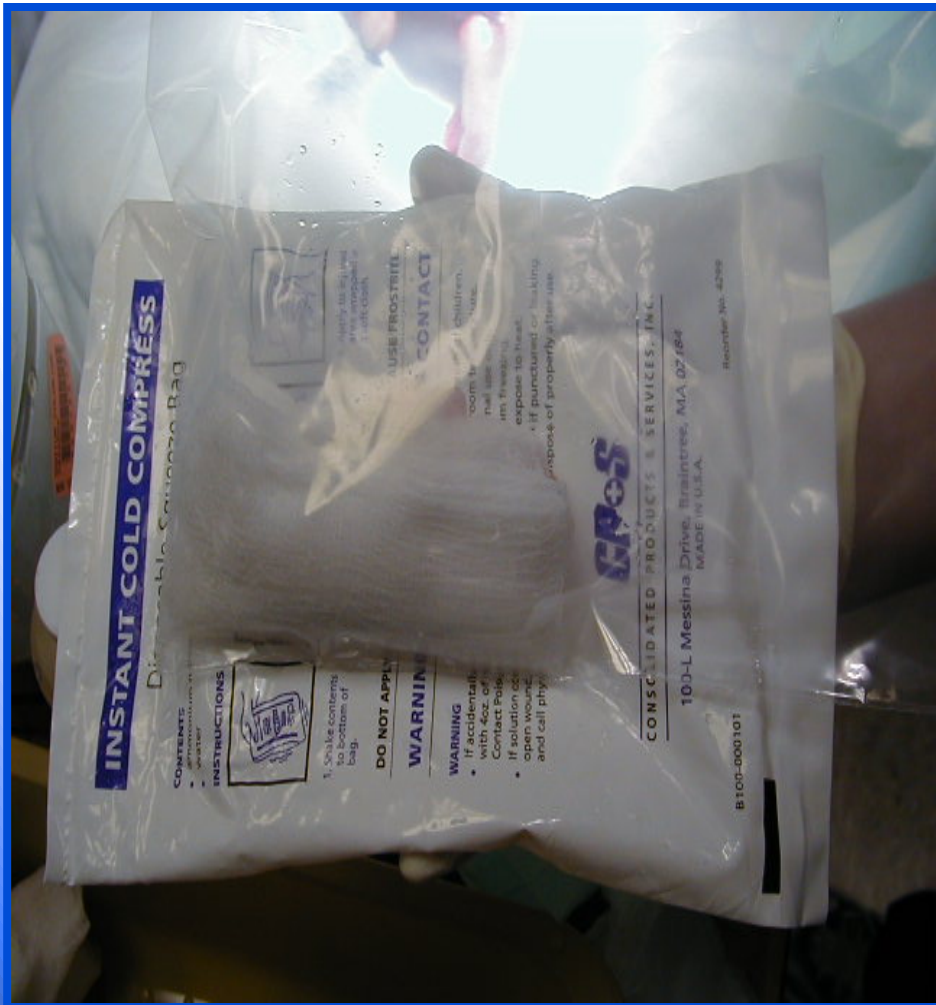


# Amputation Care (1)

- In a plastic bag in ice water (not directly in water)
- Thumb has better outcome proximal to IP joint
- Distal third of fingertip doesn't need graft in small children
- General indications for replantation
  - Multiple digits
  - Thumb
  - Single digit between PIP & DIP (distal to the superficialis insertion)
  - Metacarpal (palm)
  - Wrist, forearm
  - Almost any part in child

# Amputation Care (2)

**Clean and Sharp is Best**



**Amputated Part Storage**



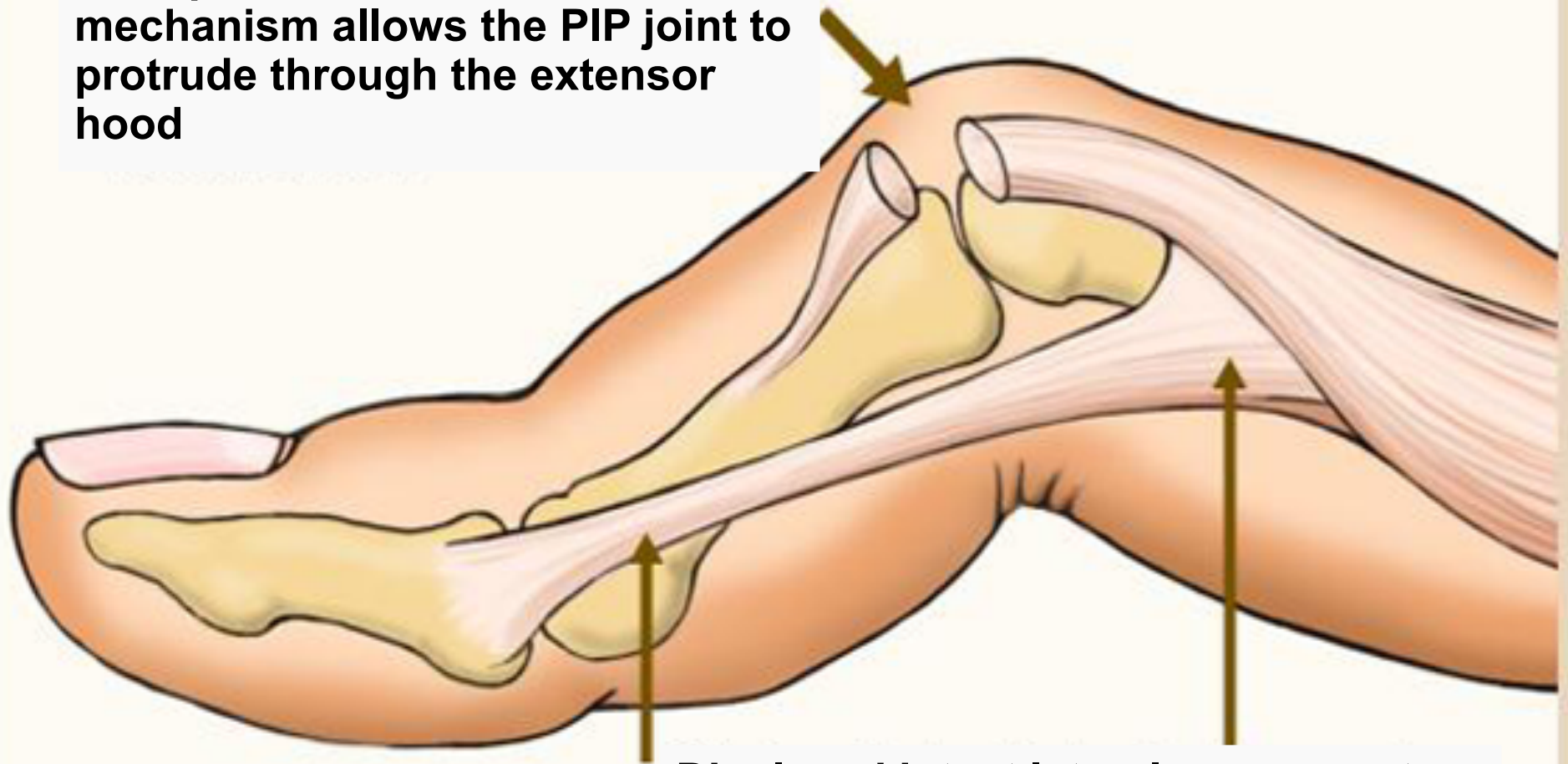
# Boutonniere Deformity

- Central slip extensor hood disruption near PIP joint
- Forced flexion at PIP joint
- Lateral bands of extensor hood split and become PIP flexors
- +/- avulsion fracture
- Deformity (PIP flexion and DIP extension)
- Treatment: splint PIP in extension



# Boutonniere Deformity

**Disruption of the central extensor mechanism allows the PIP joint to protrude through the extensor hood**



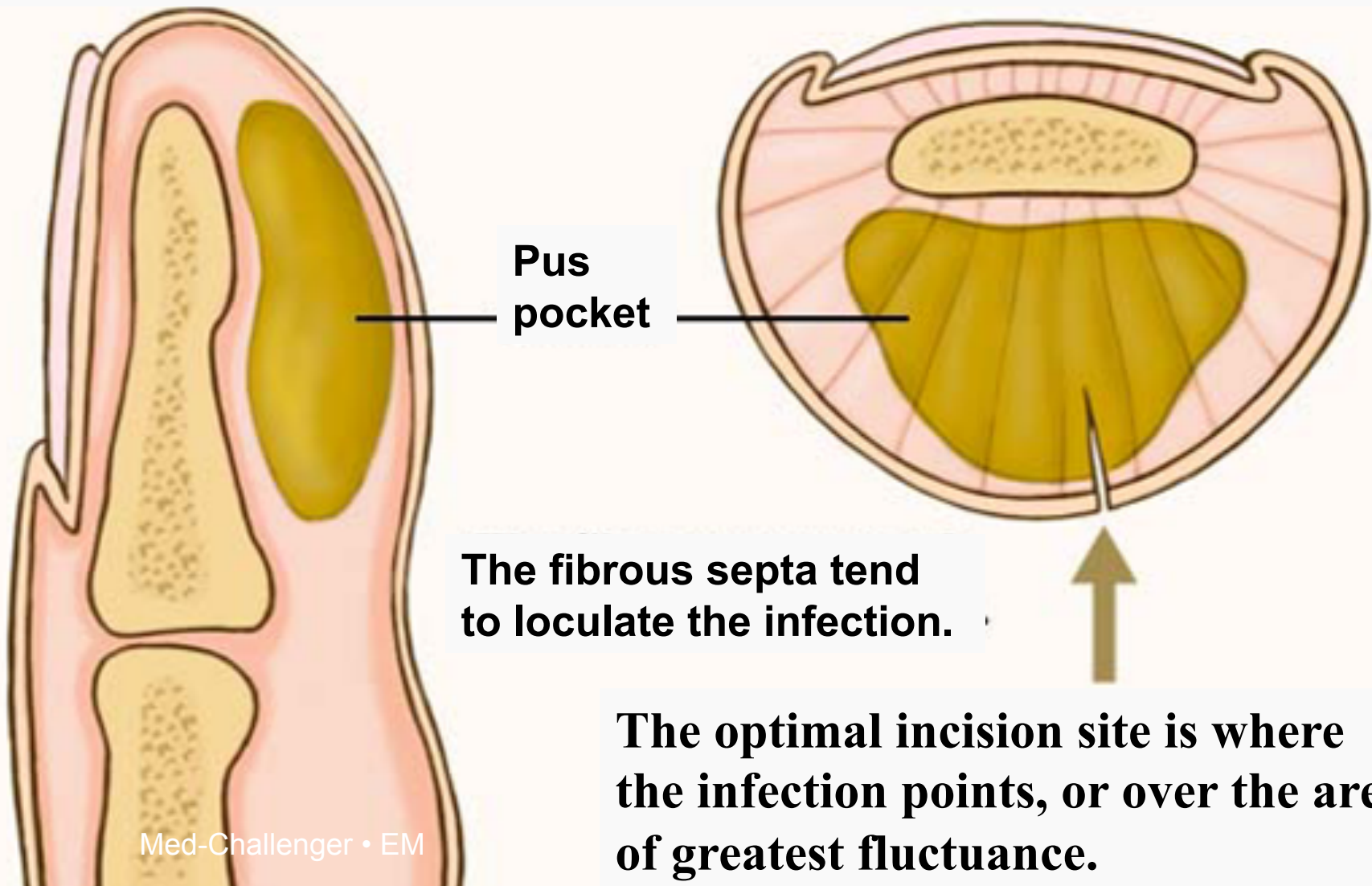
**Displaced intact lateral components of the extensor mechanism hold the DIP joint in extension while flexing the PIP joint.**

# Felon (1)

- Staph. aureus
- Pulp space infection
- Distal fingertip
- Treatment: I&D, antibiotics



## Felon (2)



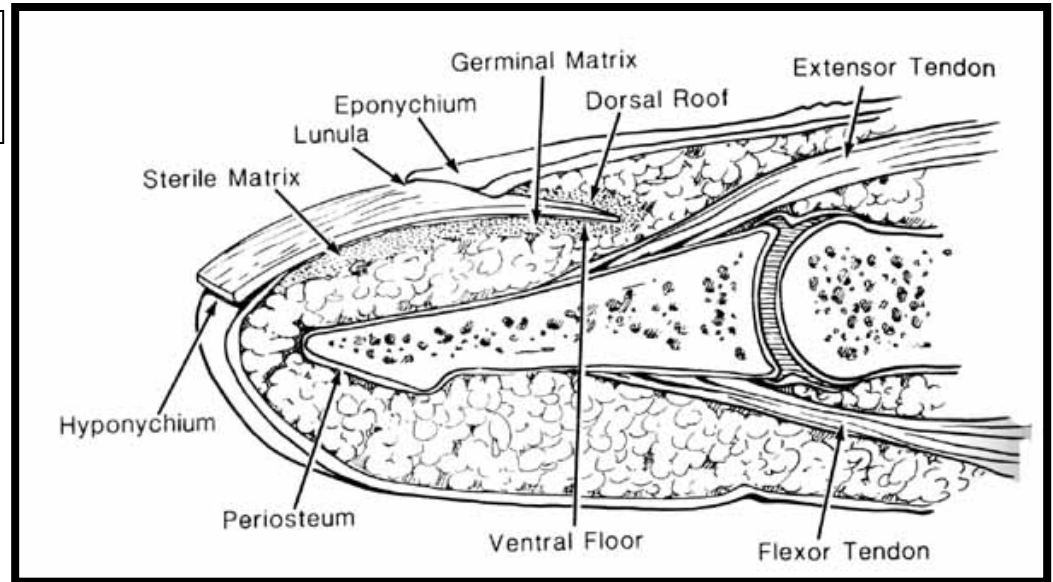


# Felon (3)



# Paronychia (1)

- Nailbed infection
- Acute infection usually Staph
- Chronic infection:
  - C. albicans, other fungi
  - Moist hands (dishwashers, bartenders)
- Treatment: I&D, soaks, ABX not indicated
- Consider osteo if not improving
- DO NOT I&D herpetic whitlow as this will often result in herpetic myositis





# Paronychia (2)

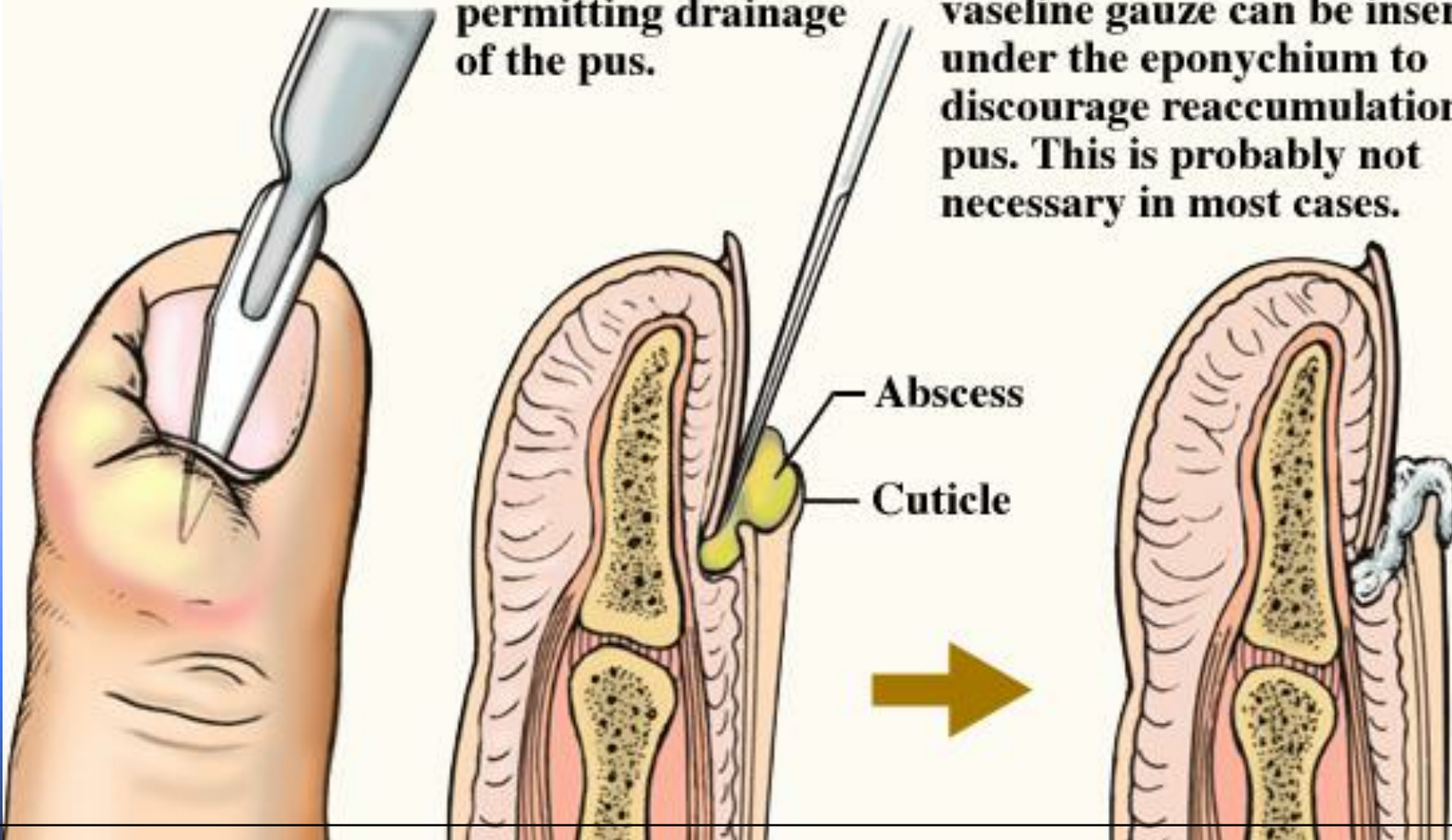


# Paronychia (3)

## Paronychia Drainage: Simple Paronychia

- 1. Use a #11 scalpel blade to separate and lift the eponychium from the nail, permitting drainage of the pus.**

- 2. (Optional) A small drainage wick or packing of Adaptec or vaseline gauze can be inserted under the eponychium to discourage reaccumulation of pus. This is probably not necessary in most cases.**





# Collar Button Abscess

- Palmar aponeurosis prevents extension volarly
- Pus spreads between MC bones and erupts dorsally creating a hand abscess
- A volar and dorsal abscess connected by a tract
- Look for splinter/FB on the palm!



# Sporotrichosis

- Rose gardener
- Fungal infection with skip lesions
- SSKI or itraconazole treatment





# Gamekeeper's (Skier's) Thumb

- Ulnar collateral ligament (UCL) of thumb MCP joint
- UCL critical for pincher and grasp function
- Forced radial abduction MCP joint
- Associated avulsion fracture is common
- Treatment
  - Partial tear: thumb spica splint
  - Complete tear: surgery
- Complication: chronic instability
- Bull rider's thumb = RCL injury



# Mallet Finger (1)

- Extensor tendon disruption (DIP)
- Forced flexion of DIP (ball striking a fully extended digit)
- Avulsion fracture dorsal base of distal phalanx
- +/- avulsion fracture
- Treatment: splint in extension, hand referral

# Mallet Finger (2)



# Mallet Finger (3)



**Tear of  
extensor  
tendon**



**Avulsion fracture  
of dorsal base of  
distal phalanx**



**Deformity resulting  
from inadequate  
treatment**

# Metacarpal Fractures (Neck)

- Fracture of the metacarpal neck is most common hand fractures
- Boxer's fracture: fracture of the neck of 5<sup>th</sup> mc
- All have volar angulation
- Ring & 5<sup>th</sup> mc tolerate greater angulation
  - Ring  $< 35^{\circ}$ , 5<sup>th</sup>  $< 45^{\circ}$
  - Ulnar gutter splint
- Index and middle fingers
  - Less mobility, tolerate less angulation ( $< 15^{\circ}$ )
  - Radial gutter splint

**Rotational displacement = unacceptable**

# Boxer's Fracture



# Metacarpal Fractures (Shaft)

- Angulation is unacceptable for 2<sup>nd</sup> and 3<sup>rd</sup> metacarpals
- Angulation amounts that are acceptable:  
Index 10° Long 20° Ring 30° Small 40°
- All rotational deformities must be corrected
- Operative fixation is usually required for 2<sup>nd</sup> and 3<sup>rd</sup> metacarpals
- Ulnar gutter splints usually fail to maintain any significant correction of angulation
- Short-arm casting with “outriggers” do work

# Metacarpal Fractures (Head)

- Intraarticular fractures
- Direct trauma or crush
- Laceration over MCP suspect human bite
- Any displacement gives poor outcome
- All require hand referral





# Metacarpal Fractures (Special)

## *Bennett's Fracture*

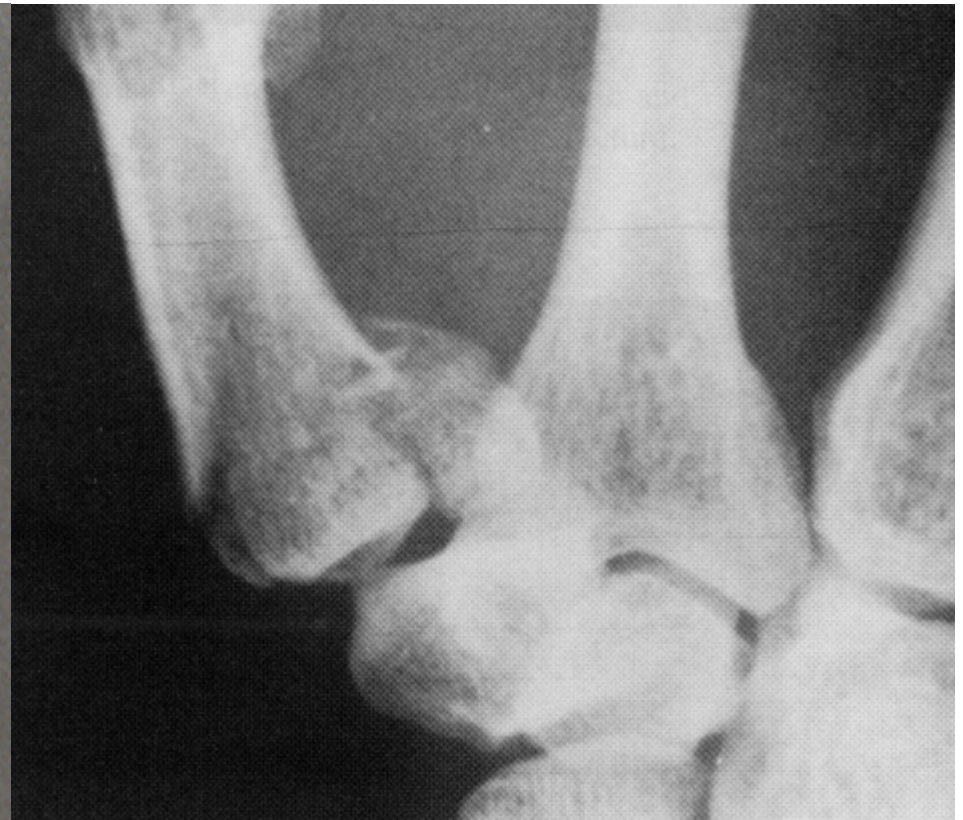
- Axial load with hand closed
- Ulnar aspect of base of thumb at metacarpal joint
- Intraarticular with dislocation or subluxation at the CMC joint
- Anatomical reduction required, ORIF

## *Rolando Fracture*

- Comminuted intraarticular, requires ORIF
- No subluxation dislocation of CMC joint
- **Worse prognosis**

Thumb spica + emergent ortho referral

# Bennett's Fracture | Rolando Fracture



# Flexor Tenosynovitis (1)

- Secondary to puncture wound of volar surface: especially cat bites
- Kanavel's signs

- Diffuse fusiform swelling, erythema
- Pain on palpation proximal sheath
  - Severe pain on extension
  - Held in slightly flexed position

- Treatment: surgical I&D

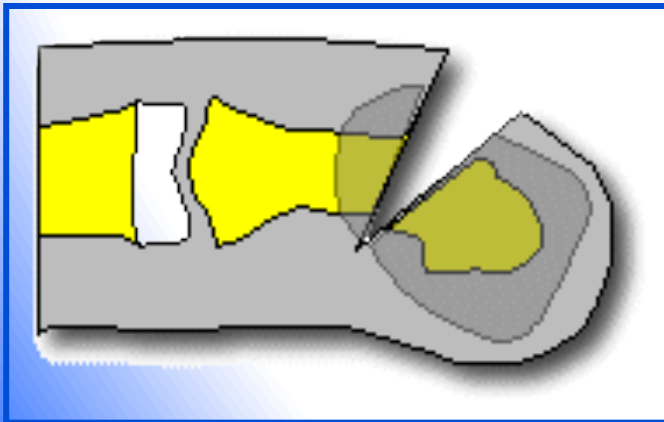


# Flexor Tenosynovitis (2)

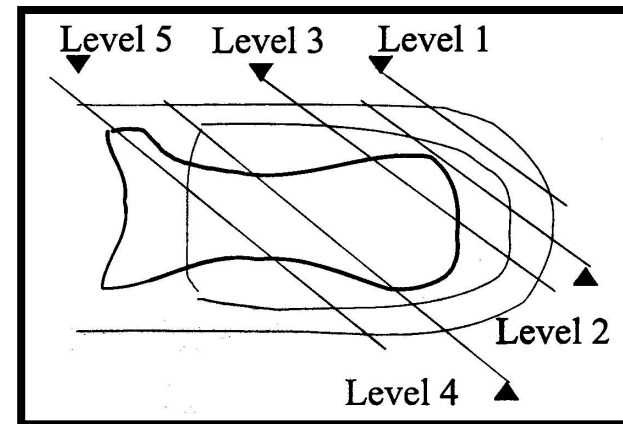


# Fingertip Injuries

- Zone 1: 2/3 of proximal nail bed preserved, no bone exposure, heals with secondary intention
- Require surgical treatment
  - Zone 2: exposed bone
  - Zone 3: loss of entire nail bed plus exposed bone



**ZONE II**

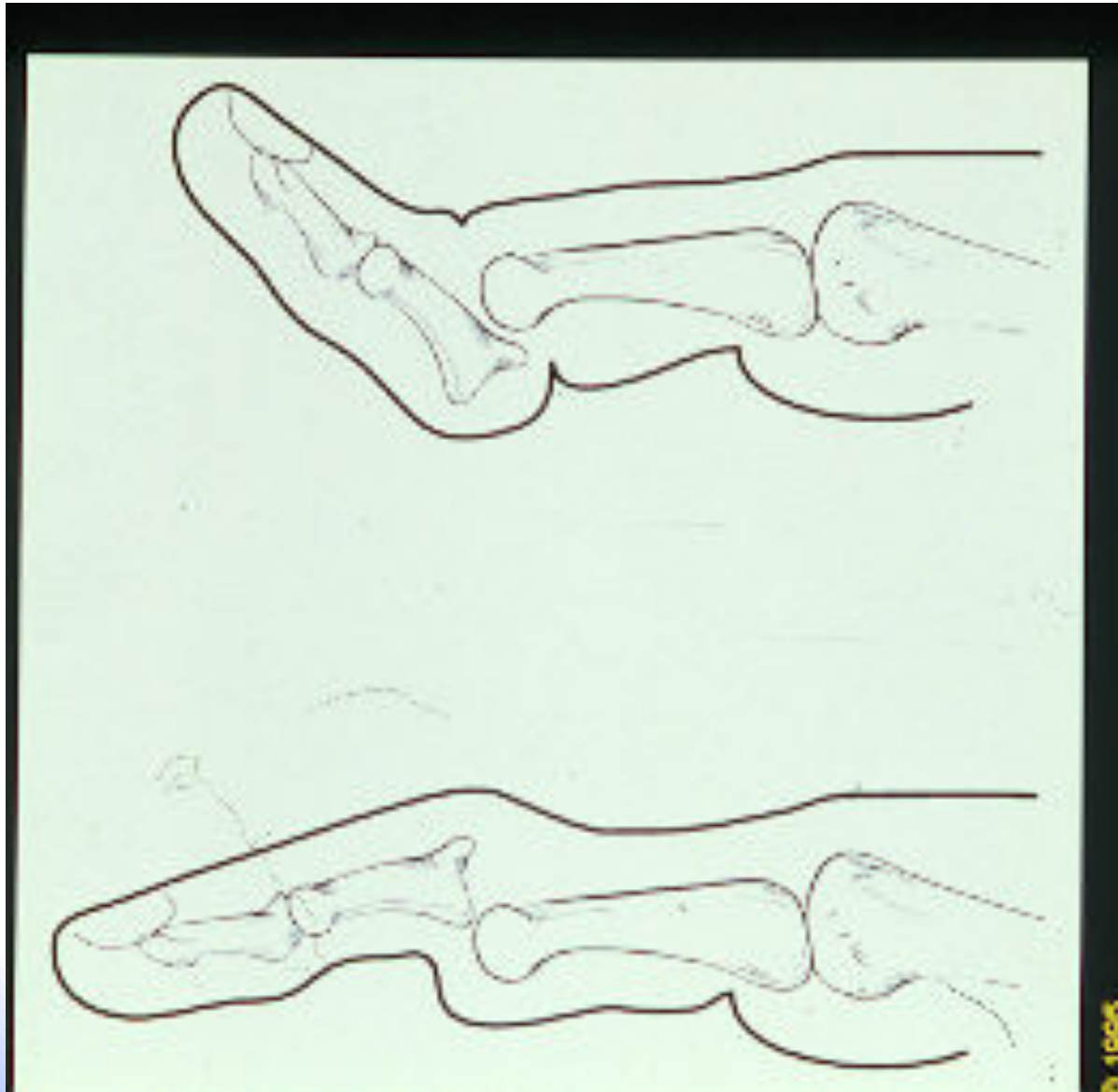


**International Classification**

# Finger Dislocations (1)

- DIP dislocation is uncommon
- PIP dislocation is common
  - Dorsal dislocation very common (rupture of volar plate, ulnar deviation 2° RCL rupture)
  - Reduction: digital block: distraction and slight hyperextension, then repositioned
  - Splint at 30 ° flexion, refer
  - Can't reduce?? (due to volar plate entrapment )
- MCP
  - Less common than PIP dislocation
  - Hyperextension, rupture of volar plate, dorsal dislocation
  - Volar plate is commonly entrapped in joint space making closed reduction impossible

# Finger Dislocations (2)





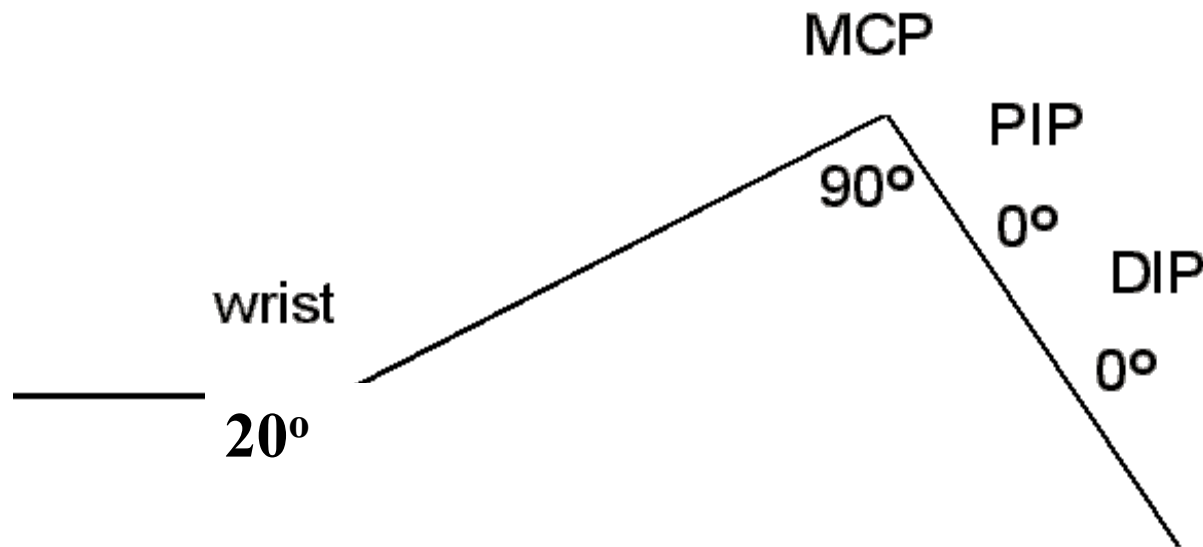
# Finger Facts

- High pressure injection injury: OR
- Subungual hematoma requires trephination
- Flexor digitorum profundus (FDP)
  - Flexion of DIP joints
  - Test: immobilize MCP and PIP of same digit
- Flexor digitorum superficialis (FDS)
  - Primary flexor of PIP
  - Test: immobilize MCP and IP of adjacent digit



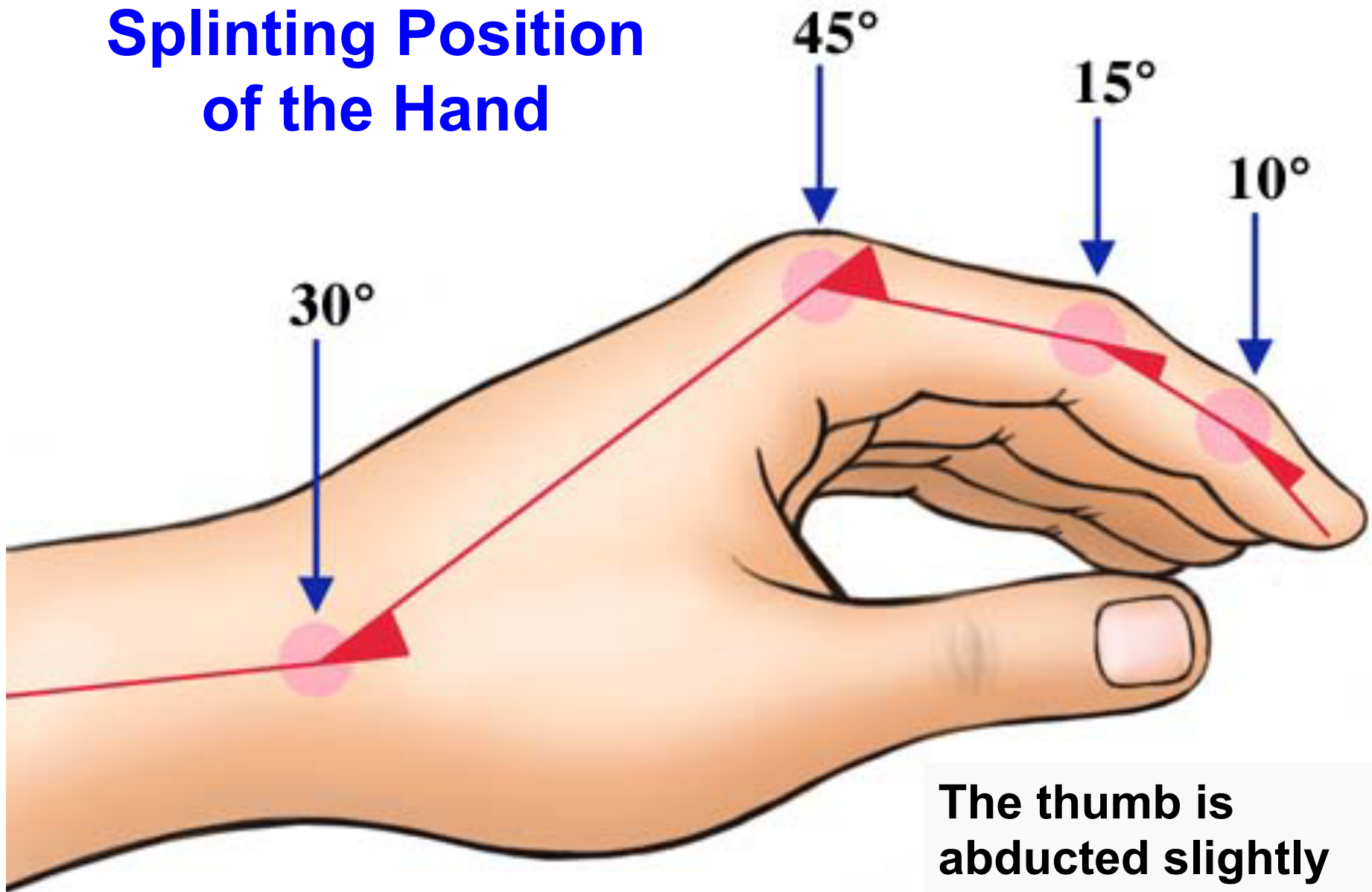
# Intrinsic Plus Splinting

## *“Safe Position”*



- Metacarpal and unstable proximal / middle phalanx fractures
- Decrease “freeze” at MCP
- Decrease “freeze” at PIP
- “Blade of the hoe” position

## Splinting Position of the Hand



**Distal wrist / carpal fractures**

The thumb is  
abducted slightly  
away from the palm

# Fractures of the Wrist



# Colles' Fracture (1)

- **Most common fracture in adults >50**
- Distal radius at the metaphysis
- Dorsal displacement
- “Dinner fork” deformity
- Ulnar styloid fracture is common
- Treatment: closed reduction

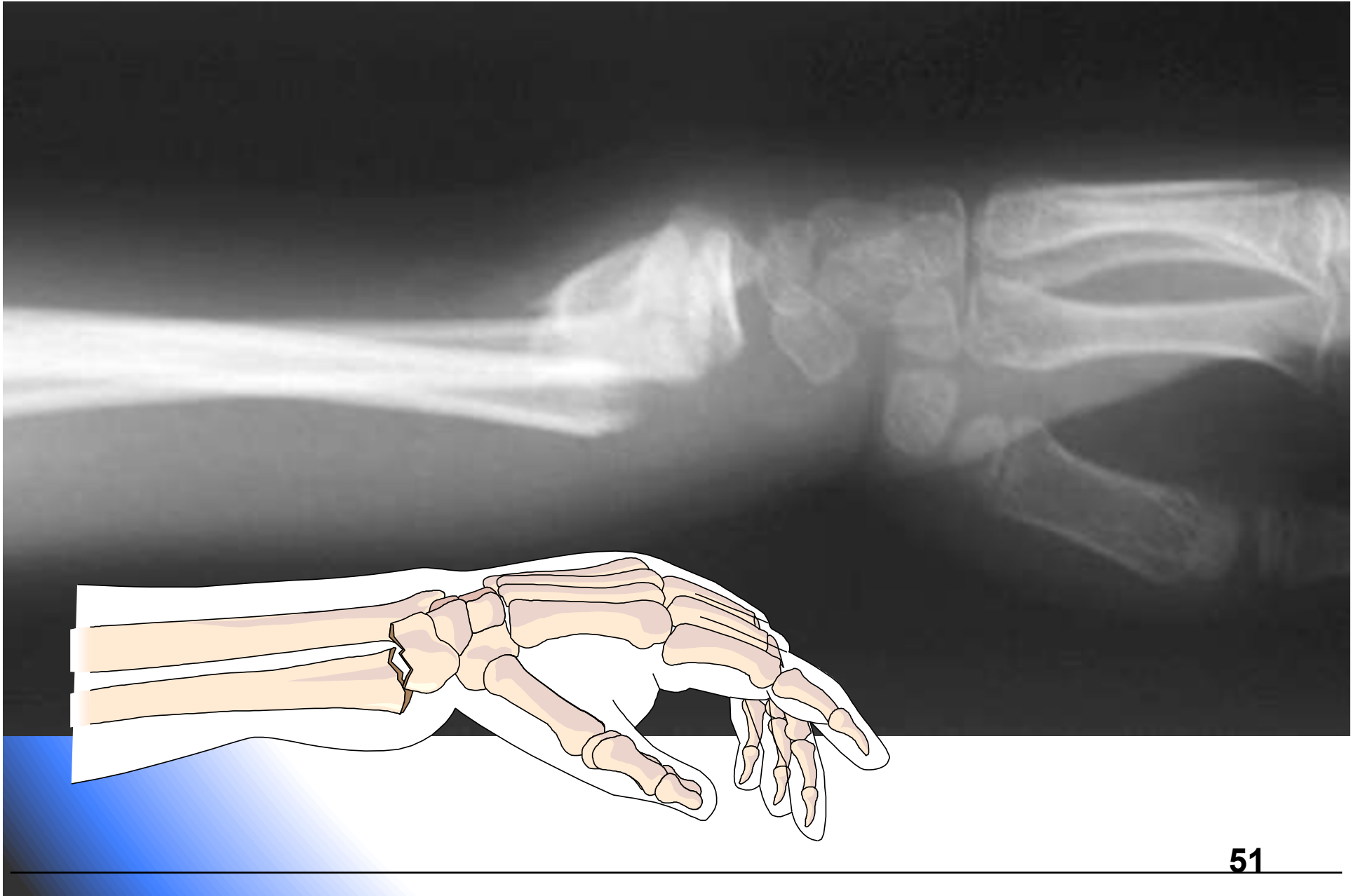
**Complication: median nerve injury**



# Colles' Fracture (2)



# Colles' Fracture (3)



# Smith's Fracture (1)

- “Reverse Colles”
- Volar displacement of distal radius
- Associated median nerve and flexor tendon injury
- Closed reduction

## Triquetrum Fracture

- Most common dorsal chip fracture of the wrist
- Pain on dorsum of wrist and ulnar styloid
- Painful to flexion

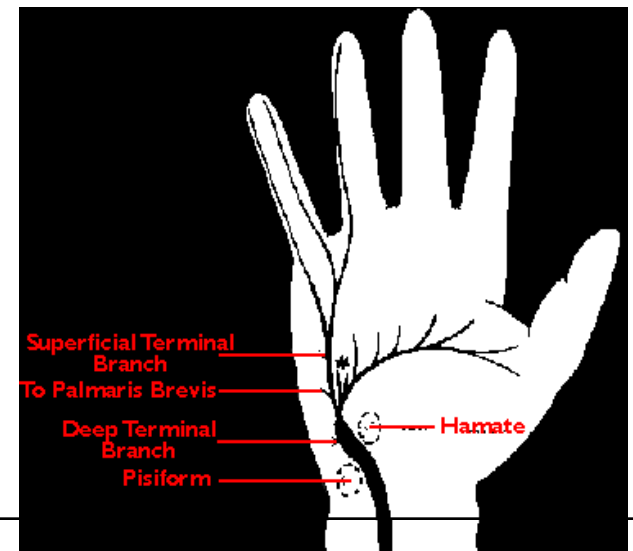
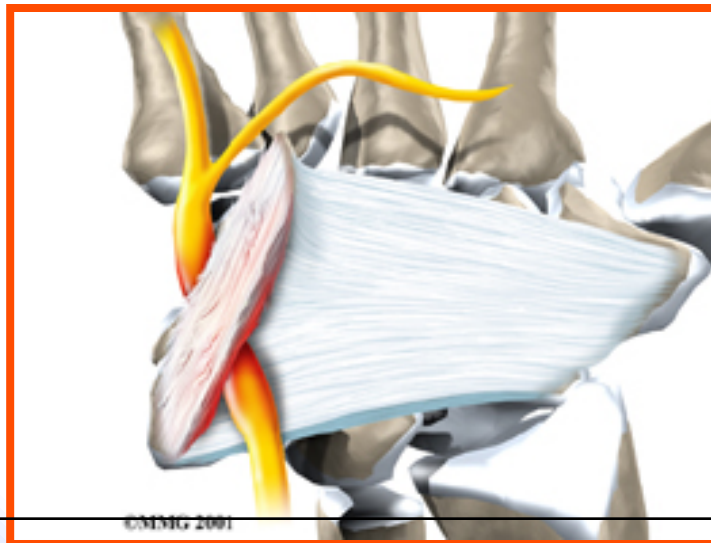


# Smith's Fracture (2)



# Guyon's Canal Syndrome

- A palmar ligament connects the pisiform and the hamate forming a tunnel = Guyon's canal
- The ulnar nerve runs in this canal and is subject to entrapment within it
- Cause numbness and tingling in the ring and small finger
- Causes = canal cyst, repetitive trauma (cyclist [handlebar neuropathy], golf, hitting baseballs)
- Splint
- Surgically decompress





# Scapholunate Dissociation

- Most common ligamentous injury of hand
- Commonly missed
- Fall outstretched hand
- > 3 mm widening of scapholunate space
- Thumb spica, hand referral



# Perilunate / Lunate Dislocation (1)

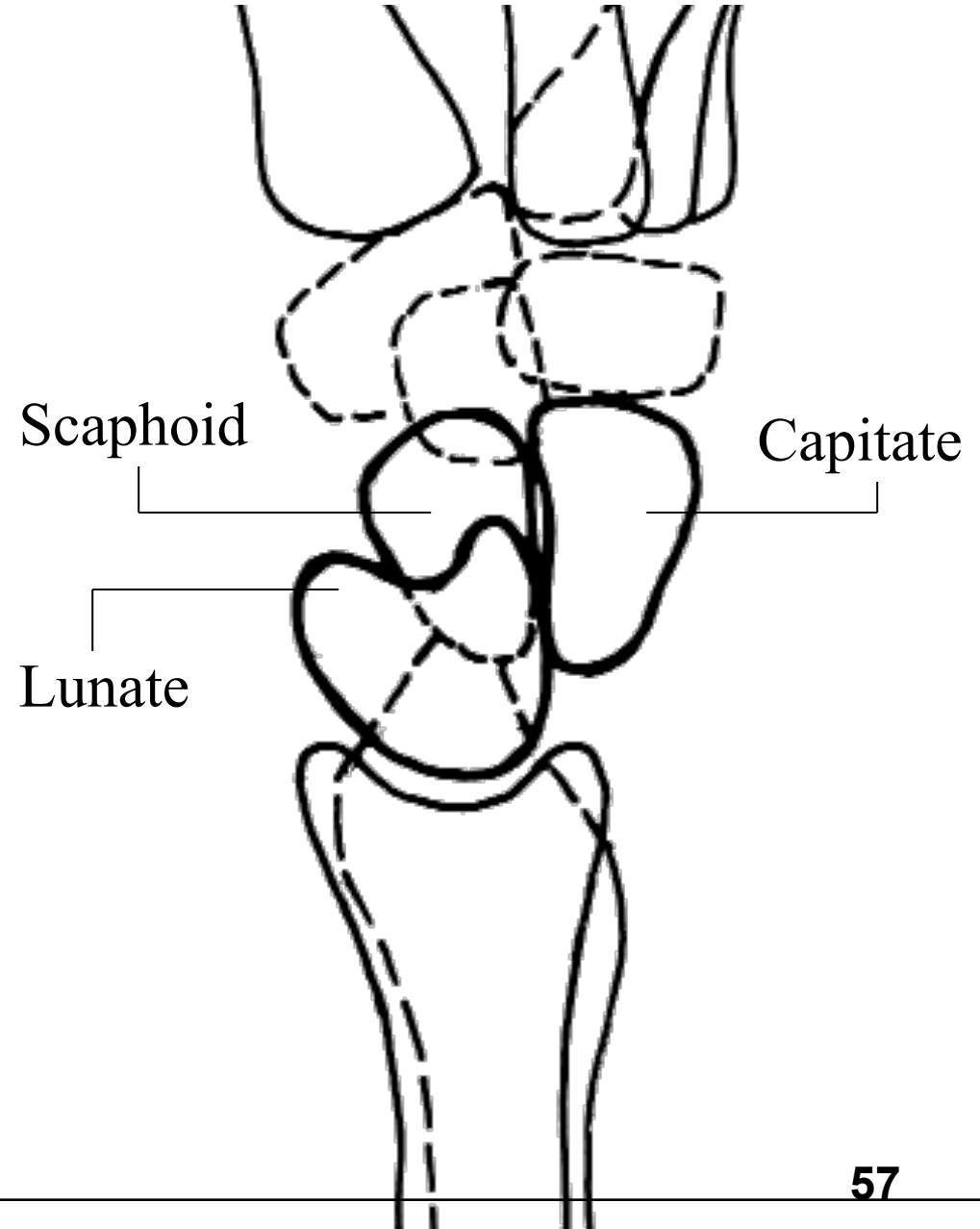
- Forceful hyperextension
- Median nerve injury common
- Lateral X-ray (most helpful)

Perilunate: capitate displaced, lunate aligned  
Lunate: capitate aligned, lunate displaced

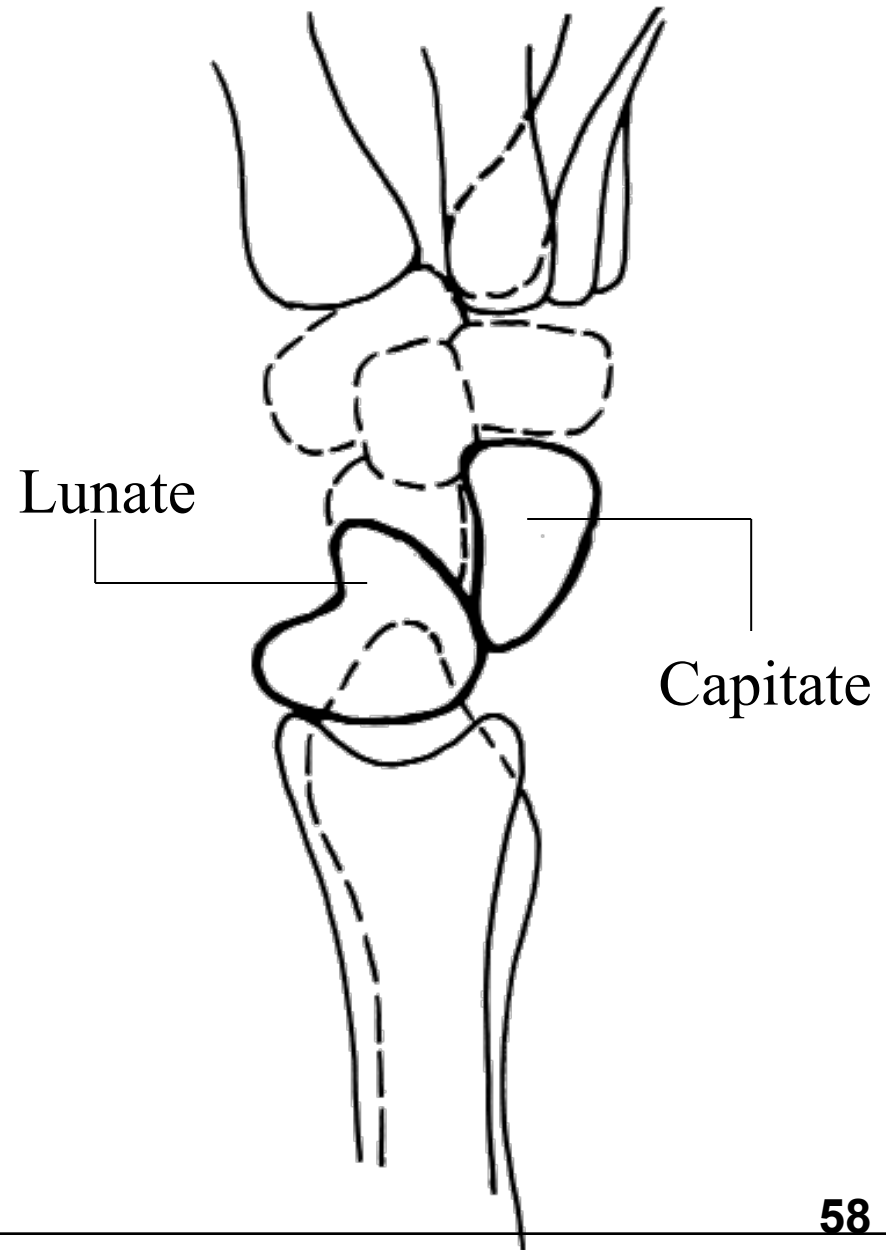
- X-ray: “piece of pie”
- Lunate fracture associated with avascular necrosis

**Complications: median nerve injury, scaphoid fracture**

# Perilunate Dislocation (2)



# Lunate Dislocation



# Scaphoid Fracture

- Most common carpal fracture

**Tenderness in “snuff box”**

- Initial X-rays may be negative
- Thumb spica splint

**Complication: avascular necrosis**

- Repeat X-ray in two weeks (or bone scan in 3 days) or CT or MRI

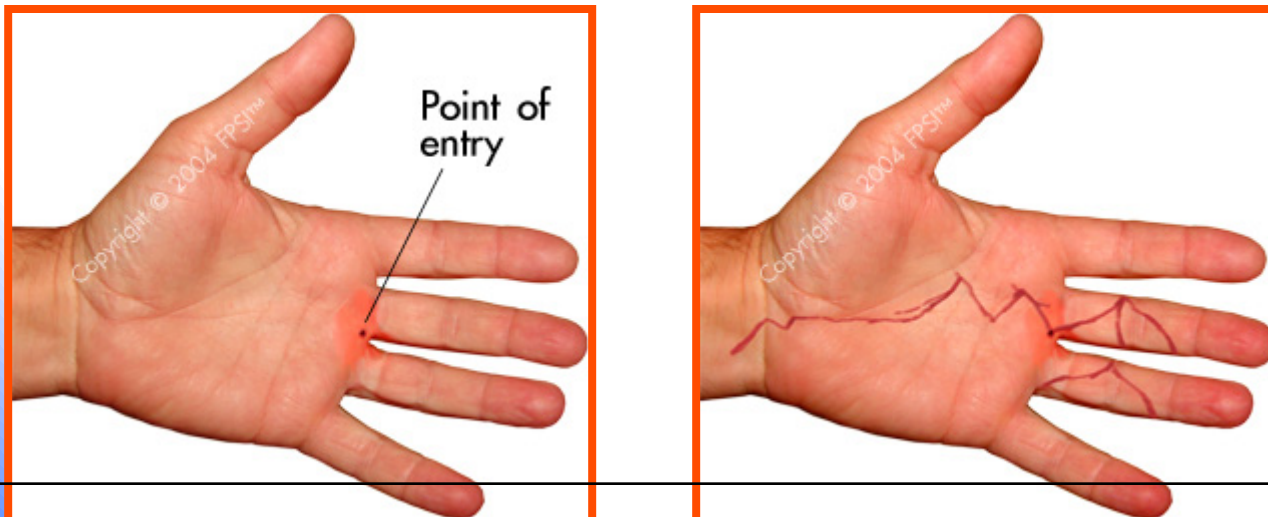


# Ulna, Radius, and Scaphoid Fracture



# High Pressure Injection Injuries

- Substance under high pressure is injected into the hand
- Grease, paint, hydraulic fluid
- Oil-based paint causes the most severe reaction (ischemia, possible amputation)
- X-ray for radiopaque substance, subcutaneous air
- Complications: compartment syndrome, ischemia
- May appear benign initially
- Requires emergency débridement and decompression

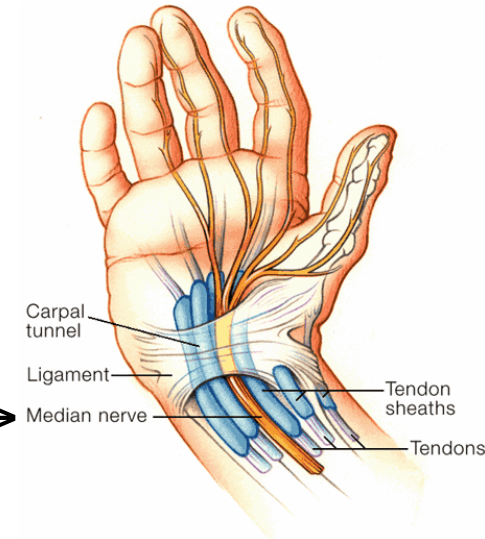




# The Forearm

# Carpal Tunnel Syndrome

- Entrapment of the median nerve
- May be worse at night
- **Tinel's sign**: tap volar wrist → paresthesias
- **Phalen's sign**: hyperflex wrist → paresthesias
- Risk factors: pregnancy, hypothyroid, DM, RA



## DeQuervain's Tenosynovitis

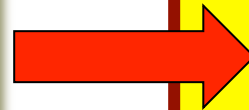
- Overuse syndrome
- Dorsal and radial compartments of the wrist
- **Finkelstein's test**: ulnar deviation of the fist hand reproduces pain
- Treatment: splint, NSAIDs, rest



# Galeazzi Fracture (1)

- Distal radial fracture, usually displaced
- Disrupted distal radio-ulnar joint
- Pain and swelling of wrist
- Complication: ulnar nerve injury
- Treatment: ORIF

**Galeazzi**  
**Radial fx**  
**Ulnar fx**  
**Monteggia**



**G**                      **M**  
↓                      ↓  
**R**                      **U**



# Galeazzi Fracture (2)



Galeazzi  
Radial fx

Ulnar fx

Monteggia

# Monteggia Fracture (1)

- Proximal ulnar shaft fracture, usually displaced
- Proximal radial head dislocation
  - Annular ligament disruption
- Pain and swelling of elbow
- Complications
  - Radial head fracture
  - Radial nerve injury
  - Nonunion
- Treatment in adults: ORIF

# Monteggia Fracture (2)

Galeazzi

Radial fx

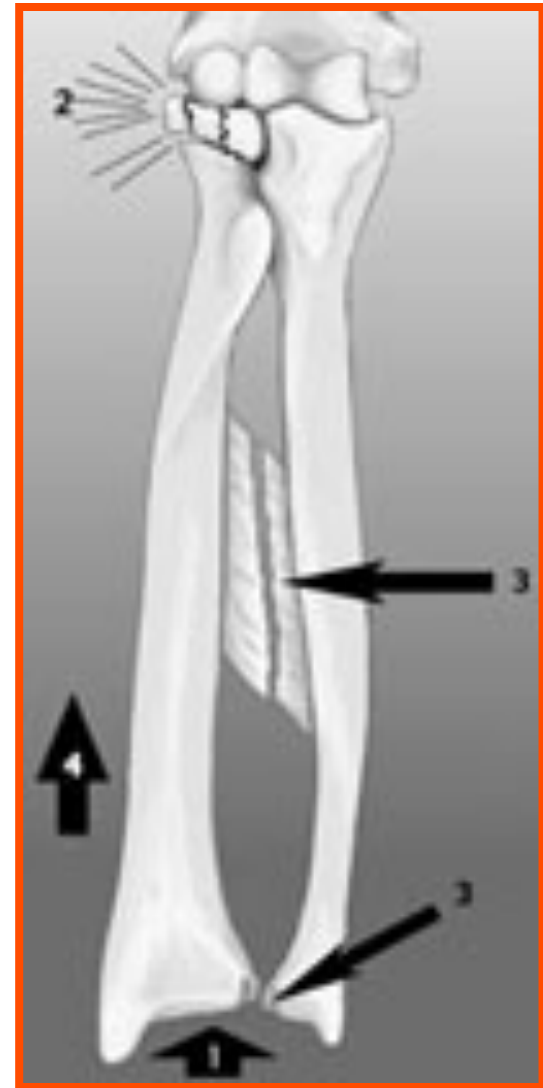
Ulnar fx

Monteggia



# Essex-Lopresti Injury

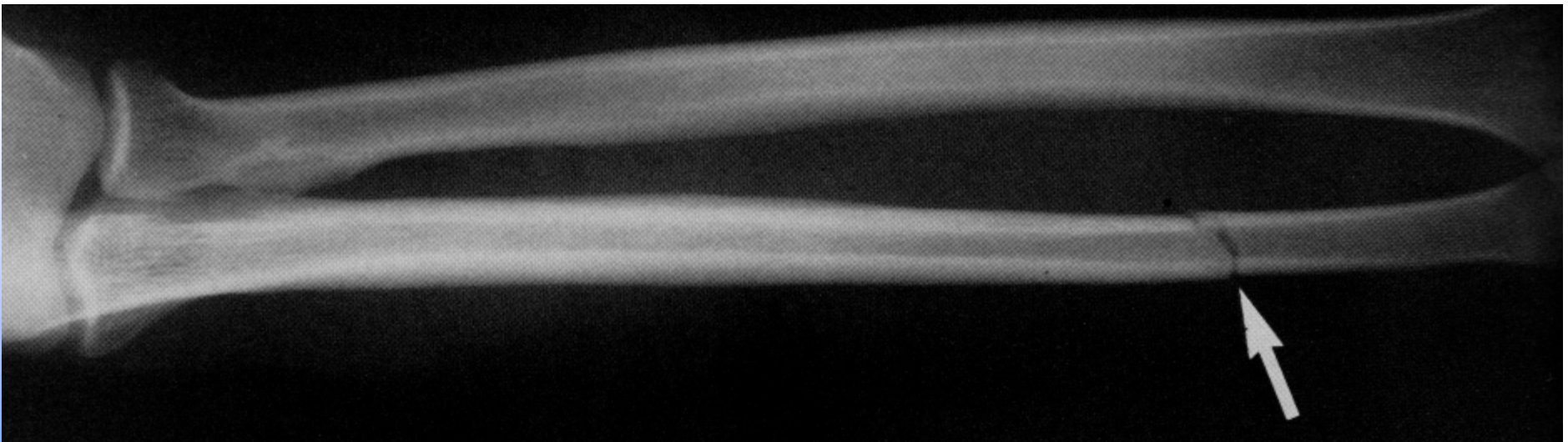
- Radial head fracture
- Dislocation of distal RU joint
- Interosseous membrane disruption
- ORIF generally needed
- Severe wrist pain with “negative” wrist films
- FOOSH mechanism



# Ulnar Nightstick Fracture (1)

- Nondisplaced ulnar shaft fracture
- Common defense injury
- Complications include
  - Missed Monteggia fracture (radiohumeral dislocation)
  - Radial nerve injury
  - Nonunion
- Treatment
  - Nondisplaced: splint, early ROM
  - Displaced fracture may require ORIF

# Ulnar Nightstick Fracture (2)





# Both Bone Forearm Fracture (1)

- Requires great amount of force
- Nondisplaced fractures are very rare
- Requires ORIF
- Closed reduction is possible in children
- Complications
  - Reduced ability to supinate and pronate
  - Nonunion
  - Neurovascular injury

**Beware of Compartment Syndrome**

# Both Bone Forearm Fracture (2)



# Volkmann's Contracture

- Inadequate circulation to the forearm
- Result is forearm pronation, flexion of wrist and digits, paralysis of intrinsic muscles
- Caused by many compressive states
- Pain, digit swelling and paraesthesias
- Seen with elbow and forearm fractures, tight casts
- Irreversible damage in 6 hours

**Patient with cast complaining of pain and numbness in hand: cast must be removed immediately**

# The Elbow



# Nursemaid's Elbow

- History of being pulled or swung by arm
- Forearm flexed and pronated, child reluctant to move arm
- Subluxation of the radial head beneath the annular ligament (becomes entrapped)
- Tear of annular ligament
- Peak ages 1-4
- X-rays not necessary
- Reduction: supinate forearm and flex elbow



# Olecranon Bursitis (1)

- Acute or chronic inflammation of bursa
- Common bursae affected: olecranon (student's elbow), prepatellar bursa (carpet layer's knee)
- Repetitive minor trauma (leaning on elbow at work)
- Septic and nonseptic bursitis can be difficult to distinguish
- Minimize labs
- Avoid I & D : aspirate instead

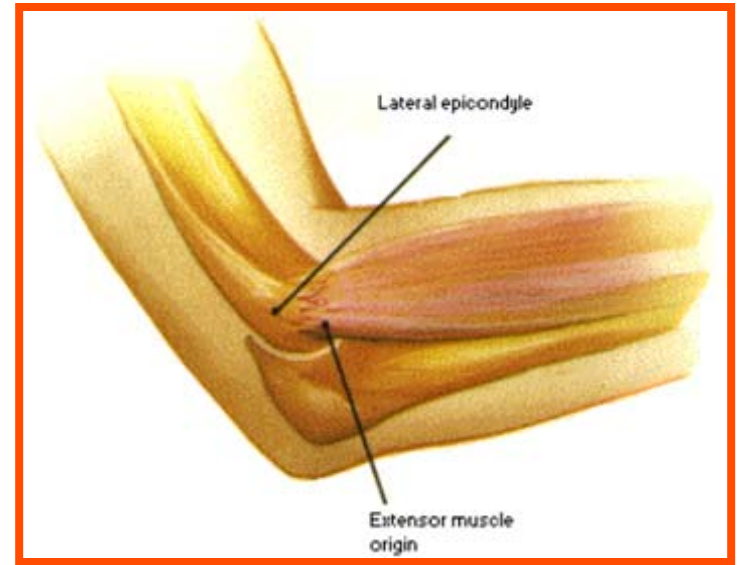


# Olecranon Bursitis (2)

- Must consider septic bursitis
  - Abrupt onset
  - Swollen, hot, erythematous, tender
- Aspiration of bursal fluid is therapeutic and diagnostic
- Septic bursitis
  - Staph, Strep, MRSA
  - Some may need IV antibiotics, debridement, open irrigation and admission (most do not)
- Nonseptic
  - Splint, elevate, compressive dressing

# Epicondylitis

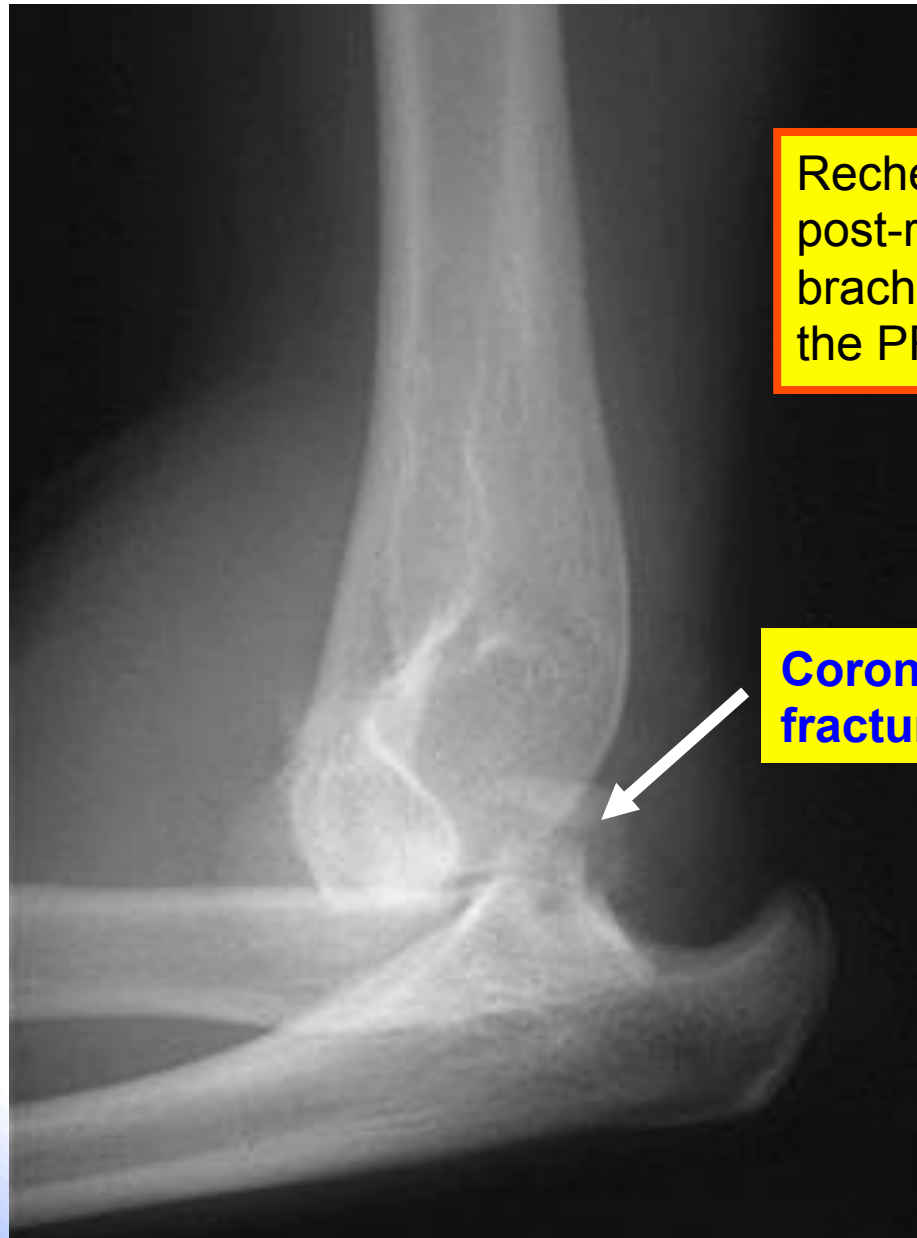
- Lateral (tennis elbow)
  - Forearm extensor muscle overuse
  - Pain in lateral elbow with wrist extension
  - Treatment: avoidance, rest, NSAIDs
- Medial (Little League elbow)
  - Golf, throwing, pitching
  - Forearm flexor muscle overuse
  - Pain in medial elbow. Grip decreased 2° pain
  - May have ulnar neuritis (paresthesias of ring and small fingers)



# Elbow Dislocation

- Majority are posterior
- Vascular injury: brachial artery (consider angio)
- Nerve injury: ulnar nerve most common
- Medial epicondyle fractures common in children
- Treat early to avoid articular cartilage damage
- Avoid hyperextension to prevent bleeding
- Stability depends largely on coronoid fracture

# Posterior Elbow Dislocation



Recheck vascular status  
post-reduction to R/O  
brachial artery injury from  
the PROCEDURE!

Coronoid process  
fracture



# Elbow Radiographic Abnormalities

- Fat pad sign
  - Posterior fat pad is never normal
  - Intraarticular hemorrhage
  - Intracapsular hemorrhage
  - Occult radial head fracture
  - Also seen with gout, villonodular synovitis, and some infections
- Anterior fat pad
  - Small fat pad may be normal
  - Large fat pad (sail sign) is abnormal



# Radial Head Fracture (1)

- Fall on outstretched hand (FOOSH)
- Radial head is driven against the capitellum
- Pain with passive rotation of the forearm
- Most common “occult” elbow fracture in adults
- Fracture classification
  - Type I: nondisplaced
  - Type II: marginal impaction, displacement and angulation
  - Type III: comminuted radial head
  - Type IV: any of the above plus elbow dislocation

# Radial Head Fracture (2)

- Treatment
  - Type I: brief sling and early range of motion
  - Type II: same as type I, unless no improvement or mechanical block
  - Type III: radial head excision
  - Type IV: treated for both dislocation and fracture

# Radial Head Fracture - Fat Pad Sign



# Supracondylar Fracture (1)

- Can be complete or incomplete
- Most common occult elbow fracture in children
- Posterior displacement (due to extension)

## Rule out median nerve injury

- Complications
  - Brachial artery and median nerve injury
  - Vascular compromise
  - Forearm compartment syndrome
  - Volkmann's contracture
- X-ray may show posterior fat pad sign
- Displaced fractures require hospitalization for neurovascular checks



# Supracondylar Fracture (2)



# Anterior Humeral Line Test (1)

- Used to pick up “occult” supracondylar fractures

Anterior humeral line

- Normal: bisects middle third of capitellum



Normal anterior humeral line in association with anterior and posterior fat pads and a nondisplaced radial head fracture



Abnormal: bisects the anterior third of the capitellum or passes in front of it

# Anterior Humeral Line Test (2)



Normal



Incomplete supracondylar fracture

# The Shoulder

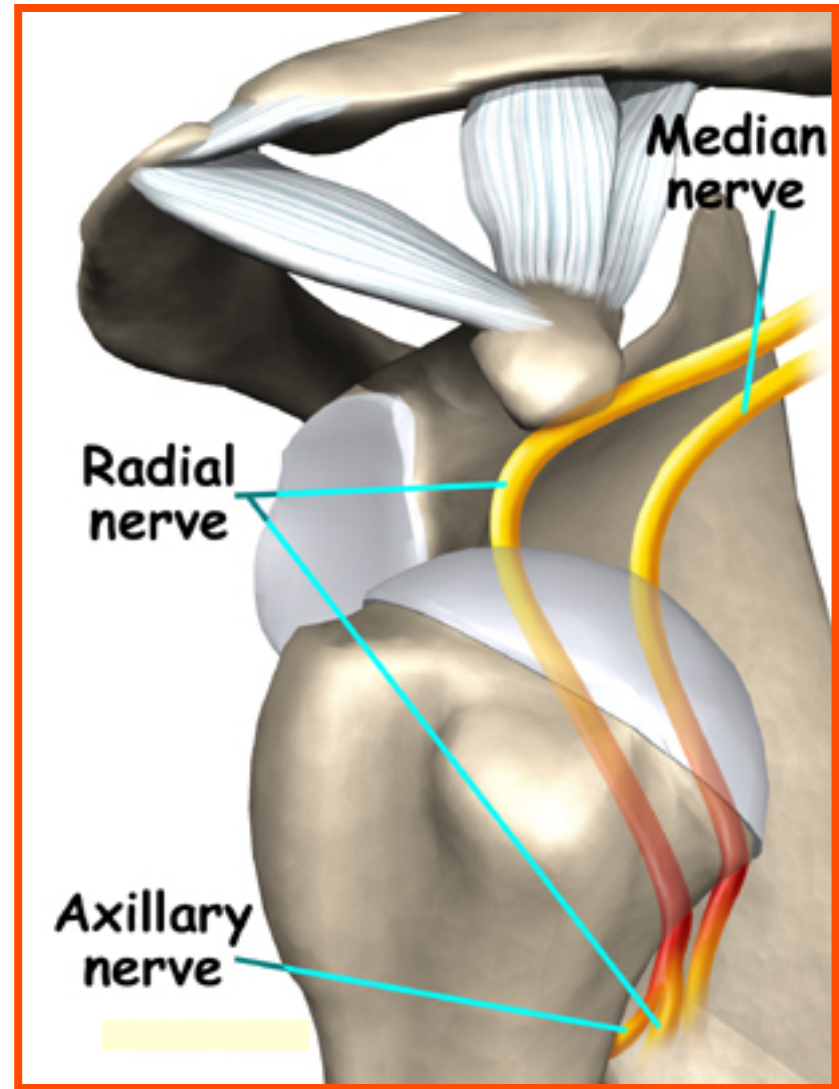
# Shoulder Pain

- Extrinsic causes: cardiac, infectious, pulmonary, abdominal (spleen) and neck
- Intrinsic causes
  - Impingement syndrome: result of repetitive overhead arm use. Includes rotator cuff tendinitis, subacromial tendinitis and bursitis, decreased active range of motion, full passive range of motion
  - Adhesive capsulitis: painful and limited active and passive range of motion, usually associated with a period of immobilization



# Shoulder Dislocation Anatomy

- Axillary nerve injury
- Suprascapular n. for peripheral blocks
- Suprascapularis pulls off the greater tubercle
- Rotator cuff = SITS muscles
  - Supraspinatus
  - Infraspinatus
  - Teres minor
  - Subscapularis



# Anterior Shoulder Dislocation (1)

- Mechanism: indirect forced abduction, extension and external rotation
- Arm held in slight abduction and external rotation
- Subcoracoid is the most common type
- Hill-Sachs lesion: notch on posterior humeral head (impression fracture)
- Bankart's lesion: labral tear +/- erosion or anterior glenoid rim fracture
  - Leads to joint laxity
  - Younger patients, initial injury
- X-ray: need scapular "Y" and AP views

**Complications: axillary nerve injury, rotator cuff injury, avascular necrosis, adhesive capsulitis**

# Anterior Shoulder Dislocation (2)

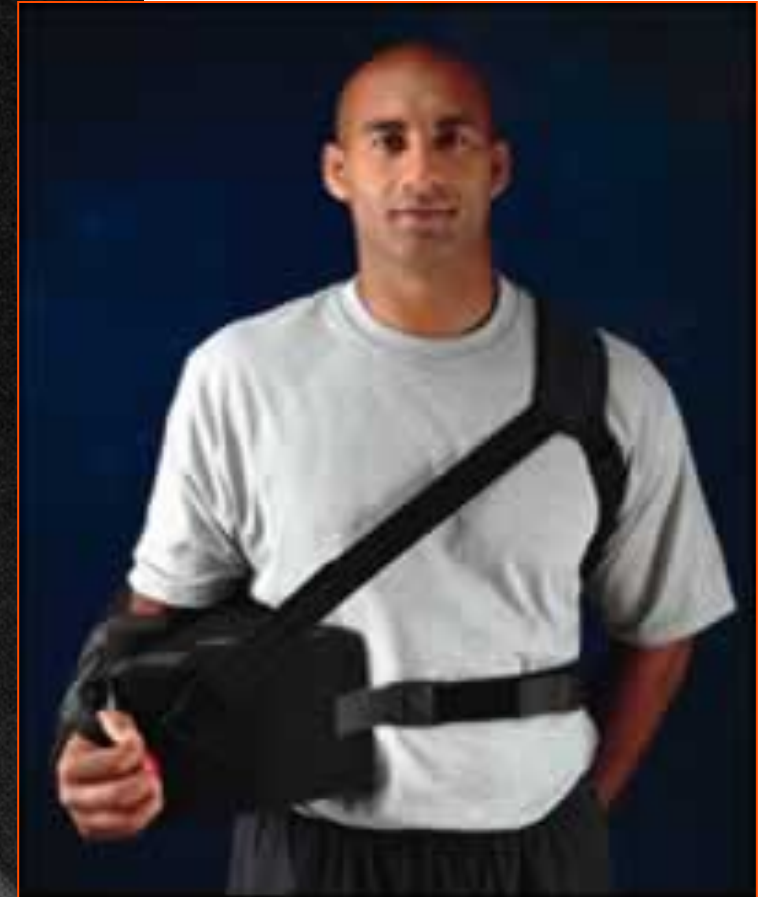
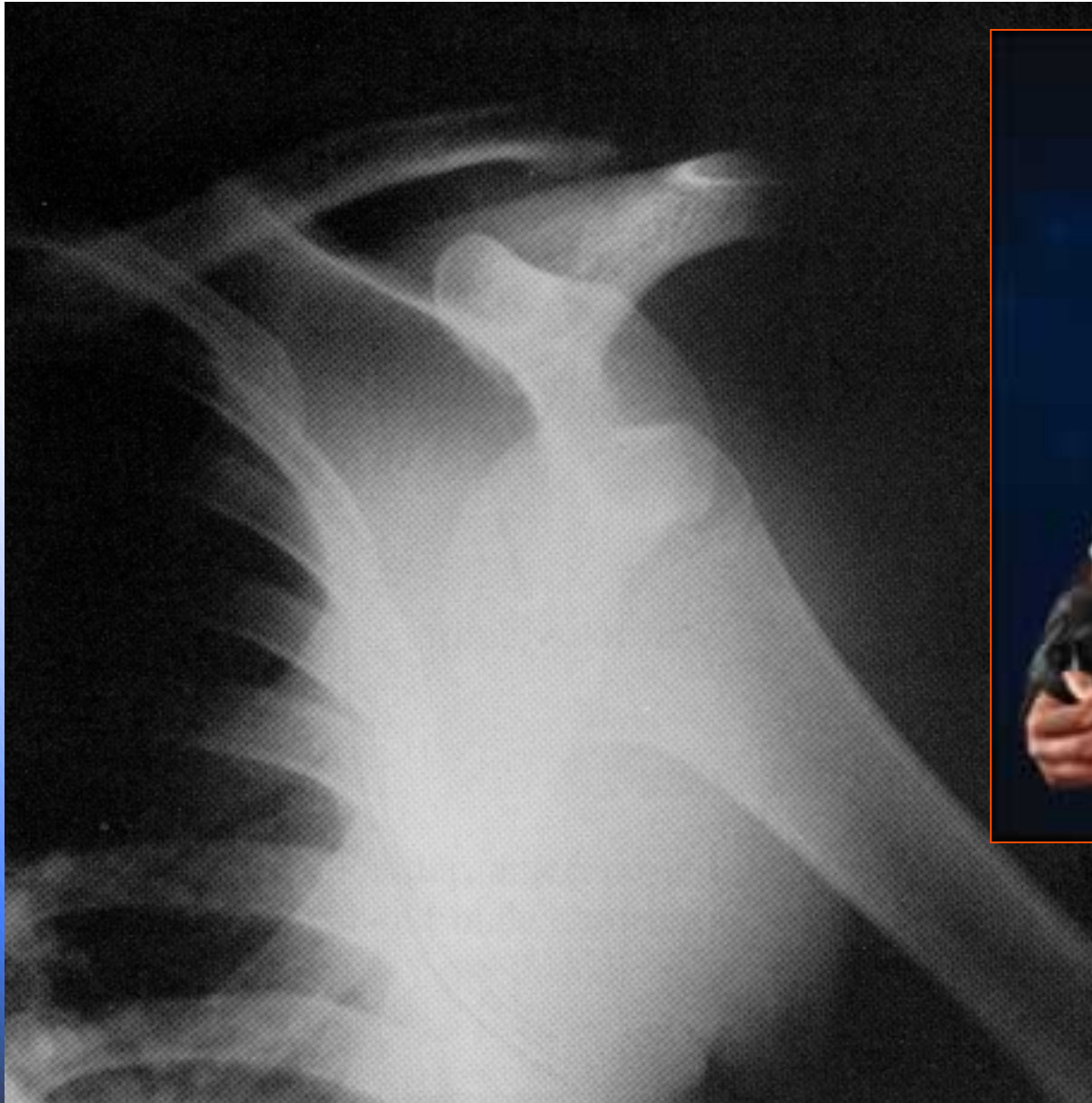
## Hill-Sachs Lesions



Hill-Sachs lesion = a compression fracture of the posterolateral articular surface of the humeral head. Is caused when the humeral head passes over the edge of the anterior glenoid fossa.

It predisposes to recurrent dislocations

# Anterior Shoulder Dislocation (3)



External Rotation for  
Unstable / Recurring  
Dislocations

# Posterior Shoulder Dislocation

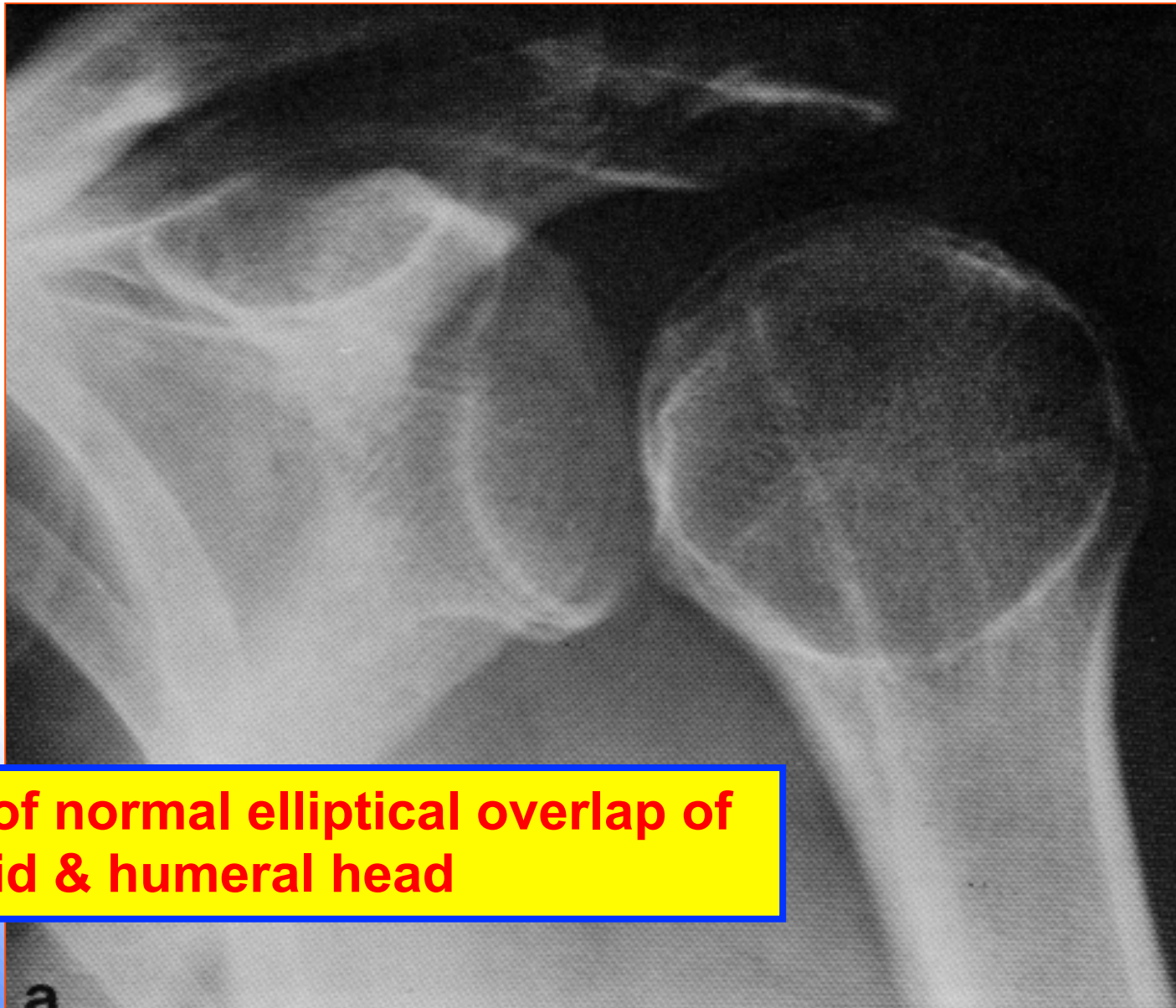
- Direct anterior blow to adducted and internally rotated arm
- Commonly missed on exam (can be bilateral)

**Can result from falls, seizure, electric shock**

- Most common is the humeral head behind the glenoid and beneath the acromion
- Arm is adducted and internally rotated
- The scapular X-ray “Y” view is diagnostic
- Most complications are fractures
- Neurovascular injuries are less common than in anterior dislocation

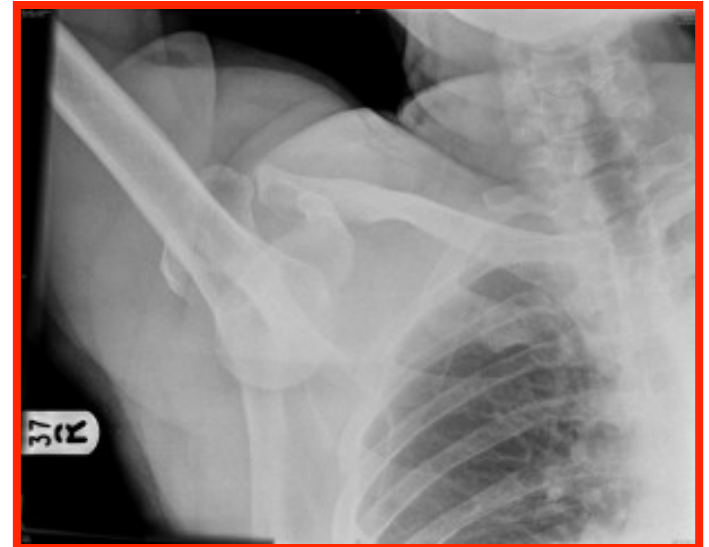


# Rifle Barrel / Light Bulb Signs



# Luxatio Erecta

- Forearm locked over forehead
- Rarest of dislocations
- Forceful hyperabduction
- Treatment: traction up and out
- Severe rotator cuff injuries are the rule
- Scapular rotation STILL works
- Same neurologic injuries



# Clavicle Fracture (1)

- Middle third
  - Most common fracture in children
  - Most involve middle third
  - Treatment: sling
- Distal third
  - Distal can be associated with ruptured coracoclavicular joint with significant medial elevation
  - Treatment: depends on displacement
  - Sling
  - Displaced: ortho referral for ORIF

# Clavicle Fracture (2)

- Medial third
  - Uncommon
  - Requires strong injury forces
  - Diligent search for associated injuries
- Indications for surgery
  - Displaced distal third
  - Open
  - Bilateral
  - Neurovascular injury

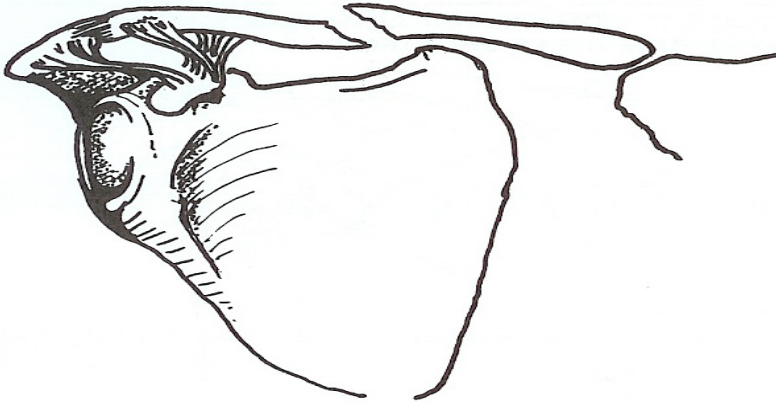
Medial third: consider intrathoracic trauma  
(subclavian artery and vein)



# Clavicle Fracture (3)

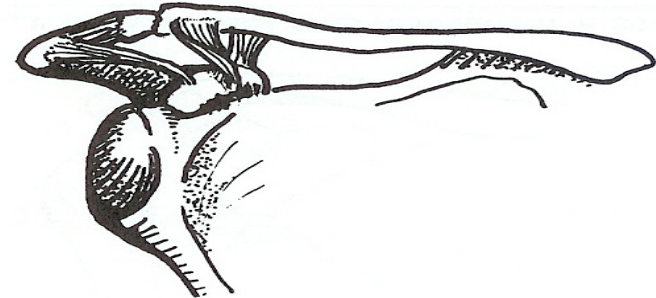
## CLASS A: MIDDLE THIRD FRACTURES (p. 298)

Type II: Displaced in children and in adults

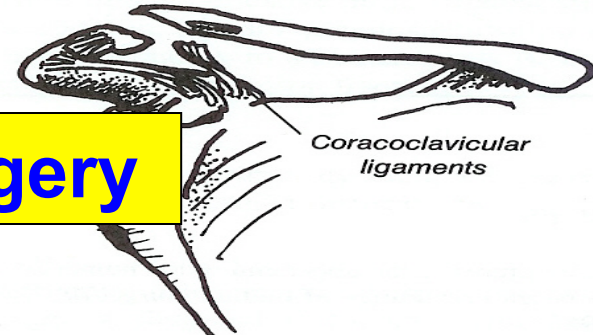


## CLASS B: DISTAL THIRD FRACTURES (p. 301)

Type I: Nondisplaced, with ligaments intact



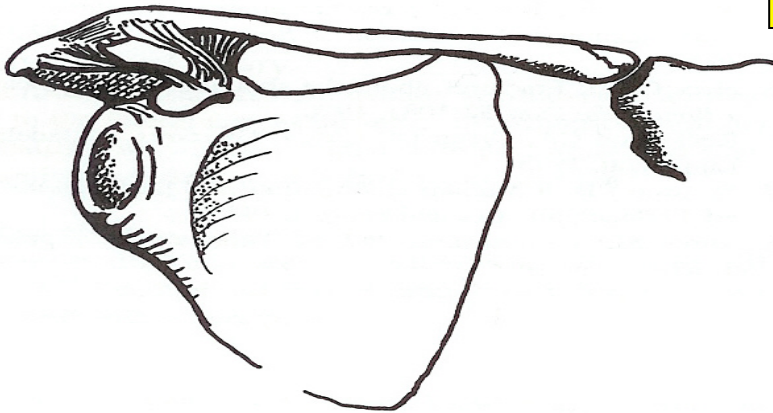
Type II: Displaced, with ligaments ruptured (unstable)



Type III: Articular surface involvement of the acromioclavicular joint



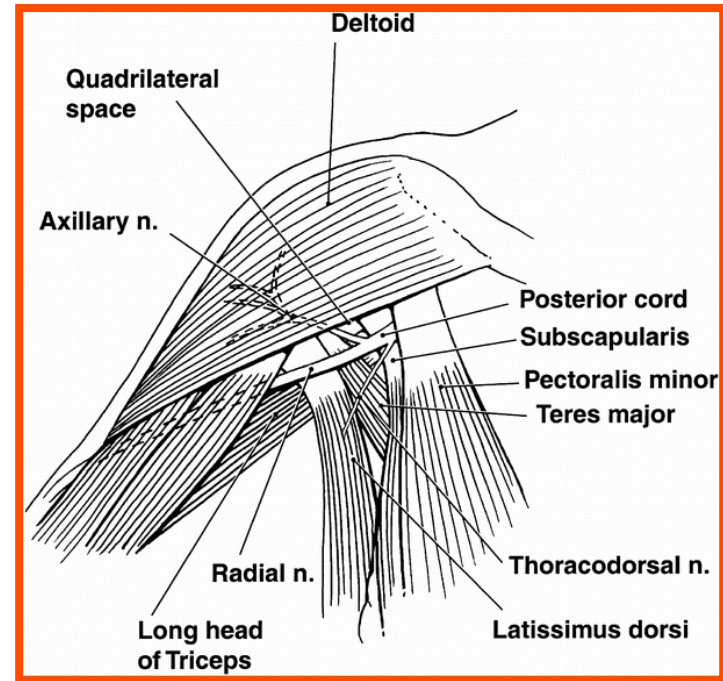
## CLASS C: MEDIAL THIRD FRACTURES (p. 302)



**Surgery**

# Humerus Fracture (1)

- Proximal fracture
  - Injury to axillary nerve
  - Test deltoid sensation
- Midshaft distal fracture
  - Radial nerve injury is common
  - Test wrist drop and 1<sup>st</sup> web space sensation
  - Rule out pathological fracture (e.g. multiple myeloma)





# Humerus Fracture (2)

- Midshaft fracture
- Spiral groove
- Radial nerve
- Wrist drop common
- Often a sling is enough

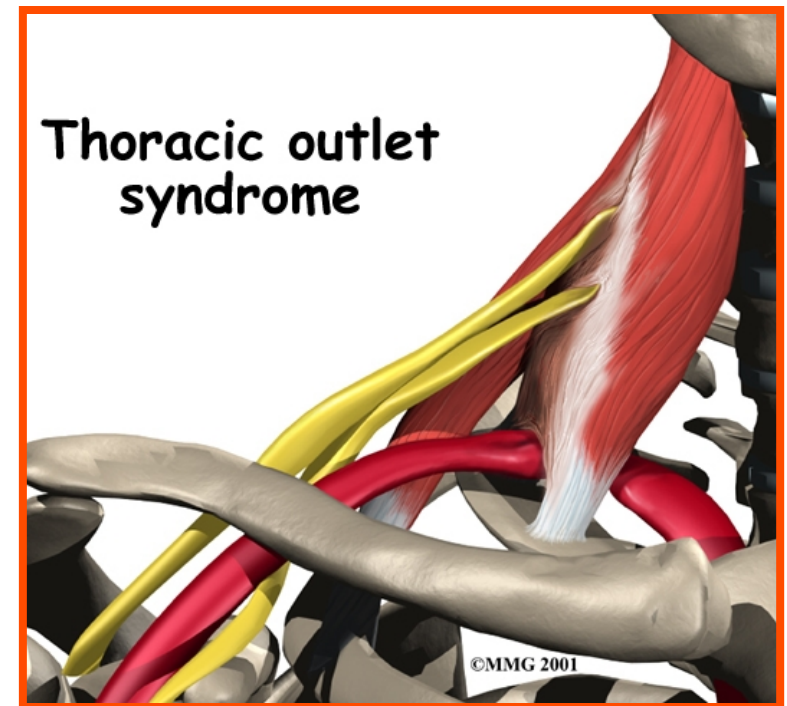


# Rotator Cuff Injuries

- >40 years old
- Associated with muscle weakness and atrophy
- ↓ abduction and external rotation plus cuff tenderness
- Supraspinatus, infraspinatus and teres minor insert on greater tubercle (“SIT” muscles)
- Subscapularis inserts on lesser tubercle
- **Unable to abduct or externally rotate**
- Partial tears are more common
- Supraspinatus is most commonly injured
- MRI is diagnostic

# Thoracic Outlet Syndrome (1)

- Compression of the brachial plexus, subclavian vein or artery as they pass through the thoracic outlet
- Associated with cervical rib
- 3 Types
  - Neurologic
    - Most common
  - Venous
  - Arterial
    - Least common, most serious



# Thoracic Outlet Syndrome (2)

- Most reliable test: elevated arm stress test (EAST)
  - Test for all 3 types of thoracic outlet syndrome: raise hands above head, then open and close fist for 3 minutes
  - Positive test: unable to complete, paresthesias, claudication
- Adson's test: palpate both radial pulses while patient turns head from side to side. Loss of pulse is a positive test (only tests for arterial thoracic outlet syndrome)



# Pelvic Fractures (1)

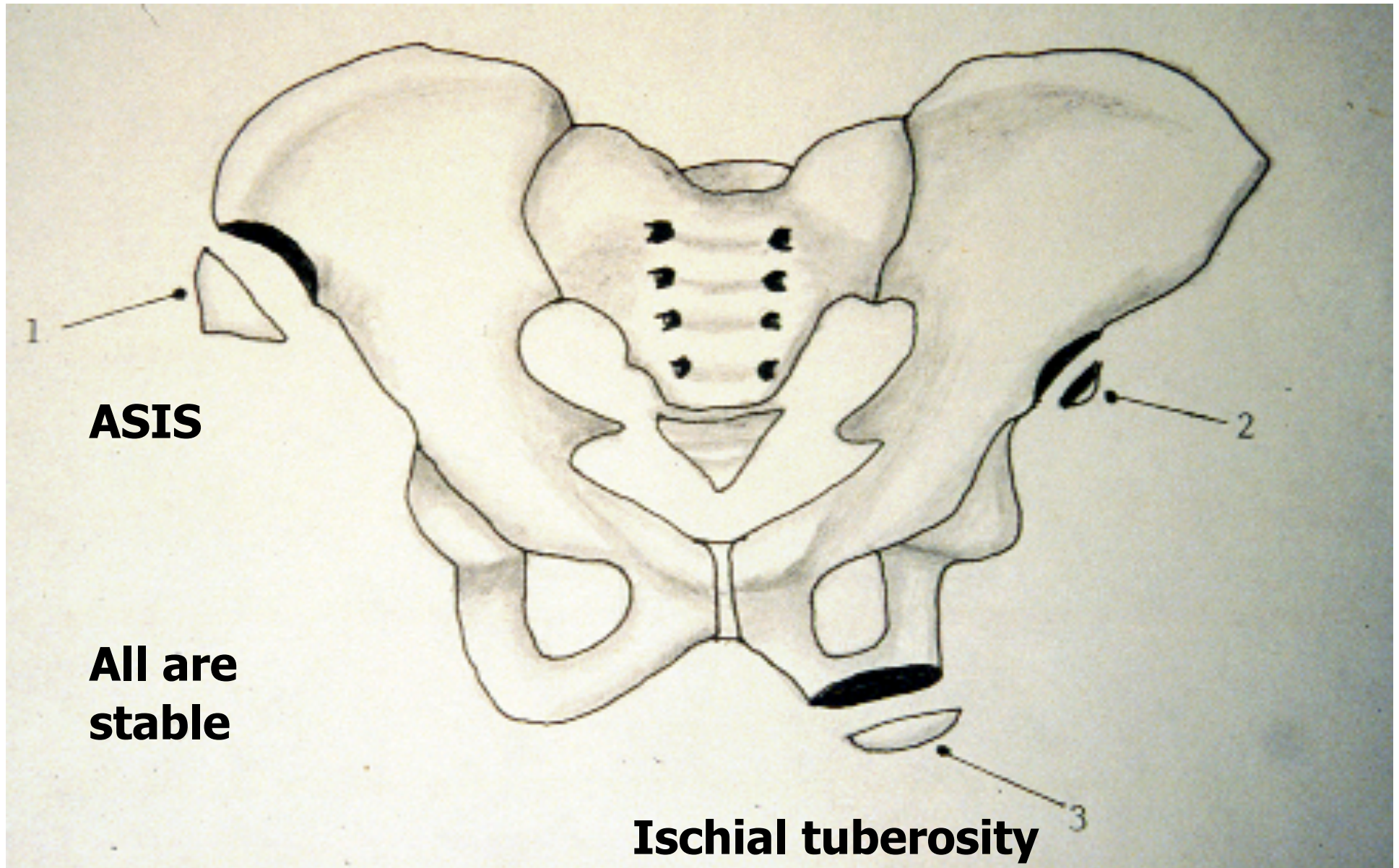
- MVCs and falls
- Type I: avulsion (single bone)
  - Conservative treatment
- Type II: single ring fracture
  - Examples: ipsilateral rami, subluxation of symphysis pubis
  - Rare: look for type III, associated visceral injuries
  - Conservative treatment



# Pelvic Fractures (2)

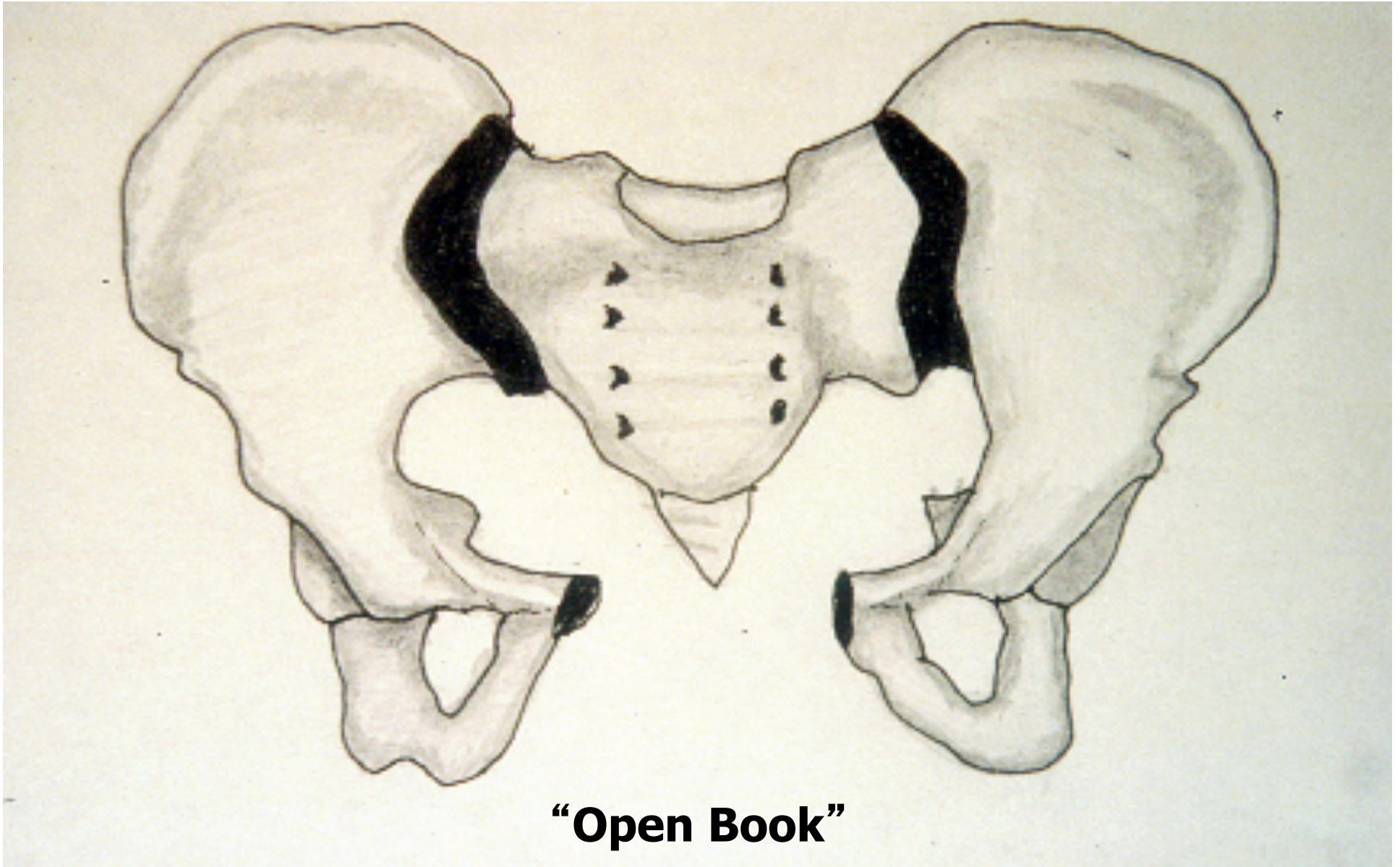
- Type III: double ring fracture
  - Unstable, associated GU and visceral injuries
  - Life-threatening hemorrhage more likely with posterior fractures
  - Immobilization
  - External or internal fixation
  - Early orthopedic consultation
  - Embolization for treatment of hemorrhage
- Type IV: acetabulum fracture
  - High energy (MVC) injuries
  - Displaced fractures require surgery

# Pelvic Avulsion Fracture





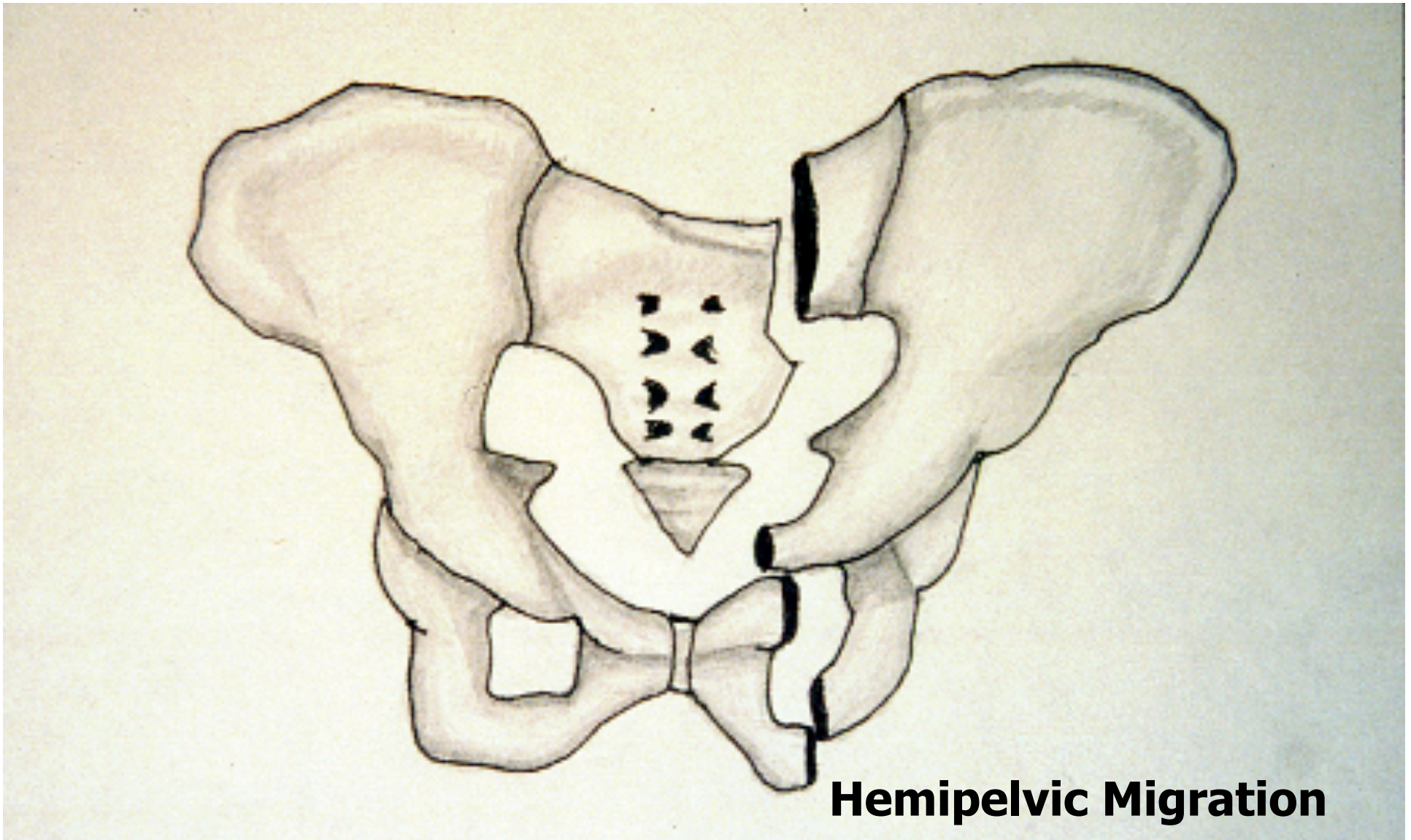
# Pelvic Disruption



**“Open Book”**

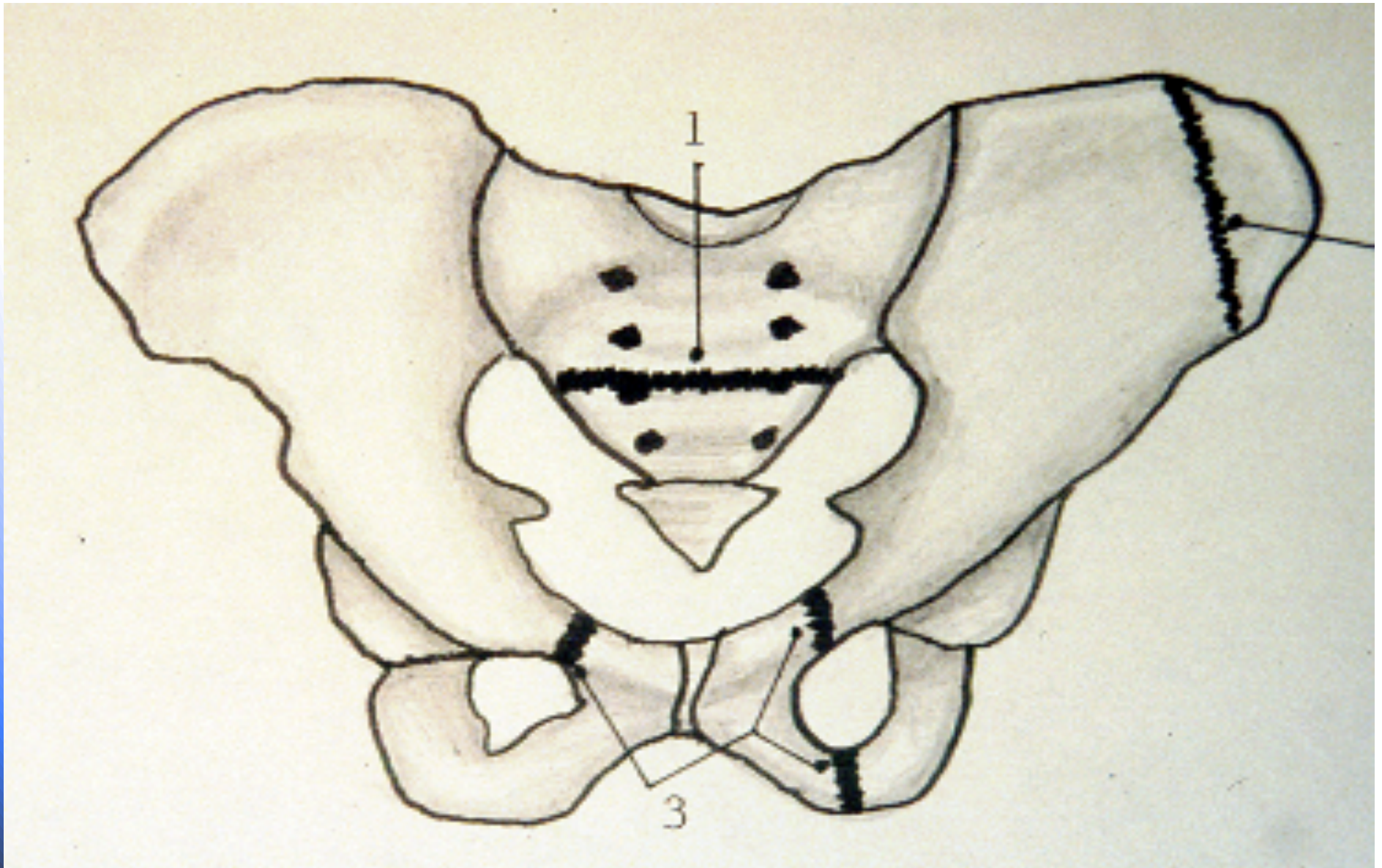


# Malgaigne Disruption

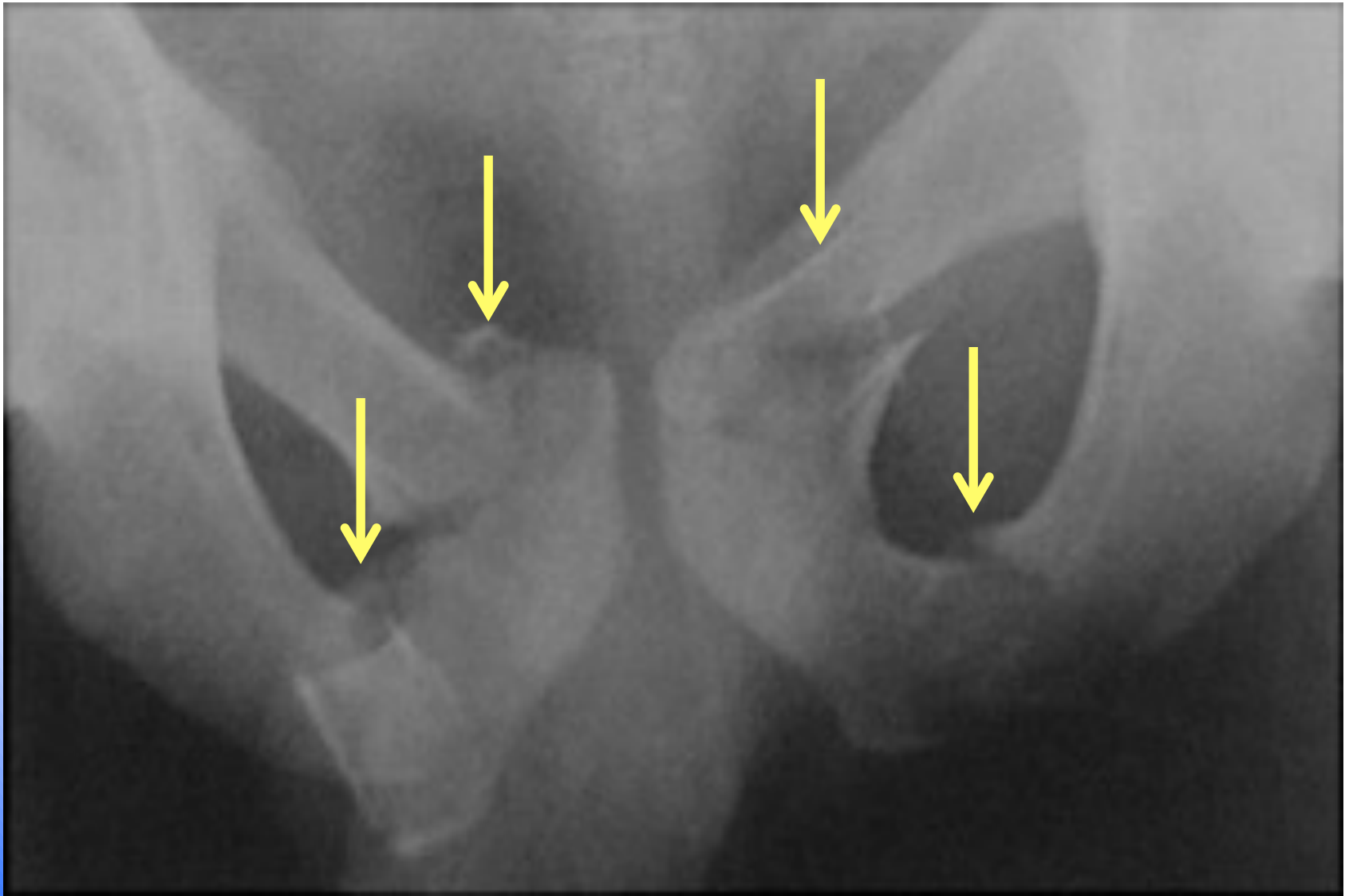




# Stable Pelvic Fractures

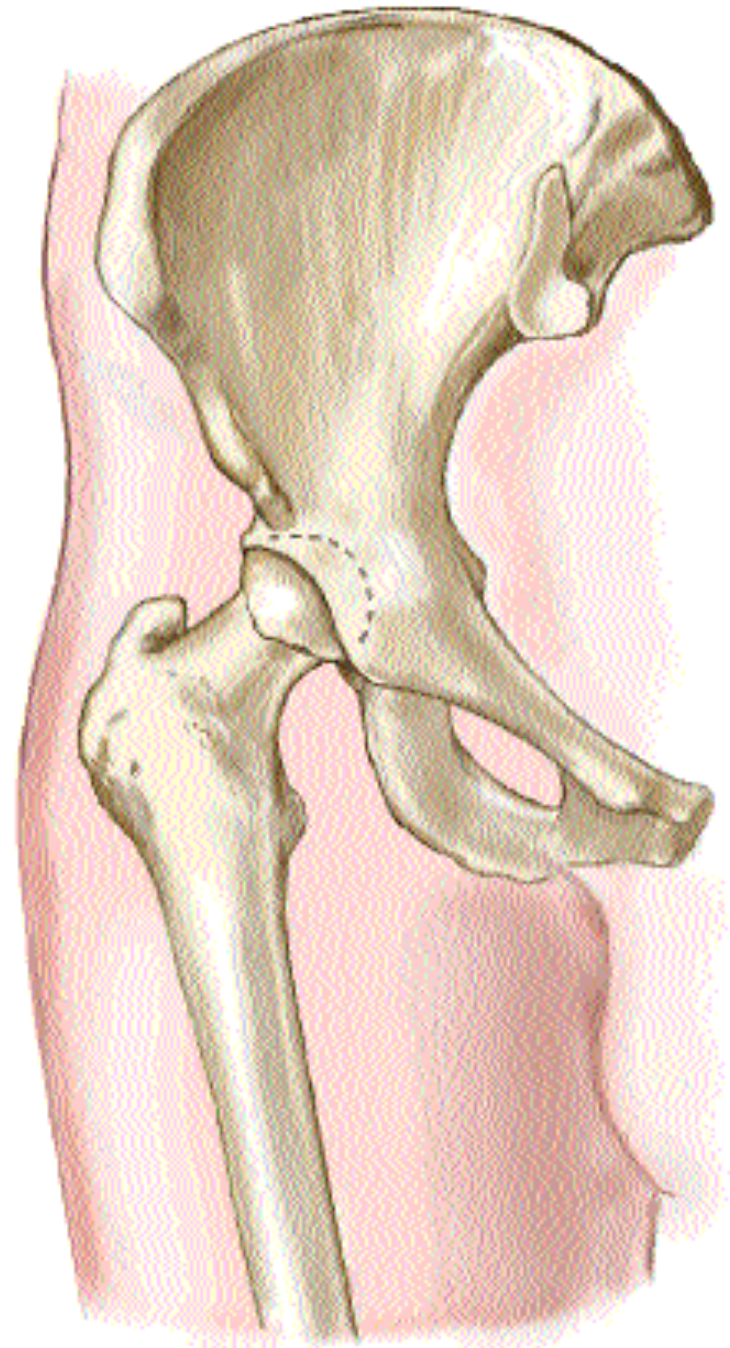


# Straddle Pelvic Fractures





# The Hip



# Hip Fractures

- Symptoms may be subtle (CT, MR when in doubt)
- External rotation, flexion, shortening
- Intertrochanteric fracture most common
- Femoral neck fractures in elderly females
- Subtrochanteric fractures (high energy) in young

**Complication: aseptic necrosis  
(femoral neck fracture)**

## Fractures of the Hip



**Subcapital**



**Transcervical**



**Base Neck**



**Intertrochanteric**



**Peritrochanteric**



**Subtrochanteric**

# Anterior Hip Dislocation

- Uncommon
- Groin mass
- External rotation
- Reduce ASAP

## Posterior Hip Dislocation (1)

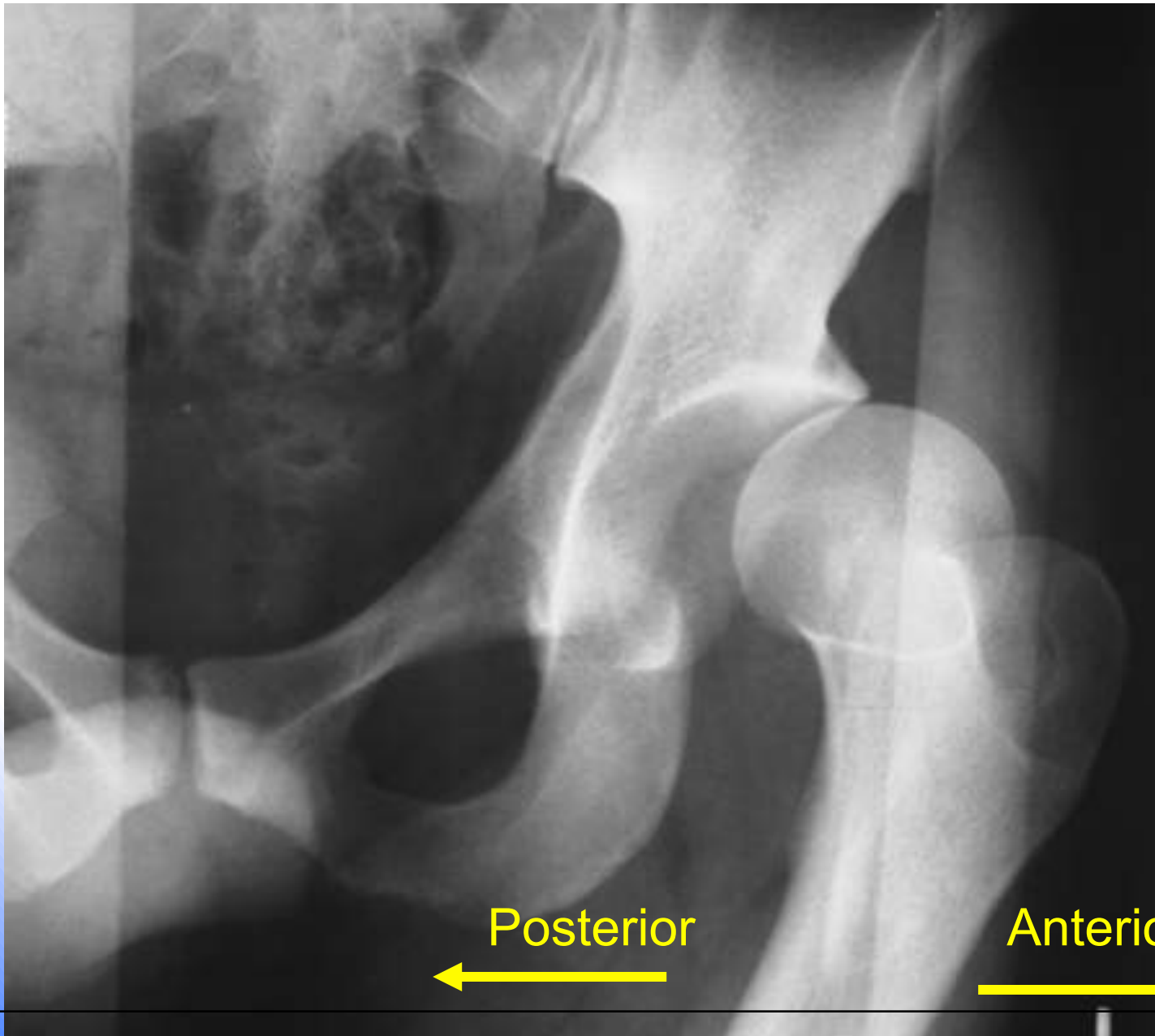
- Most common
- Mechanism: direct force (knee vs. dashboard)
- Internal rotation, flexed, adducted, shortened
- Reduce ASAP
- Complications: sciatic nerve, femoral head



AVN



# Posterior Hip Dislocation (2)





# Posterior Hip Dislocation (3)



# Legg-Calve-Perthes Disease (1)

- Boys, ages 4-8. Presents with limp
- Idiopathic avascular necrosis of the femoral head
- Sometimes bilateral
- X-rays may be normal (consider MRI)
- Bone scan is diagnostic
- Temperature and ESR are normal

**Pain and limp are early signs**

# Legg-Calve-Perthes Disease (2)



# Septic Arthritis

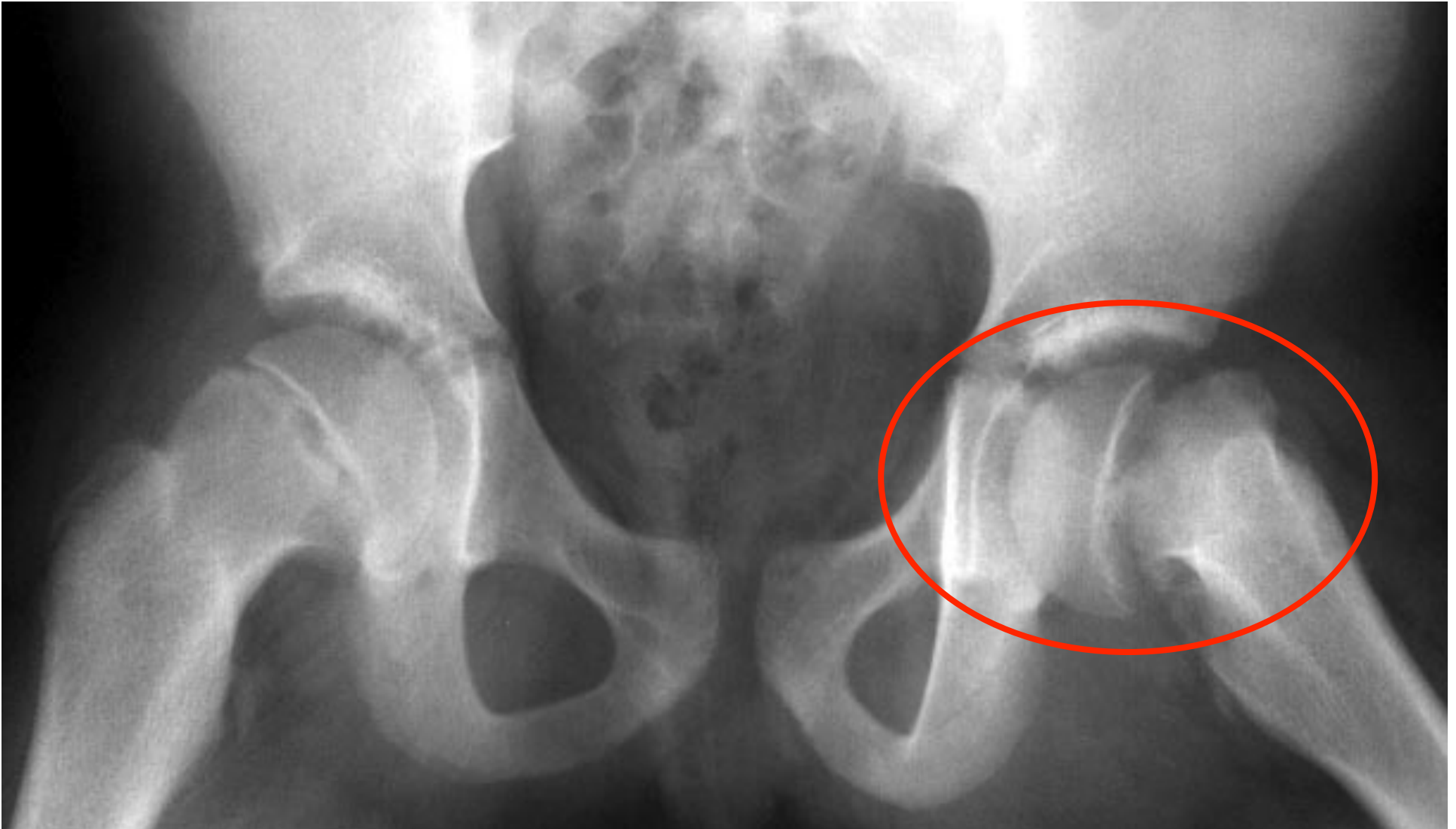
- Most common cause of painful hip in infants
- Hematogenous spread
- *S. aureus* (most common)
- *Salmonella* in sickle cell
- *N. gonorrhoeae* in adolescents
- Dx: needle aspiration

## Slipped Capital Femoral Epiphysis (1)

- Obese male adolescents, ages 10-16
- Etiology is unknown, may be bilateral
- Pain referred to knee, gradual onset
- X-ray “melting ice cream cone”, AP, frog-leg view
- Treatment: ORIF



# Slipped Capital Femoral Epiphysis (2)



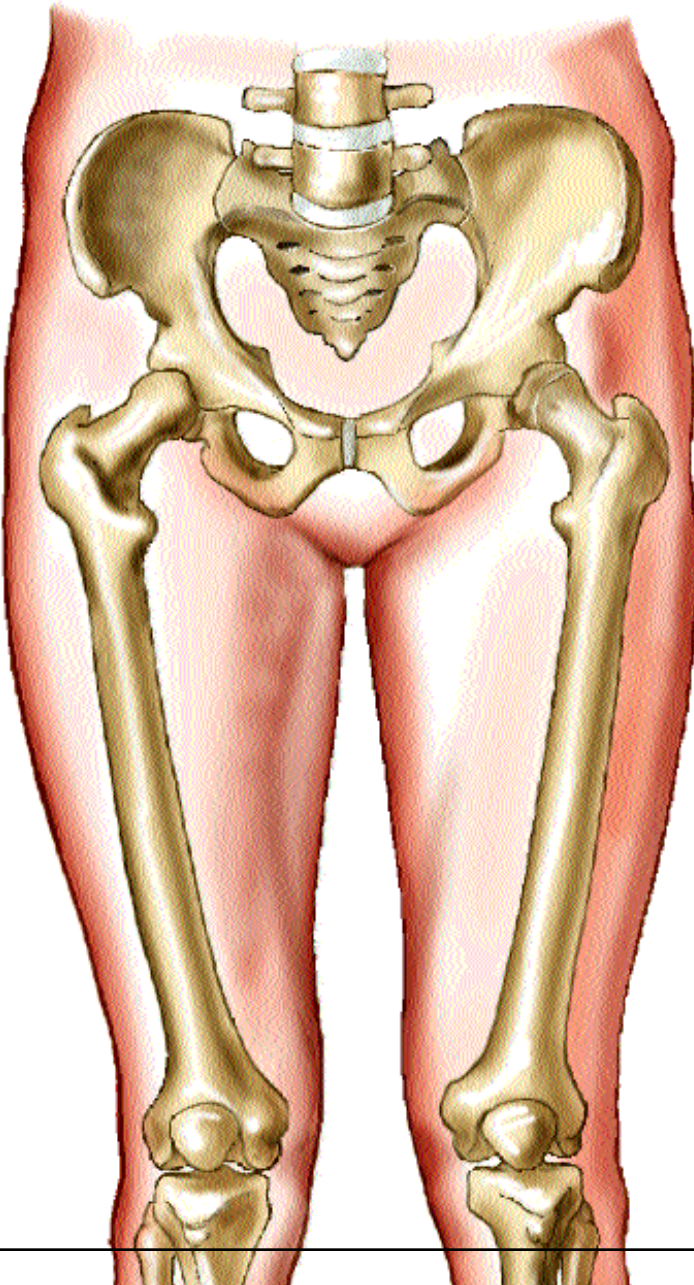


# Transient (Toxic) Synovitis

- Cause is unknown
- Associated with recent viral infection, allergic reactions, trauma
- Limp or inability to bear weight
- May have low grade fever and elevated ESR
- Diagnosis of exclusion (rule out septic hip)
- Treatment: NSAIDs, analgesics, home care

**Most common cause of painful hip in children**

# The Femur



# Femur Fracture (1)

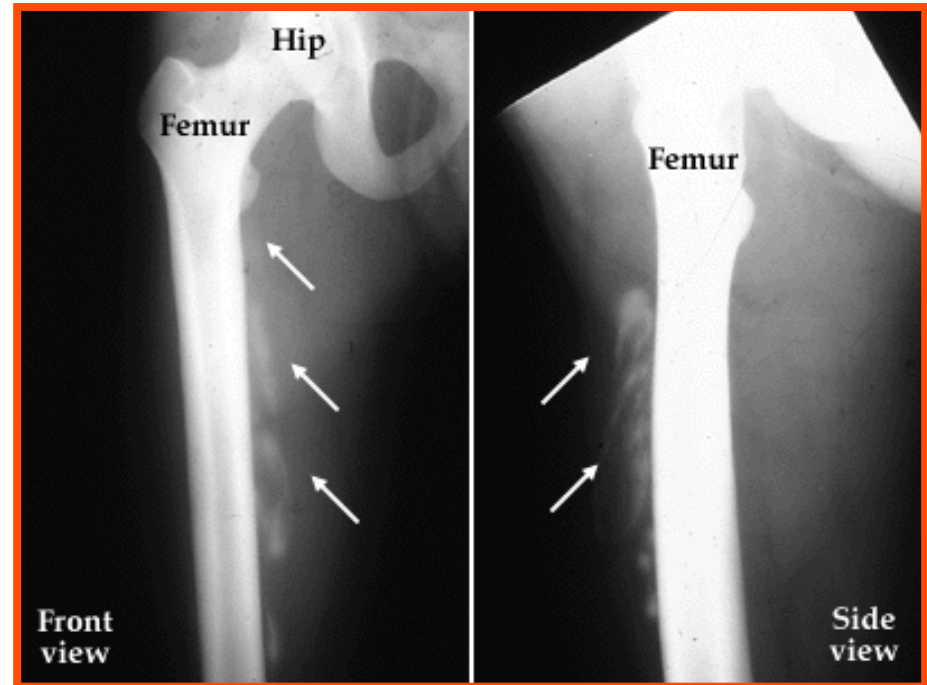
- Males, falls, MVAs
- Severe pain, unable to bear weight
- Complications: hemorrhage, neurovascular injury, fat emboli
- Splint the leg with traction splint
- Treatment: ORIF
- Potential major blood loss





# Traumatic Myositis Ossificans

- Formation of bone in muscle after injury
- Thigh muscles (quads) most common affected
- Increased risk in hemophilia and thrombocytopenia
- Management: no weight bearing, ice, elevation, wrap from foot to groin with knee flexed 90°
- Rest 2-3 days



# The Knee





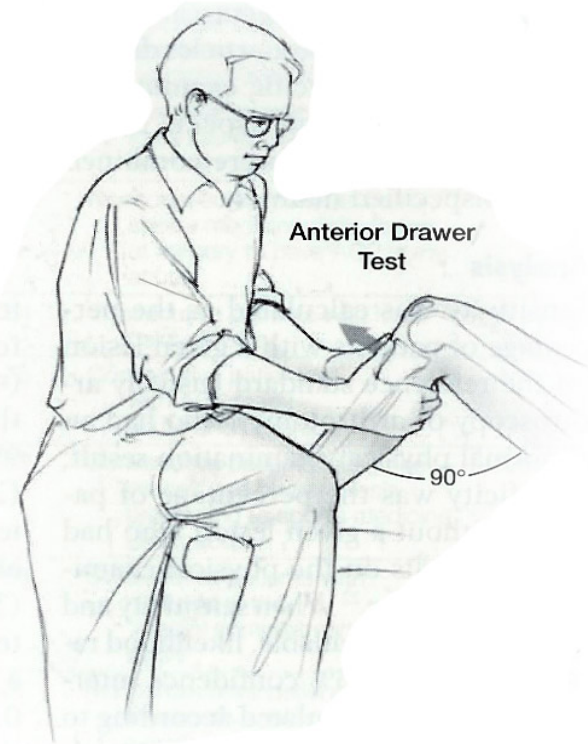
# Soft Tissue Knee Exam (1)

- ACL testing: secondary testing
  - Lateral pivot shift test
    - Valgus stress (pushing the lateral side of the knee medially), while simultaneously flexing the knee and applying internal rotation of the foot
    - A positive test: a “thud” or “jerk” at 10-20 degrees of flexion (anterior subluxation of the tibia on the femur)
- Medial collateral ligament (MCL) testing
  - Perceived widening of the joint space when medial pressure is applied over the lateral aspect of the knee when the calf is stabilized
- Combined disruption of the MCL / PCL
  - Manifest when medial pressure is applied over the lateral aspect of the knee in extension and the joint opens medially

# Soft Tissue Knee Exam (2)

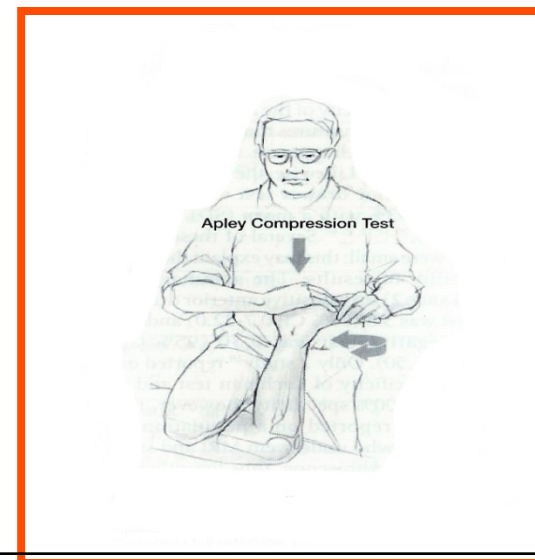
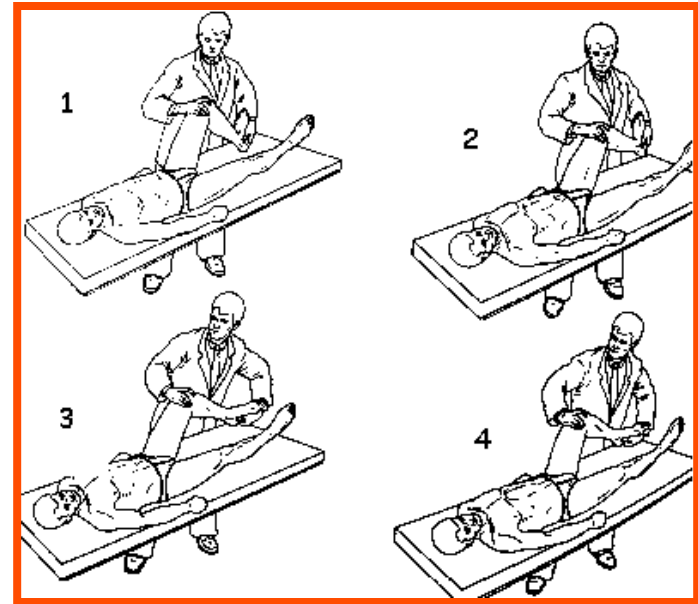


**BEST FOR ACL**

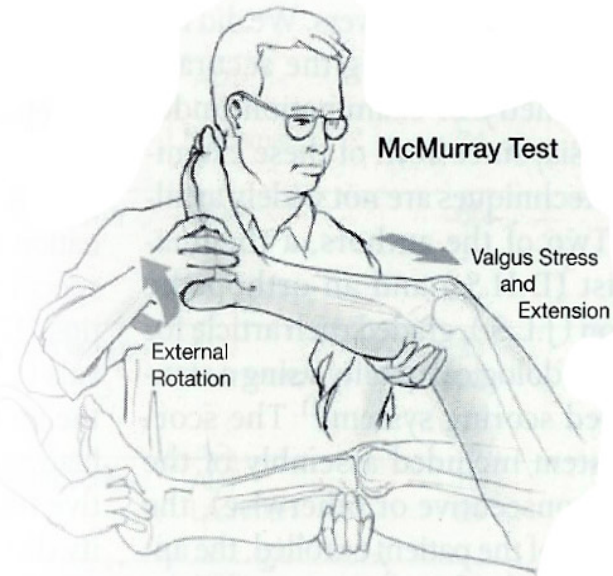
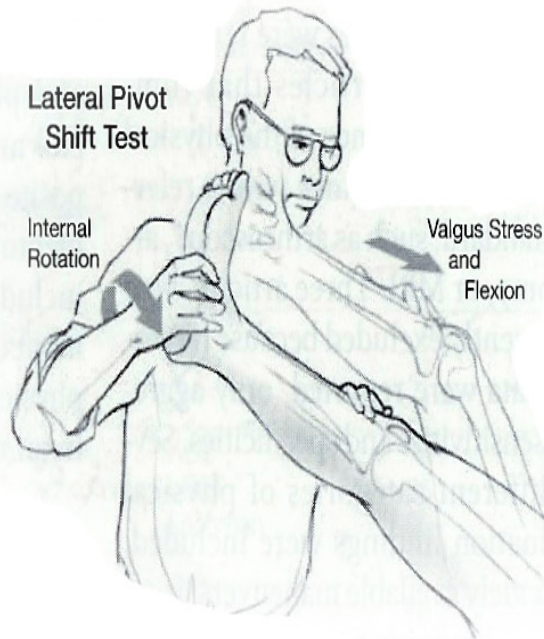


# Soft Tissue Knee Exam (3)

- **McMurray test**
  - Patient supine / examiner grasps heel and internally rotates the leg while applying valgus force on the medial aspect of the knee
  - A positive test is the detection of a “popping” sensation, typically with associated joint line pain, when the knee is fully extended from a flexed position (or locking)
- **Apley compression test**
  - Patient supine on a low table with knee flexed
  - Examiner's shin is on patient's thigh
  - Pain on external rotation of the tibia at the ankle



# Soft Tissue Knee Exam (4)



**MENISCUS**

# The “Terrible Triad”

- Significant force to the lateral aspect of the knee
- Medial collateral ligament tear
- Medial meniscus
- Anterior cruciate (often hear / sense a loud “pop”)
- Joint effusion present in the majority

## Ottawa Knee Rules

- Age 55 or older
- Isolated tenderness of the patella
- Tenderness at the head of the fibula
- Inability to flex to 90 degrees OR inability to bear weight both immediately and in the ED (4 steps) (i.e. inability to transfer weight twice on each lower limb)
- The rules are valid in children as well as adults



## Baker's Cyst

- Inflammation of the gastrocnemius bursa
- Painful, swollen popliteal fossa or calf
- Symptoms may mimic thrombophlebitis
- Dx: arthrogram or ultrasound



## Osgood-Schlatter Disease (1)

- More technical name = patellar tendon apophysitis
- Males 10-15 years, athletics
- Insidious onset, self-limited, traction injury to tibial tuberosity, can be bilateral
- Pain, swelling, erythema over ant. tibial tuberosity
- X-rays may be normal
- Treatment : NSAIDs, rest, avoid forced knee extension

# Osgood-Schlatter Disease (2)

## Tibial Apophysitis



# Osteochondritis Dissecans

- Subchondral fracture
- Cause unknown
- Adolescents, unilateral
- Medial femur most common
- X-ray may be negative
- Talar dome, capitellum
- Locked joint due to loose body



## Patellar Dislocation (1)

- Adolescent females
- Usually displaced laterally
- Reduce by extension and manual medial displacement
- Frequently recur

# Patellar Dislocation (2)



# Posterior Knee Dislocation

- Often reduce spontaneously
- Associated with injury to the popliteal artery
- Peroneal nerve injury common
- Reduce ASAP
- Arteriogram indicated
- Signs of vascular injury initially absent
- Delay of treatment >6-8 hrs high amputation rate





# Quadriceps Tendon Rupture

- Old, debilitated, steroids
- Fall, quadriceps contraction with forced knee flexion, inability to extend knee
- Pain superior to patella
- X-rays can show high-riding patella



# Tibial Plateau Fracture (1)

- Axial compression and rotation
  - Fall from height
  - Auto vs pedestrian
    - Bumper vs. knee
- CT may be helpful
- ORIF generally needed
- Associated injuries
  - Neurovascular injury with unstable fracture (acute or delayed)
  - Lateral fractures: rule out deep peroneal nerve injury (check first dorsal web space)



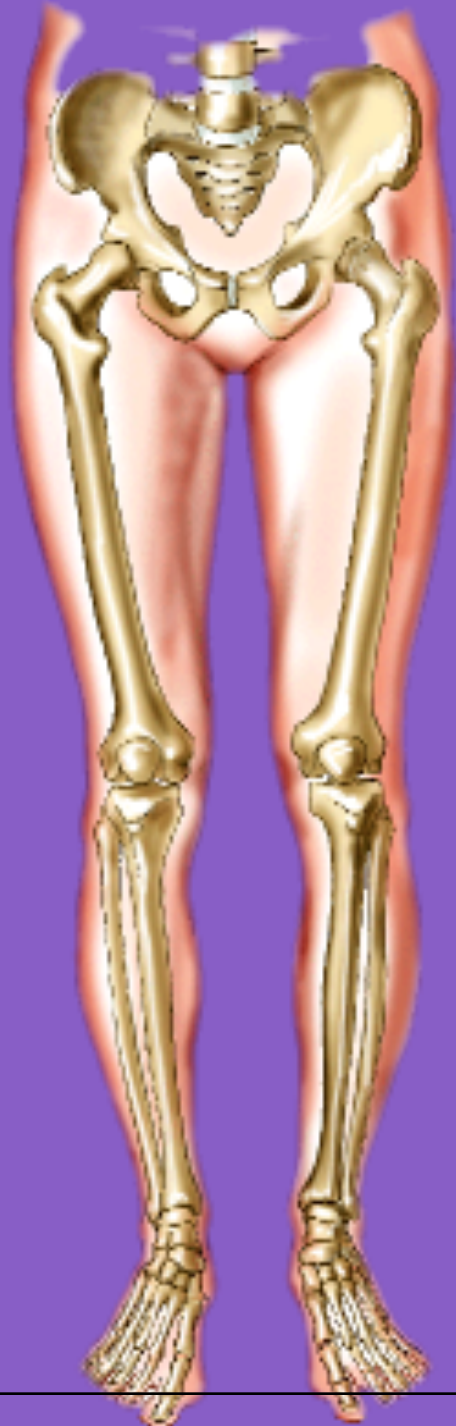
# Tibial Plateau Fracture (2)





# Tibial Plateau Fracture (3)





# The Leg



# Compartment Syndrome

- Crush injury
- Fractures: distal radius, proximal tibial shaft
- Prolonged compression
- High pressure injection injury
- Bleeding, infection, infiltration
- Bleeding disorders, anticoagulants
- Pain, pallor, paresthesia, paralysis, pulselessness (5 “P”s)
- Injury >30 mm Hg
- Indication for surgery: 40-50 mm Hg
- Irreversible damage 4-6 hours
- Treatment: fasciotomy

Most common: anterior tibial compartment secondary to tibial fracture

The earliest symptom is pain

# Gastrocnemius Rupture

- Forceful dorsiflexion with fall
- Athletic “push off” injury (tennis leg)
- Medial head most commonly injured
- Thompson’s sign negative (calf squeeze causes plantar flexion to occur and indicates Achilles is intact)
- Differential: Baker’s cyst, DVT



# The Ankle

# Achilles Tendon Rupture

- Diagnosis often delayed
- Middle aged men and basketball on ciprofloxacin....
- Sudden pain, “kicked in back of ankle,” feeling or hearing a “pop”
- Inability to palpate tendon or defect noted, bulge or knot palpated at proximal portion of tendon
- **Thompson test positive** (failure of the foot to plantar flex with calf compression)



# Ankle Dislocation

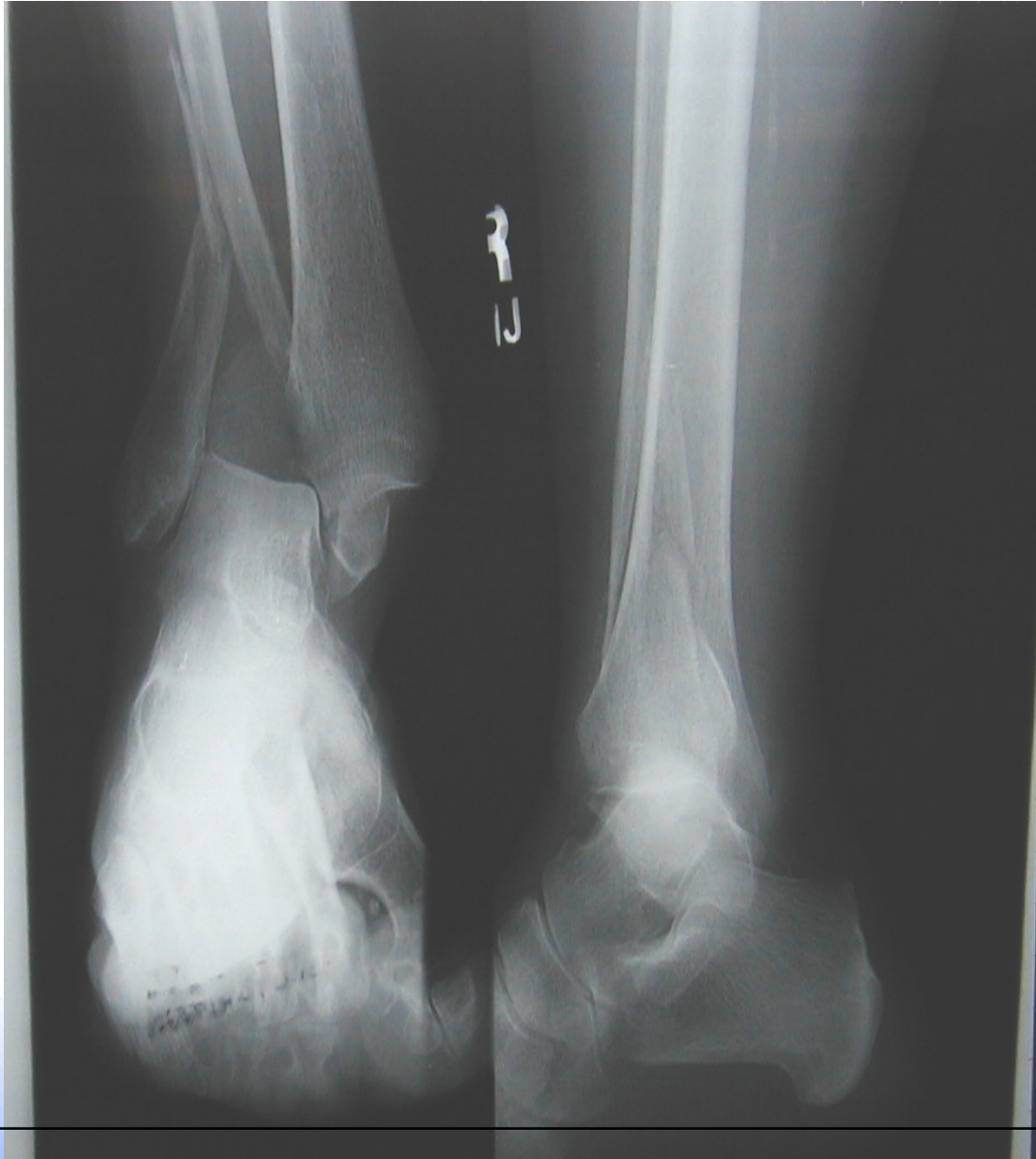
- Dislocation in four planes
  - Anterior
  - Posterior (most common)
  - Lateral
  - Upward displacement of talus (impaction)
- Associated with malleolar fractures
- May be open
- Reduce emergently
- High incidence of complications
  - Neurovascular compromise
  - Conversion of closed to open
  - Avascular necrosis



# Ankle Dislocation



# Ankle Dislocation

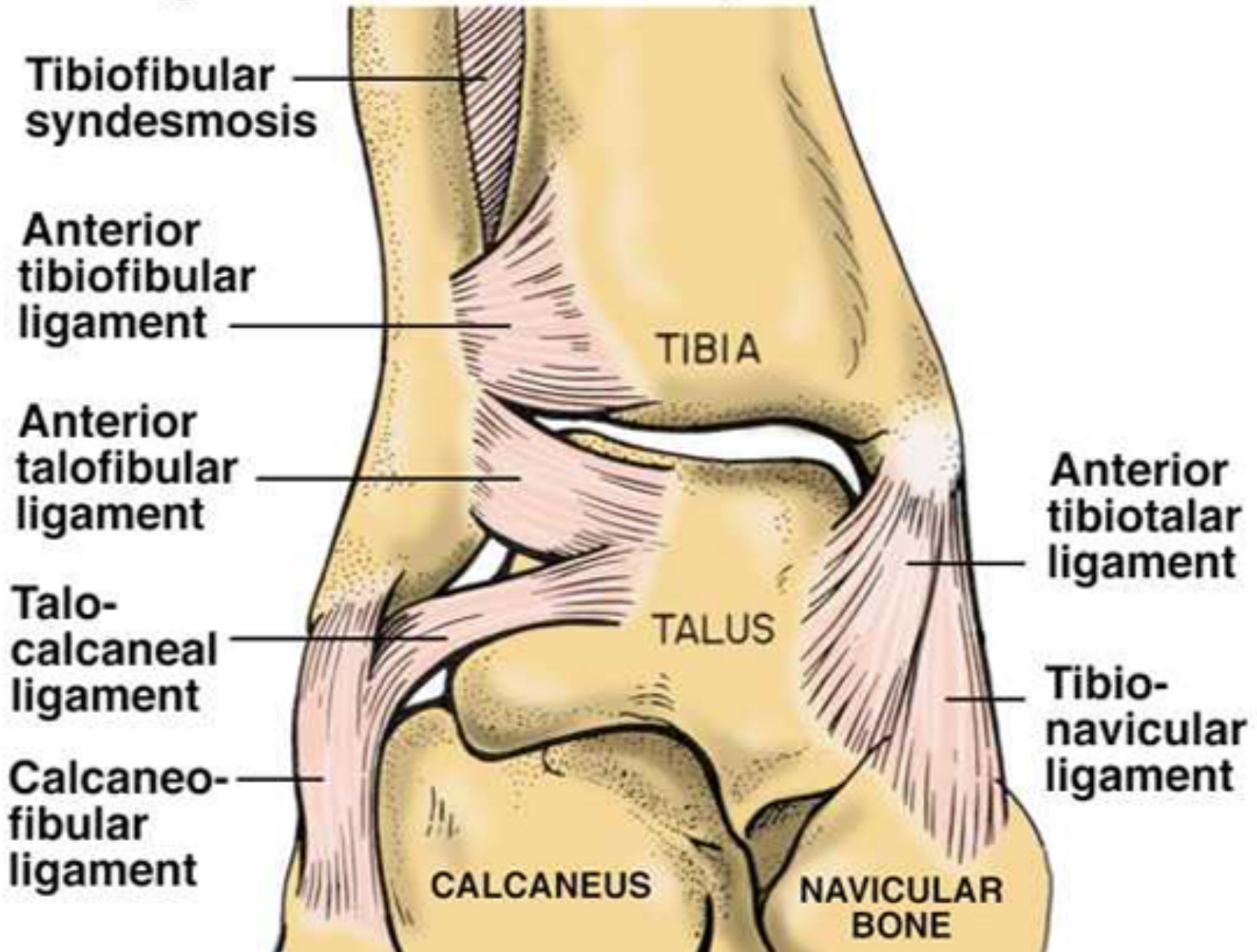


# Ankle Sprains

- Most involve the lateral ligaments
  - Anterior talofibular
  - Calcaneofibular
  - Posterior talofibular
- Most injuries are plantar flexion or inversion
- Deltoid ligament is medial. Isolated injury rare
- Treatment depends upon stability
  - Unstable: splint, early orthopaedic referral
  - Stable: rest, ice, compression and elevation



## Ligaments of the Ankle, Anterior View



# Ottawa Ankle Rules

- Simple guidelines to identify patients with ankle or midfoot injury who do not need X-ray
- Validated by numerous clinical studies
- Ankle X-rays are indicated if any of the following are present
  - Inability to bear weight (both immediately and in the emergency department),
  - Bone tenderness along the posterior edge of the distal 6 cm of either the lateral or medial malleolus
  - Point tenderness over the proximal base of the 5th metatarsal
  - Point tenderness over the navicular bone

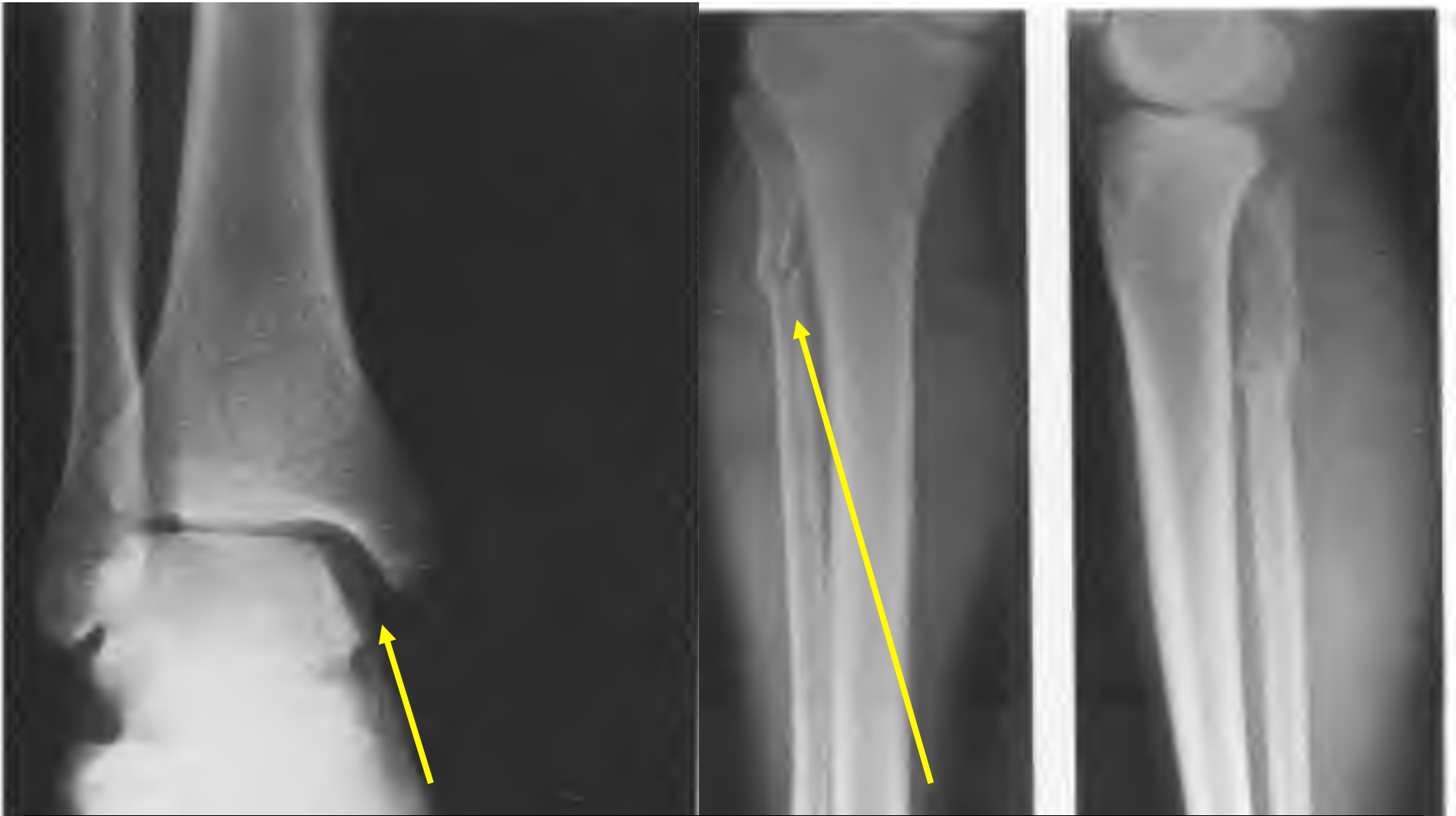


# Maisonneuve Fracture (1)

- External rotation of the ankle causing
  - Rupture of medial ligament complex (deltoid ligament)
  - Associated proximal fibular fracture
- May require surgery
- Missed on ankle X-ray

**Medial ankle tenderness & swelling:  
consider Maisonneuve fracture**

# Maisonneuve Fracture (2)



**Lateral mortise displacement + proximal fibular fracture**



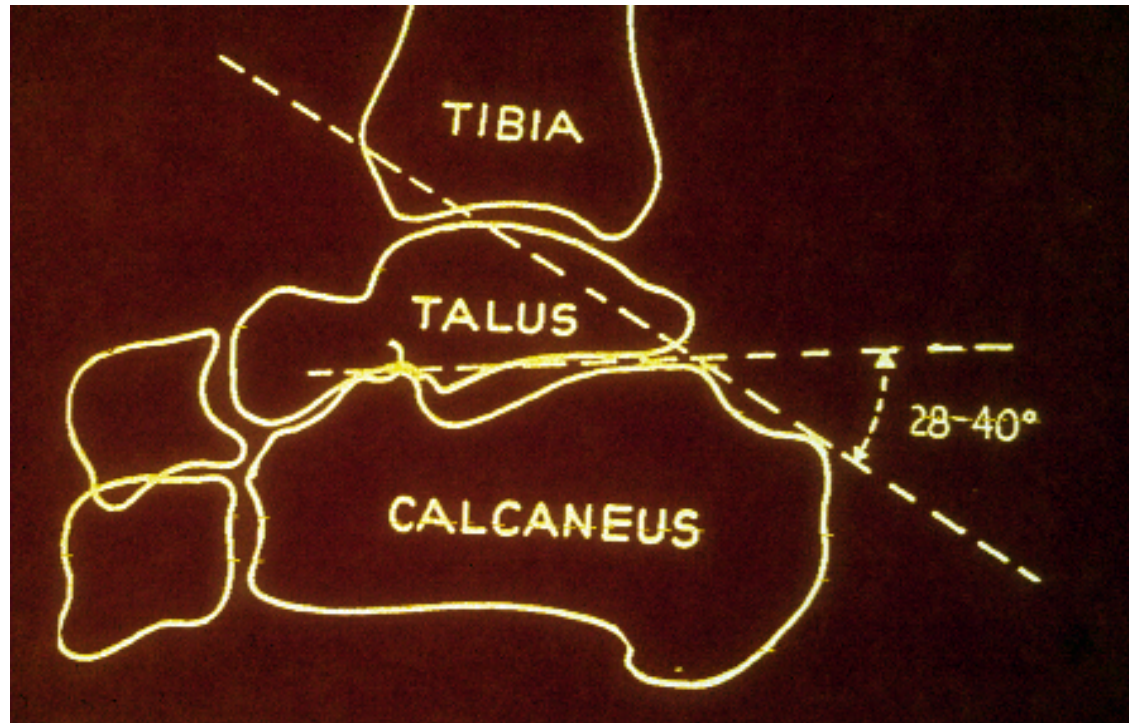
# The Foot



# Calcaneal Fracture

- Mechanism: compression from fall
- Associated with
  - Lumbosacral fractures
  - Injury to the other calcaneus
  - Other extremity injuries
  - GU, renal injuries
- Most common tarsal bone fracture
- **Bohler's angle** (normally 20-40°) may be decreased with fracture
- CT may be indicated
- Harris view (axial view) is diagnostic X-ray

# Bohler's Angle Diagram



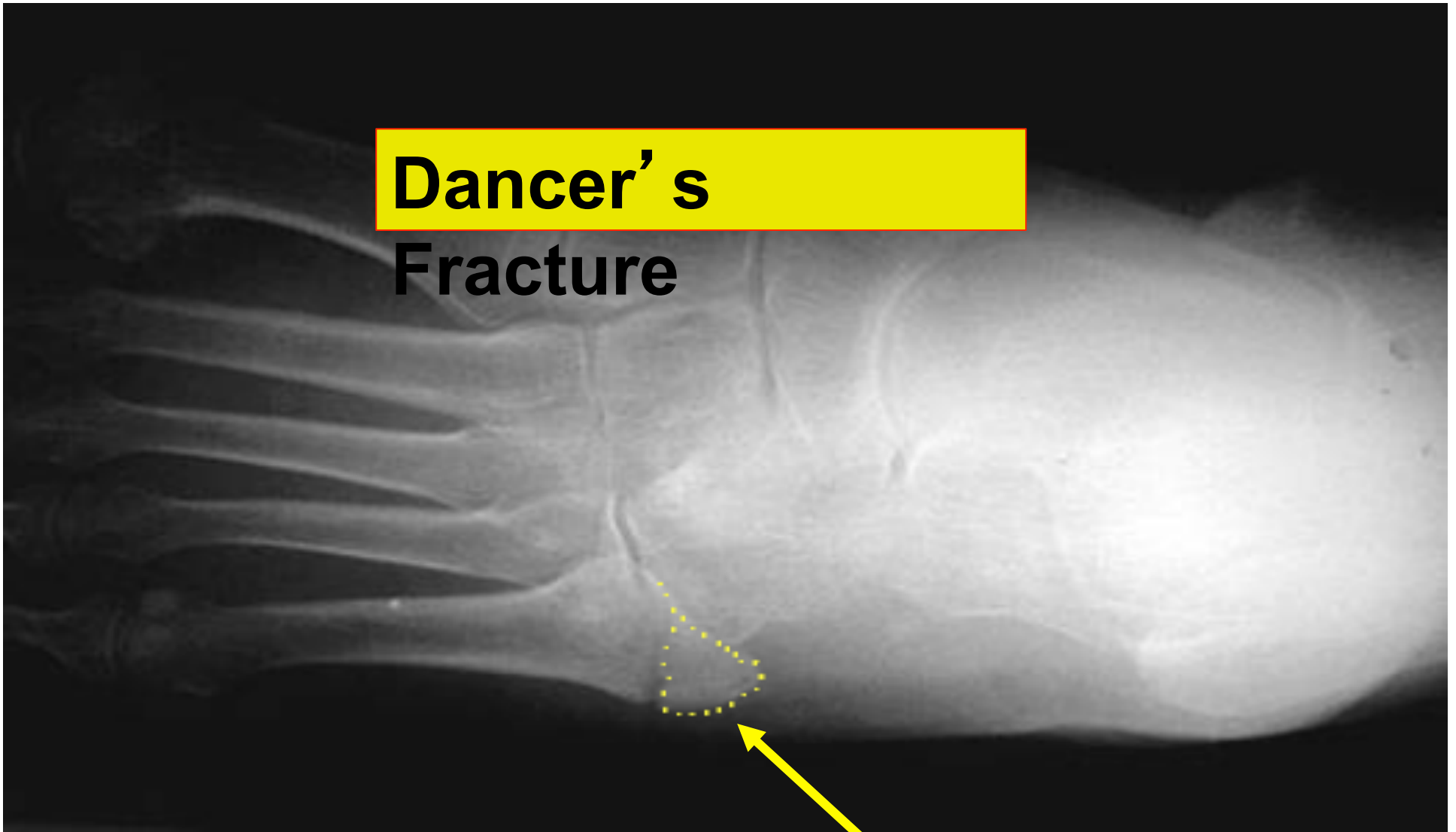


# Fifth Metatarsal Fracture (1)

- Dancer's
  - Avulsion fracture base of 5<sup>th</sup> metatarsal
  - At attachment of peroneus brevis
  - Inversion injury
  - Cast shoe only
- Jones'
  - Transverse fracture
  - Proximal diaphysis
  - Common in athletes
    - Running or jumping sports
  - Increased incidence nonunion
  - ORIF or cast

# Fifth Metatarsal Fracture (2)

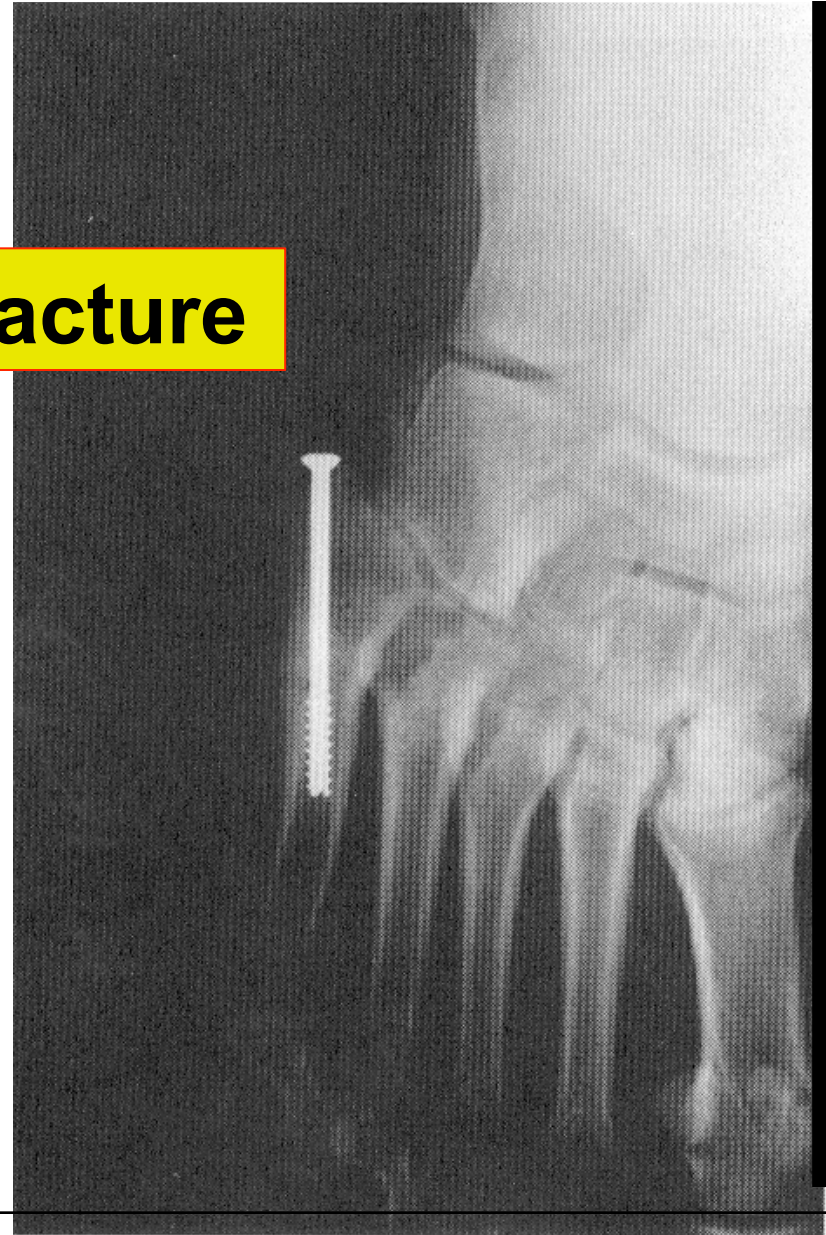
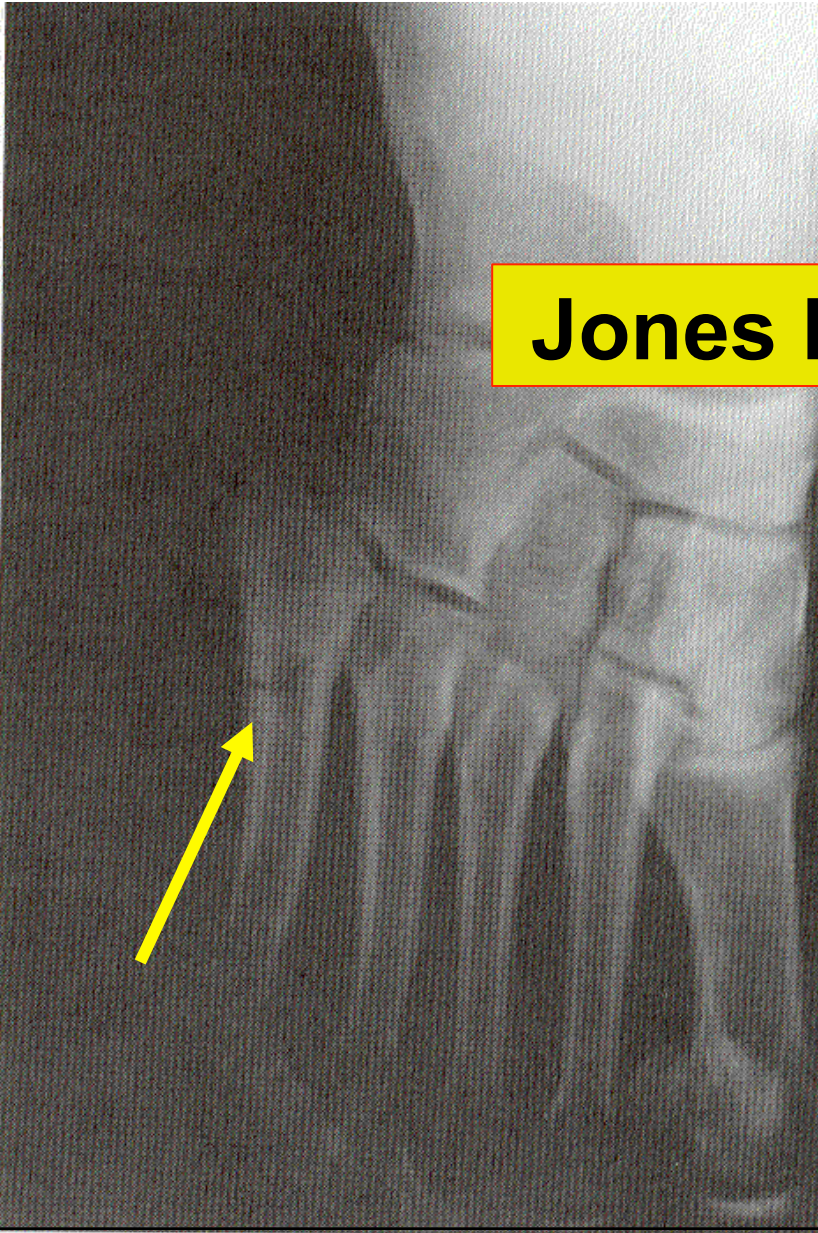
**Dancer's  
Fracture**





# Fifth Metatarsal Fracture (3)

**Jones Fracture**

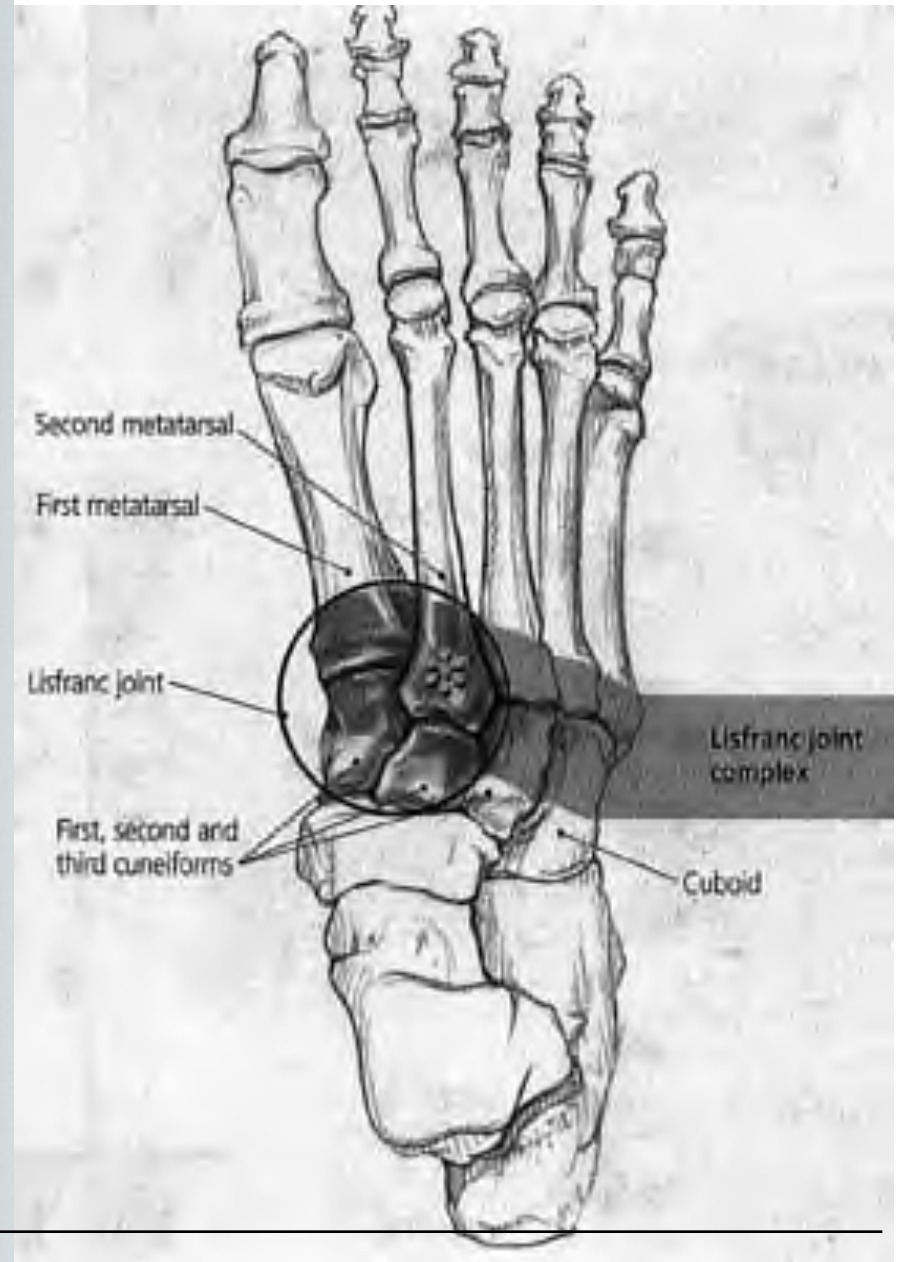


# Lisfranc's Fracture Dislocation (1)

- Tarsal-metatarsal joint
  - Metatarsal base fracture
  - Metatarsal dislocation
- Delay in diagnosis associated with long-term morbidity
- Usually 2° MVA
- Second metatarsal is critical for stability of the midfoot (both transverse and longitudinal arches)
- May require ORIF



# Lisfranc's Fracture Dislocation (2)





# Tarsal Tunnel Syndrome

- Entrapment neuropathy
- Posterior tibial nerve (motor to foot muscles and sensation to the bottom of the foot)
- Nocturnal pain is common
- Tinel's sign: tap on nerve → paresthesias
- Complication: “claw toe”



# Other Foot Facts

- March fracture: stress fracture of the second metatarsal, from pushing off
- Morton's neuroma: interdigital nerve neuropathy
- Metatarsalgia: pain, usually in obese female with recent weight gain
- Plantar fasciitis: sole pain (particularly painful with first steps or arising in the morning)
- Sever's disease: apophysitis at Achilles tendon insertion

# Bone and Joint Infections

- Neonates: group B Streptococcus
- IVDA: Pseudomonas osteomyelitis
- Sickle cell: Gram negative osteomyelitis, Salmonella
- Foot puncture wounds: Pseudomonas
- Cat bites: Pasteurella multocida
- Fresh water wounds: Aeromonas
- Diabetic foot: polymicrobial
- Human bites: Eikenella corrodens, Staph,  
Strep, anaerobes
- Reptile bites: Salmonella

# Osteomyelitis (1)

- Trauma is common precipitating event

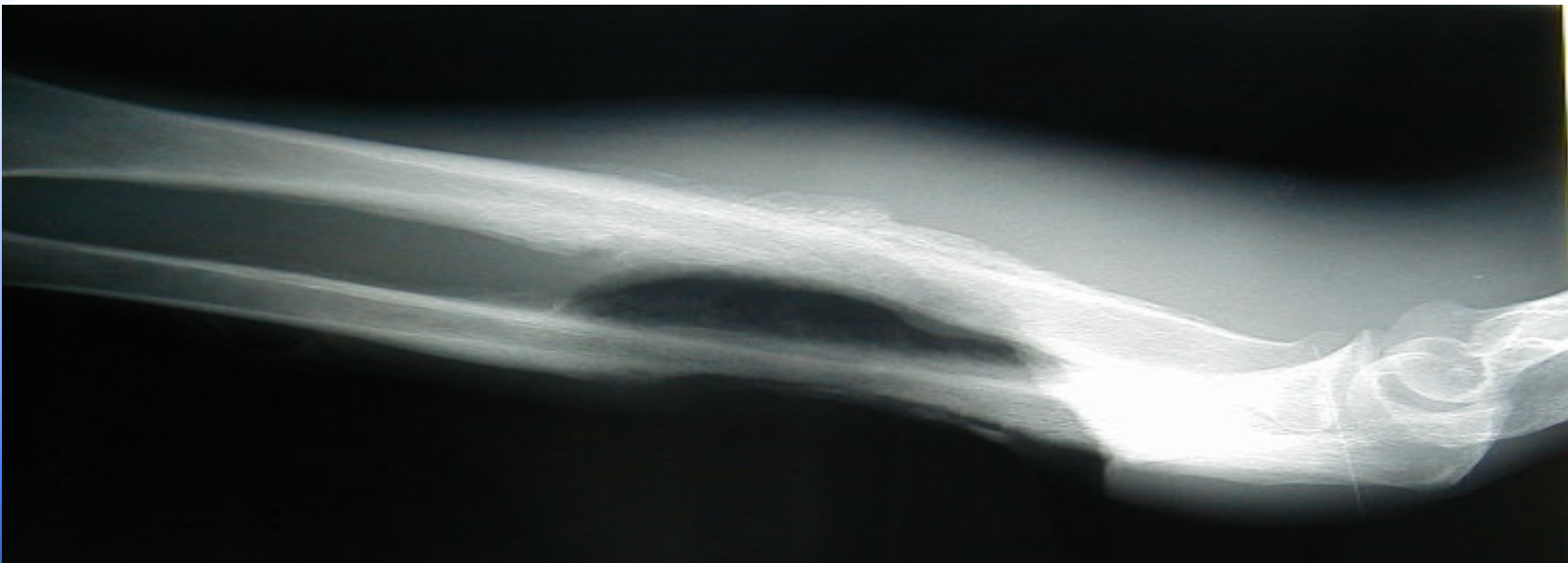
**Early diagnosis: bone scan**

- ESR usually elevated
- Plain X-ray not helpful early in disease
- Femur and tibia common sites

## Osteogenesis Imperfecta

- Children: blue sclerae, flaccid joints
- Frequent fractures, growth retardation
- Misdiagnosed as child abuse
- Fractures usually stop after adolescence

# Osteomyelitis (2)







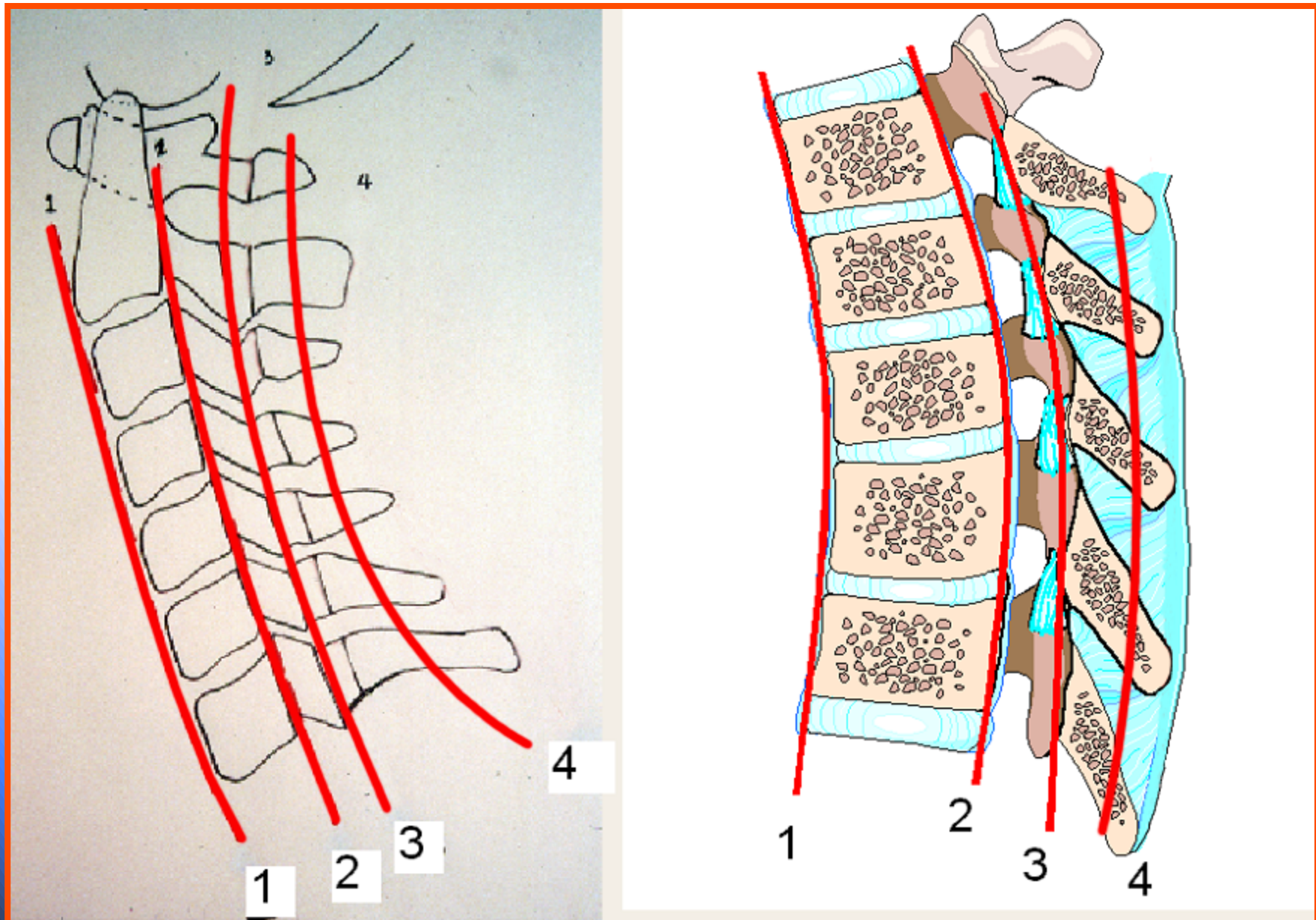
# The Spine

# Anatomy

- 4 lines
  - Anterior longitudinal
  - Posterior longitudinal
  - Spinolaminar
  - Spinous process
- Predental space
  - Adults <3 mm
  - Peds <5 mm
- Prevertebral space
  - 6 mm @ C2
  - 22 mm @ C6



# 4 Lines of C-Spine



# Nerve Roots in the Arm

ROOT	REFLEX DECREASED	SENSORY LOSS	MOTOR WEAKNESS
C5	Biceps	Deltoid area	Deltoid (abduction) Biceps (elbow flexion)
C6	Biceps Brachioradialis	Thumb and index	Biceps (elbow flexion) Wrist extensors
C7	Triceps	Long finger	Triceps (elbow extension)
C8		Little finger	Finger adduction
T1		Medial arm	Finger abduction

# Nerve Roots in Leg

ROOT	REFLEX DECREASED	SENSORY LOSS	MOTOR WEAKNESS
L4	Knee jerk	Knee, medial leg	Knee extension
L5		Dorsum foot, big toe	Foot dorsiflexion
S1	Ankle jerk	Lateral foot, sole	Foot plantar flexion



# C-Spine Injury (1)

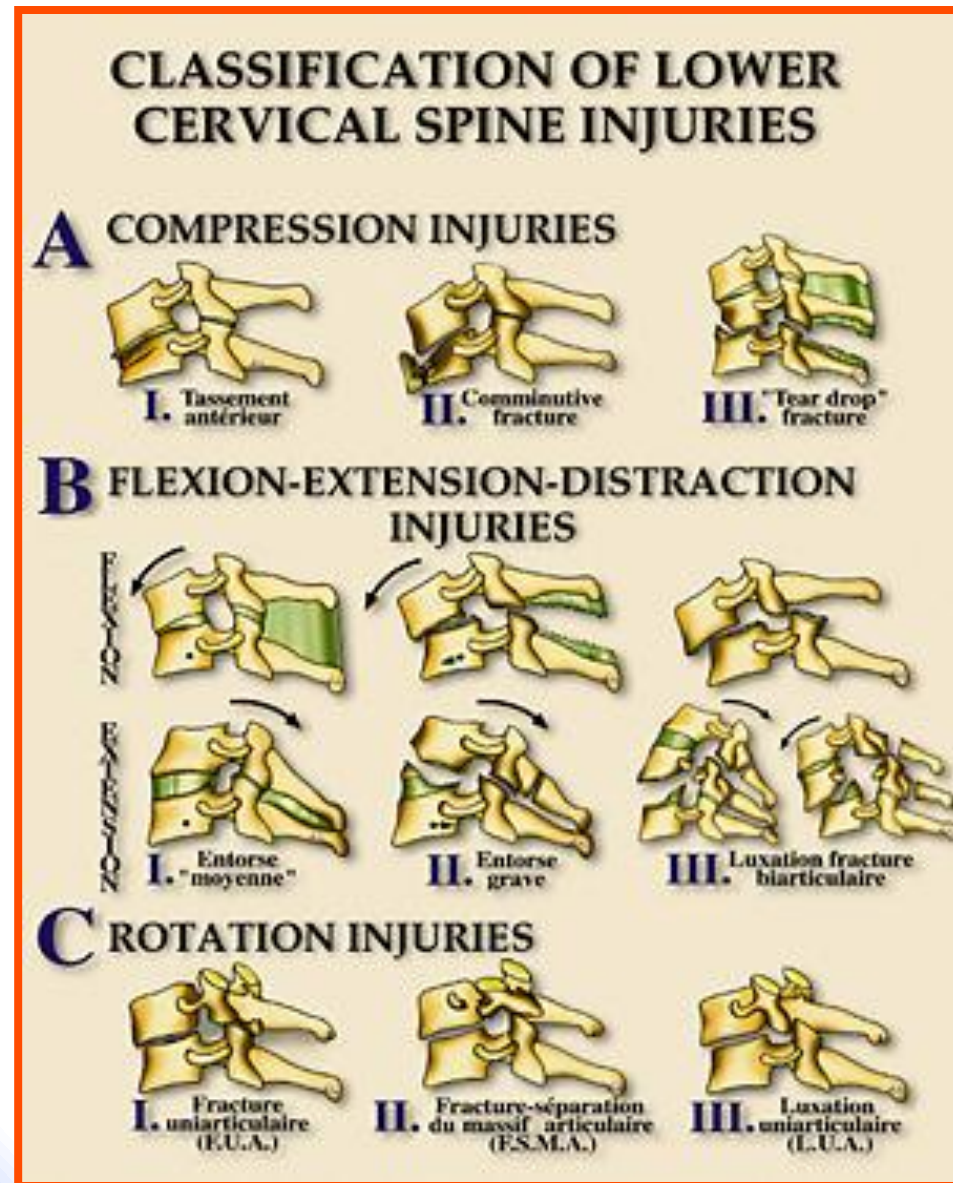
- NEXUS study
- Patients who may not require C-spine X-rays
- Clinical criteria to rule out injury
  - No posterior midline neck tenderness
  - No intoxication
  - No distracting injury
  - Normal level of alertness
  - No focal neurologic deficits
- 99% sensitive

## C-Spine Injury (2)

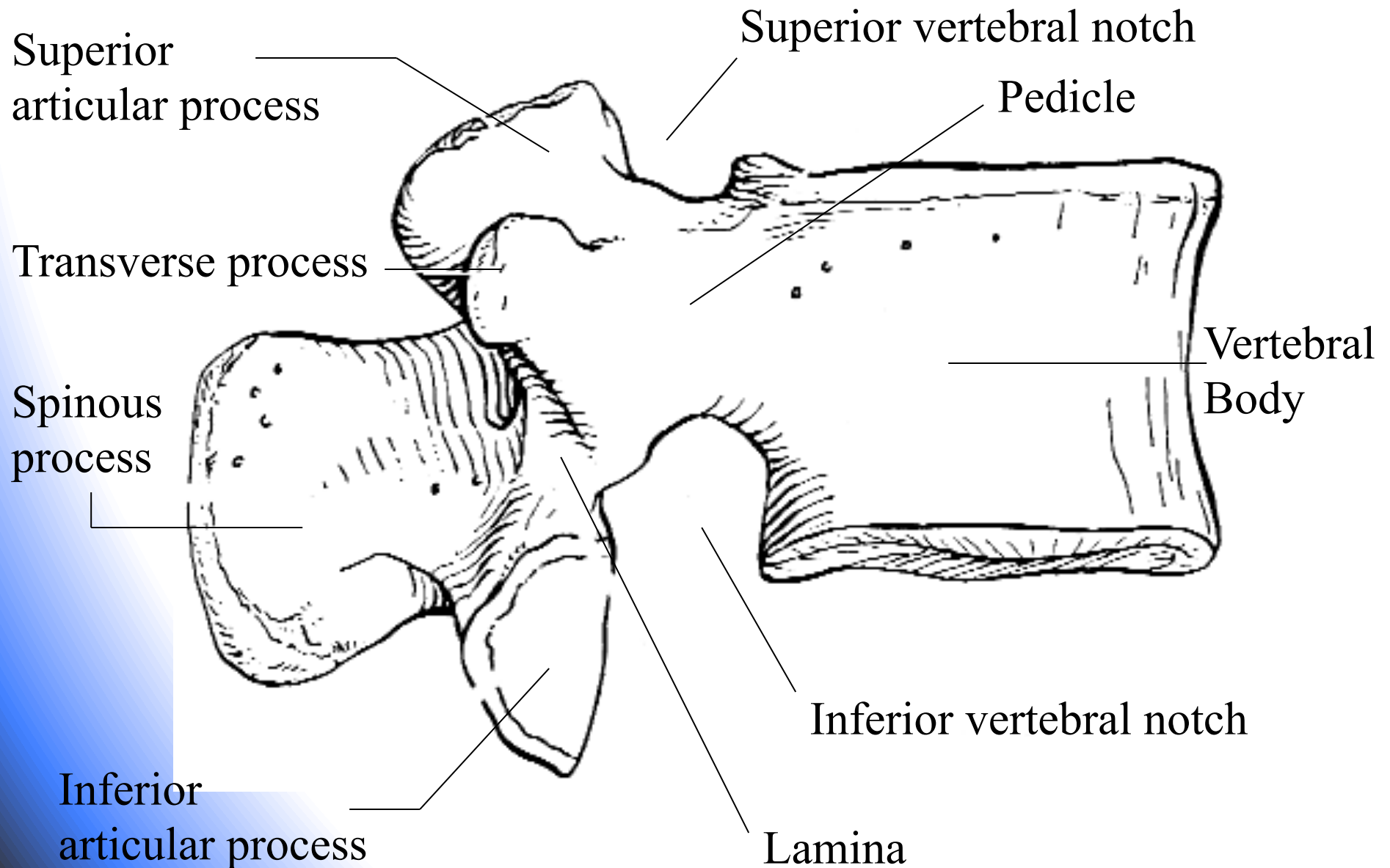
- Cause: MVA most common
- Location: C5/6 most common in adults
- 10% of cervical fractures are associated with another spinal fracture
- X-ray: 3 views (lateral, odontoid, AP)

**Must see all 7 vertebrae**  
**Adequate X-rays do not r/o fracture**

# C-Spine Injury (3)



# Vertebral - Anatomy



# Stable Cervical Fractures

- Anterior subluxation
- Clay shoveler's fracture
- Posterior arch C1 fracture
- Unilateral facet dislocation
- Wedge fracture





# Unstable Cervical Fractures

“Jefferson Bit Off A Hangman’s Thumb”

- J - Jefferson Fracture (burst of C1)
- B - Bifacet dislocation +/- fracture
- O - Odontoid types II and III
- A - Any fracture/dislocation
- H - Hangman’s fracture (posterior element C2)
- I - Teardrop fractures

# Atlantoaxial Dislocation

- C1/2 disruption
- Rheumatoid arthritis, ankylosing spondylitis
- Unstable

## Bilateral Facet Dislocation

- Flexion
- Unstable
- High incidence of cord injuries
- Subluxed >5 mm

# Atlanto-Occipital Dislocation



# C6-C7 Bilateral Facet Dislocation



# Clay Shoveler's Fracture

- Avulsion fracture of spinous process
- C6, C7, T1
- Flexion injury
- Stable

## Hangman's Fracture

- Bilateral fracture of the pedicles (neural arch) of C2
- Forward displacement (traumatic spondylolisthesis) of C2 on C3
- Unstable
- Extension mechanism
- Swischuk's line deviated  $>1.5$  mm



# C2 Pedicle Fracture



# Hangman's Fracture



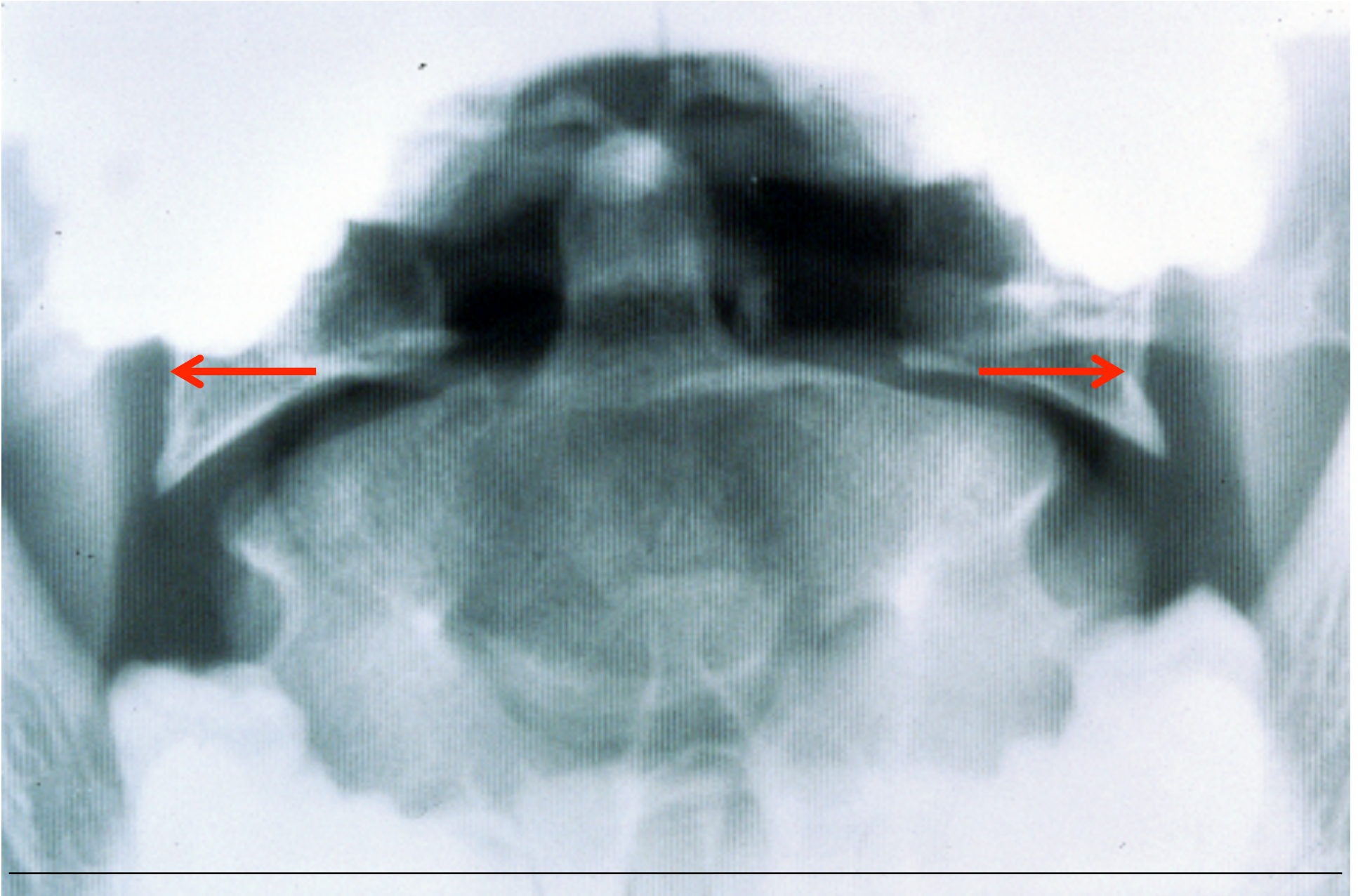
# Jefferson Fracture

- Burst fracture of atlas (C1)
- Axial compression (e.g. diving injury)
- Lateral masses of C1 displaced outward
- Consider unstable

## Posterior Neural Arch C1

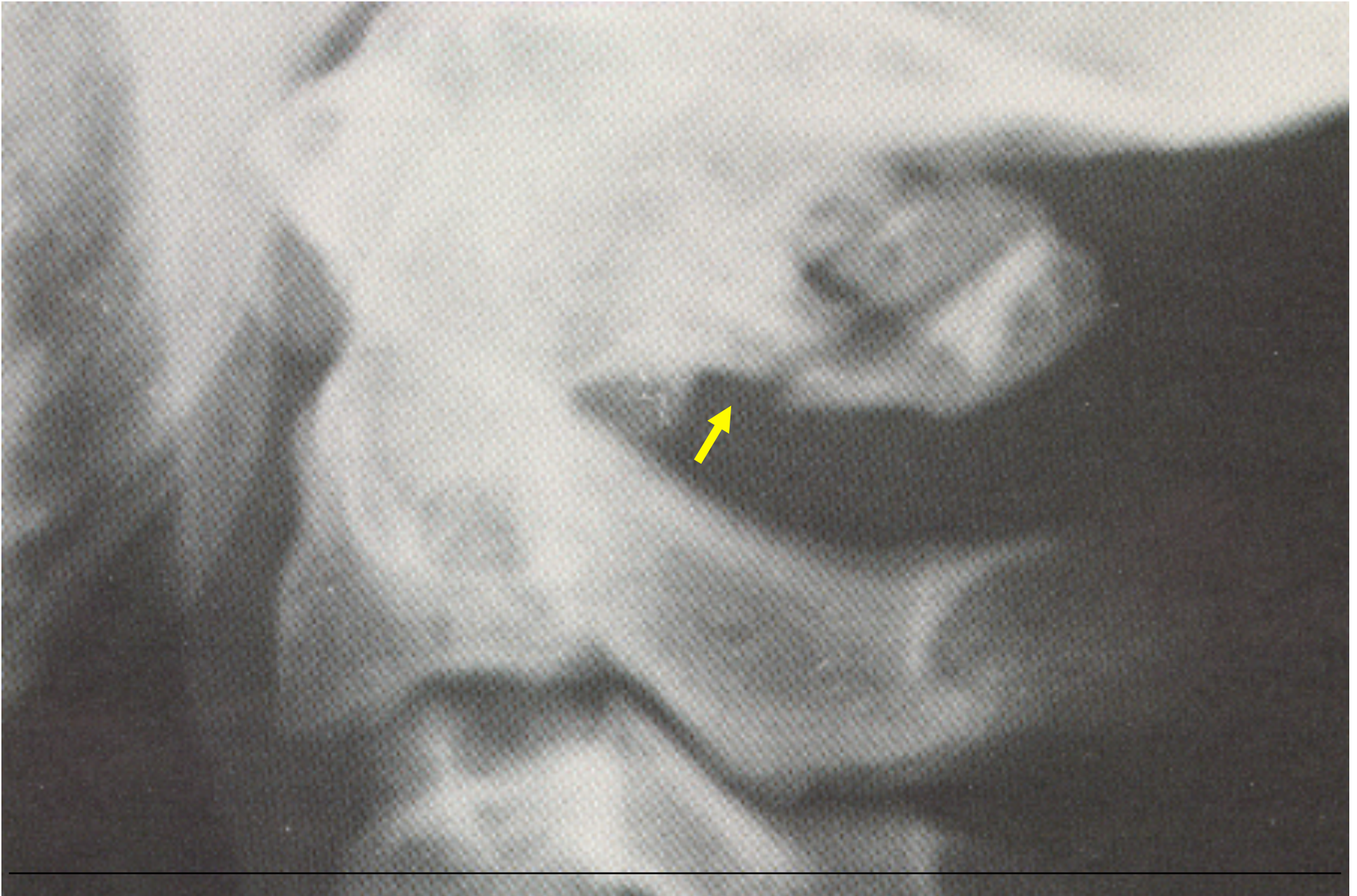
- Hyperextension
- Stable when isolated fracture
- Arch may be congenitally absent

# Jefferson Fracture





# Posterior Neural Arch Fracture





# Odontoid Fracture (1)

- Increase in prevertebral space

## Classification

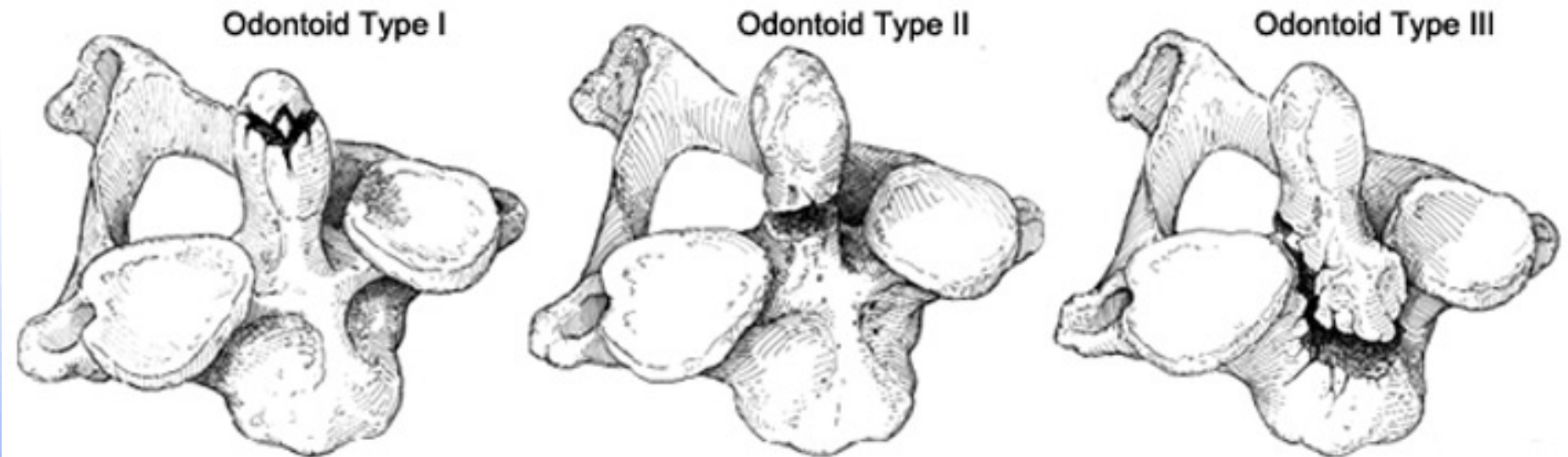
Type I: tip avulsion

Type II: at neck of dens

Type III: through body of C2

- **Most common cervical fracture in children**
- Types II and III unstable
- Atlanto-dens interval
  - 3 mm (adults)
  - 5 mm (peds)

# Odontoid Fracture (2)



# Pseudosubluxation C2 - C3 (1)

- Posterior alignment (Swischuk's line)
- Pediatric C-spine
- Allow 2-3 mm anterior misalignment
- Common below age 8
- The key to diagnosis is normal alignment of the spinolaminar line

# Pseudosubluxation C2-C3 (2)



# Teardrop Fracture (1)

- Flexion
  - Extreme flexion
  - Complete ligamentous disruption
  - Unstable
- Extension (rare)
  - Hyperextension, unstable
  - Anterior longitudinal ligament avulses inferior portion of vertebral body
  - Associated with central cord syndrome

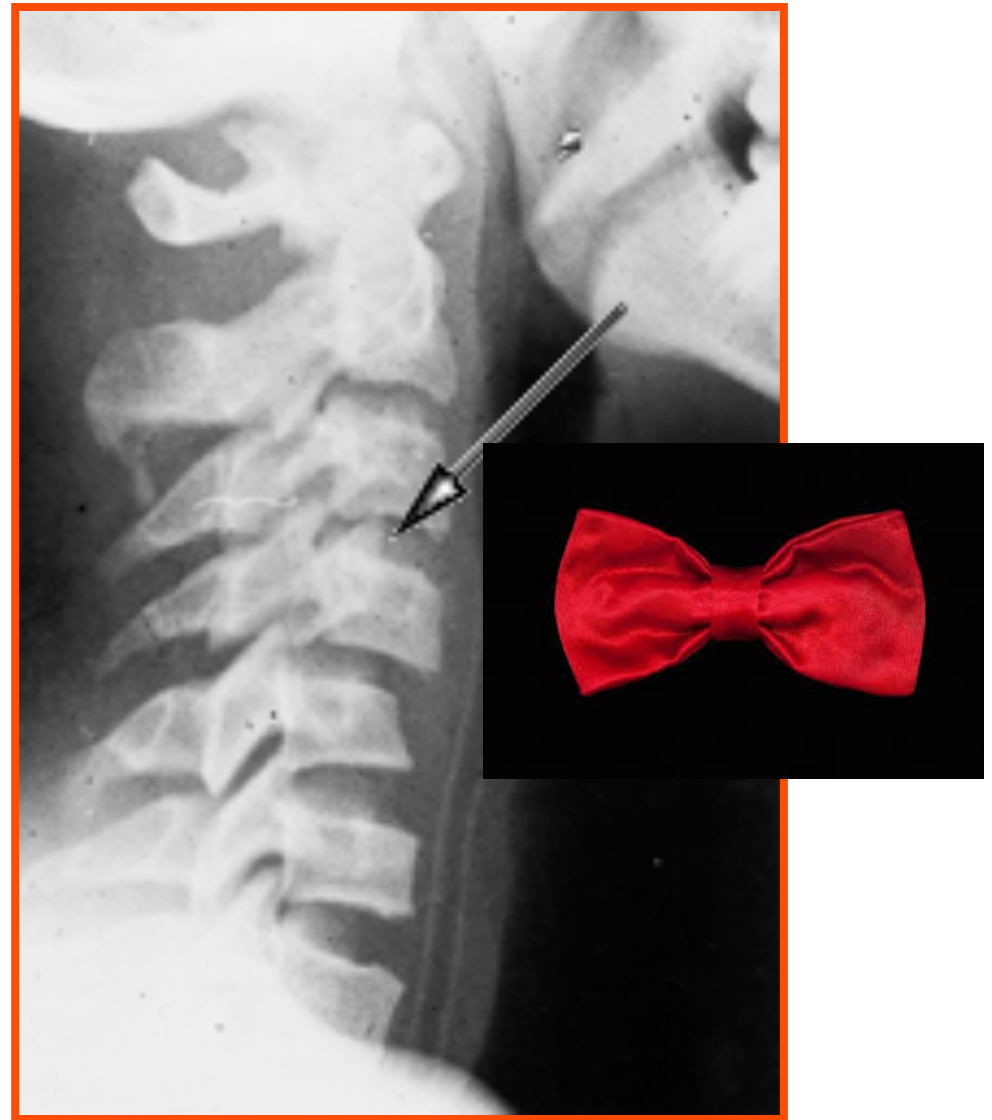


# Teardrop Fracture (2)

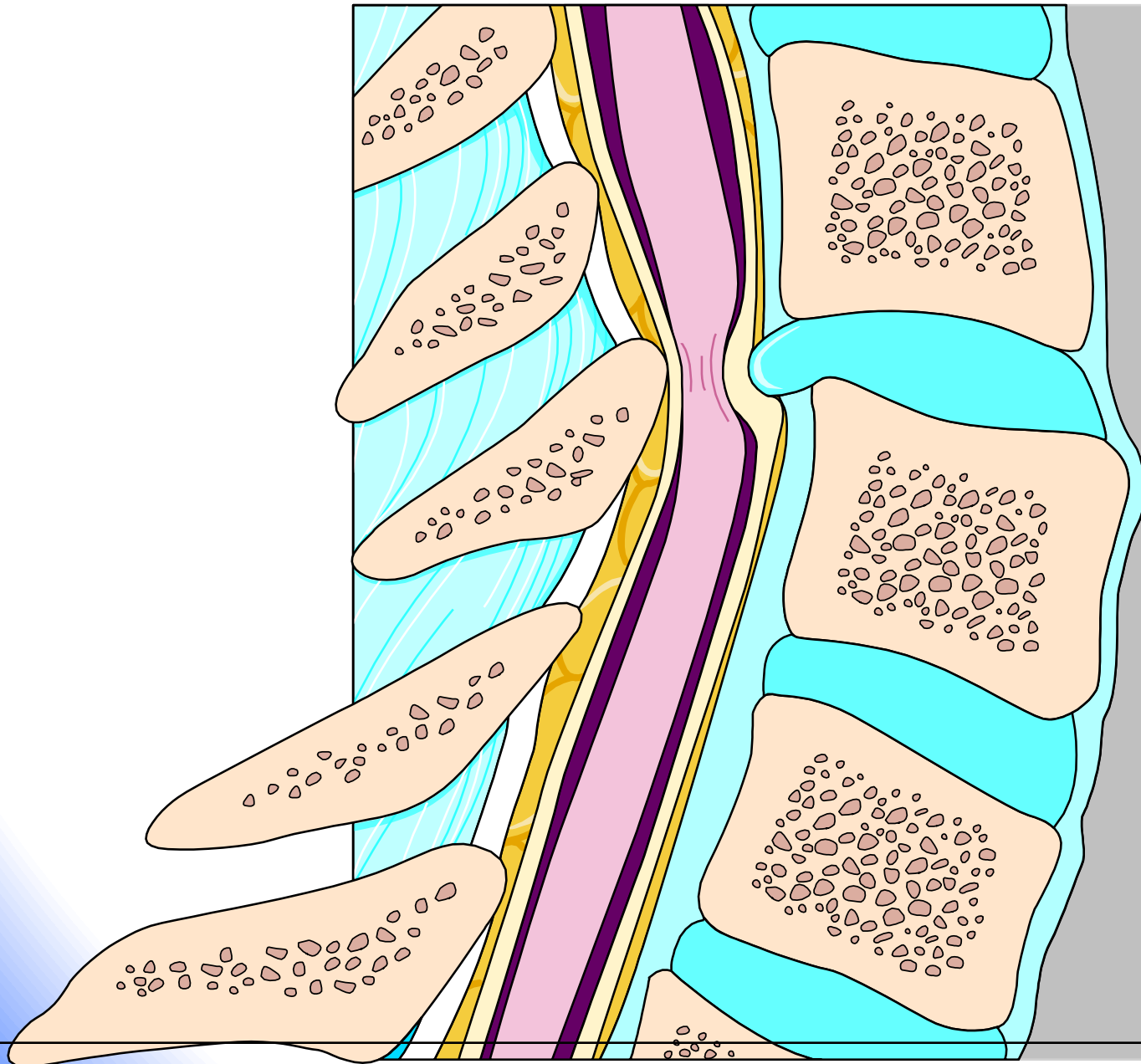


# Unilateral Facet Dislocation

- Rotational injury and flexion
- Posterior ligament complex disrupted
- Lateral X-ray: “bow-tie deformity”
- Potentially unstable



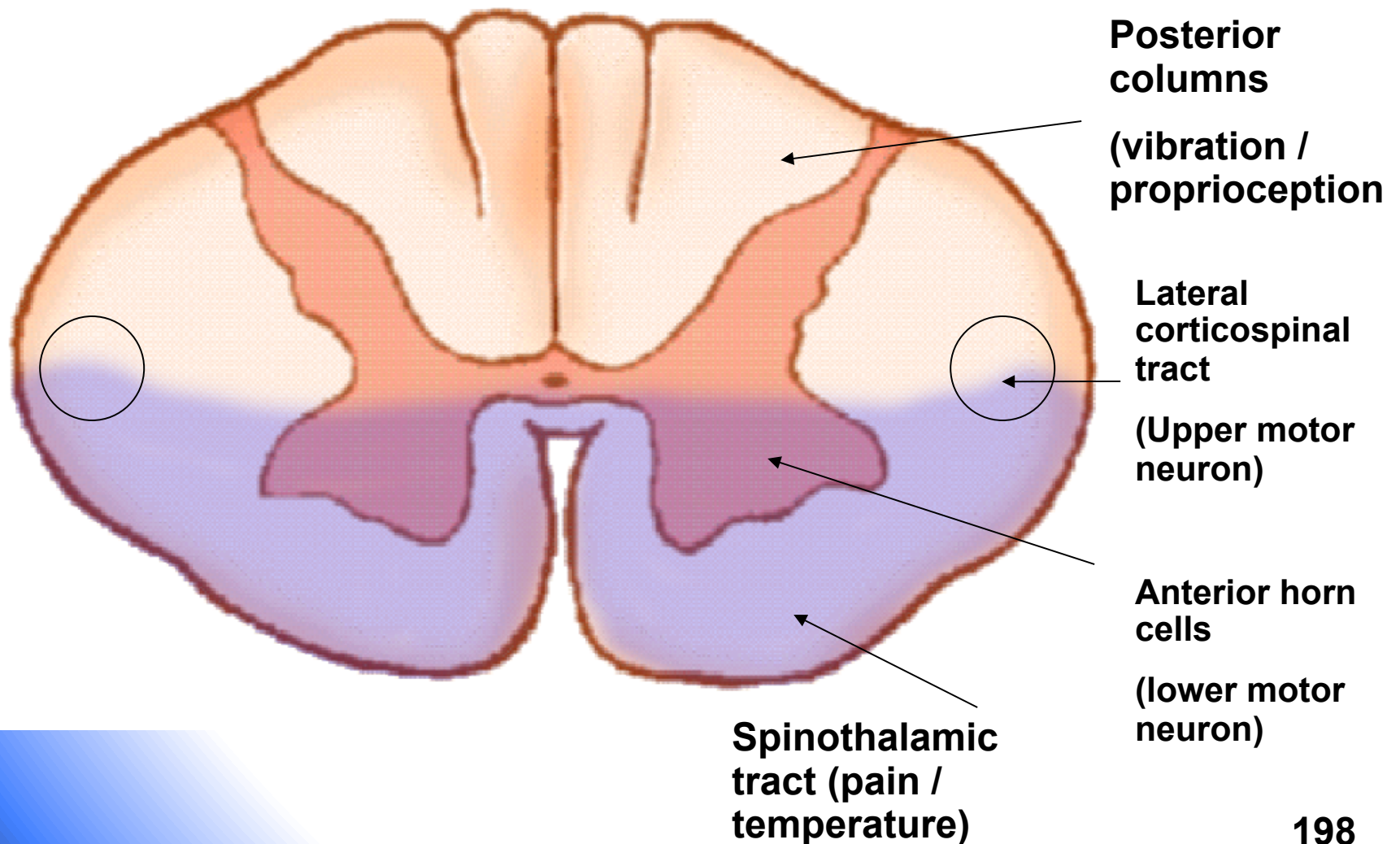
# Spinal Cord Injury



# Spinal Cord Anatomy

- Posterior columns: vibration and position (proprioception) sense
- Lateral corticospinal (pyramidal) tract: upper motor neurons
- Anterior horn cells: lower motor neurons
- Anterior spinothalamic tract: pain and temperature sensation

# Spinal Cord Syndromes



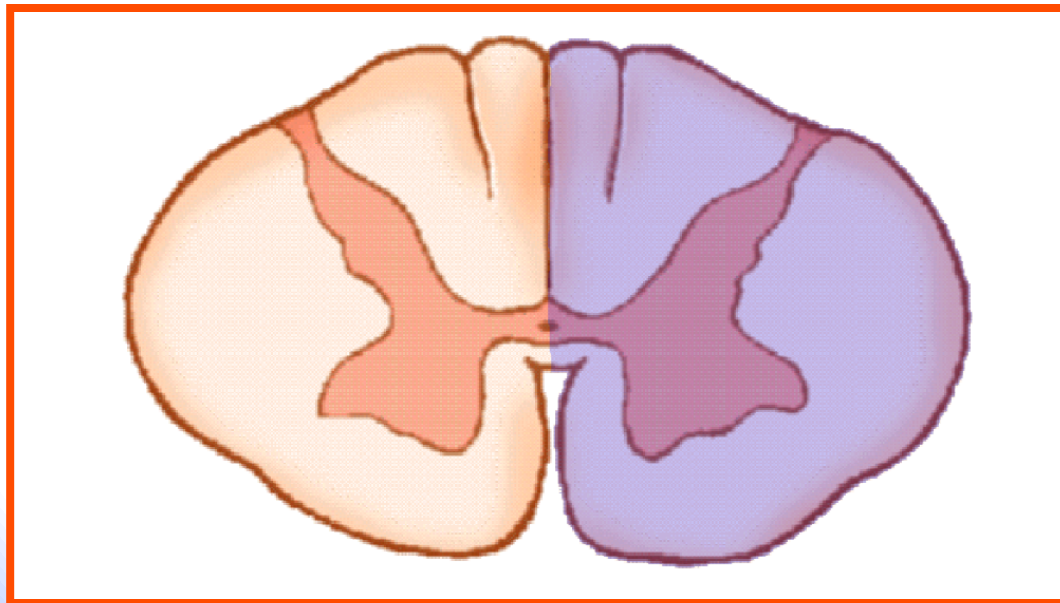


# Anterior Cord Syndrome

- Compression of the cord
- Retropulsion of bony fragments
- Disc herniation
- Injury to anterior spinal arteries
- Flexion injury
- Complete motor paralysis below injury
- Vibration and proprioception preserved
- Loss of pain and temperature sensation (hypalgesia) below injury
- Needs surgical intervention

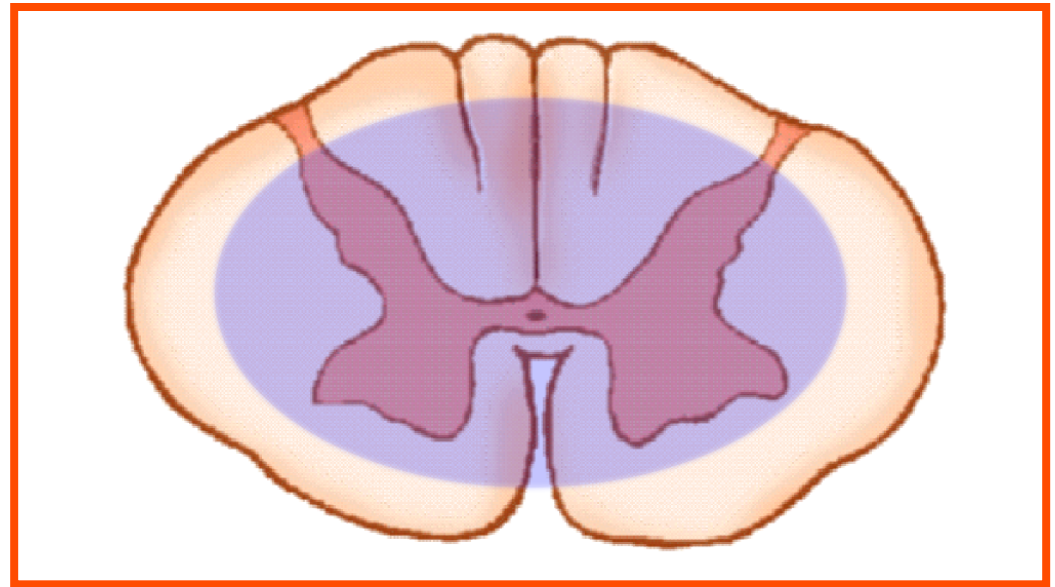
# Brown-Sequard Syndrome

- Unilateral cord injury (usually in penetrating injury)
- **Crossed findings below level**
- Ipsilateral weakness, loss of position/vibration sense
- Contralateral loss of pain and temperature sensation



# Central Cord Syndrome

- Hyperextension injury
- Older patients with DJD
- Weakness, arms > legs
- Also some loss of bladder control and some decreased sensation (distal pain and temperature)
- Sacral sparing (rectal tone present)



# Transverse Cord Syndrome

- Trauma, tumors, transverse myelitis
- **Complete loss of all sensory and motor** pathways below a certain level
- No sacral sparing

## Posterior Cord Syndrome

- Trauma (extension), B12 deficiency, tertiary syphilis
- Loss of position and vibration sensation only

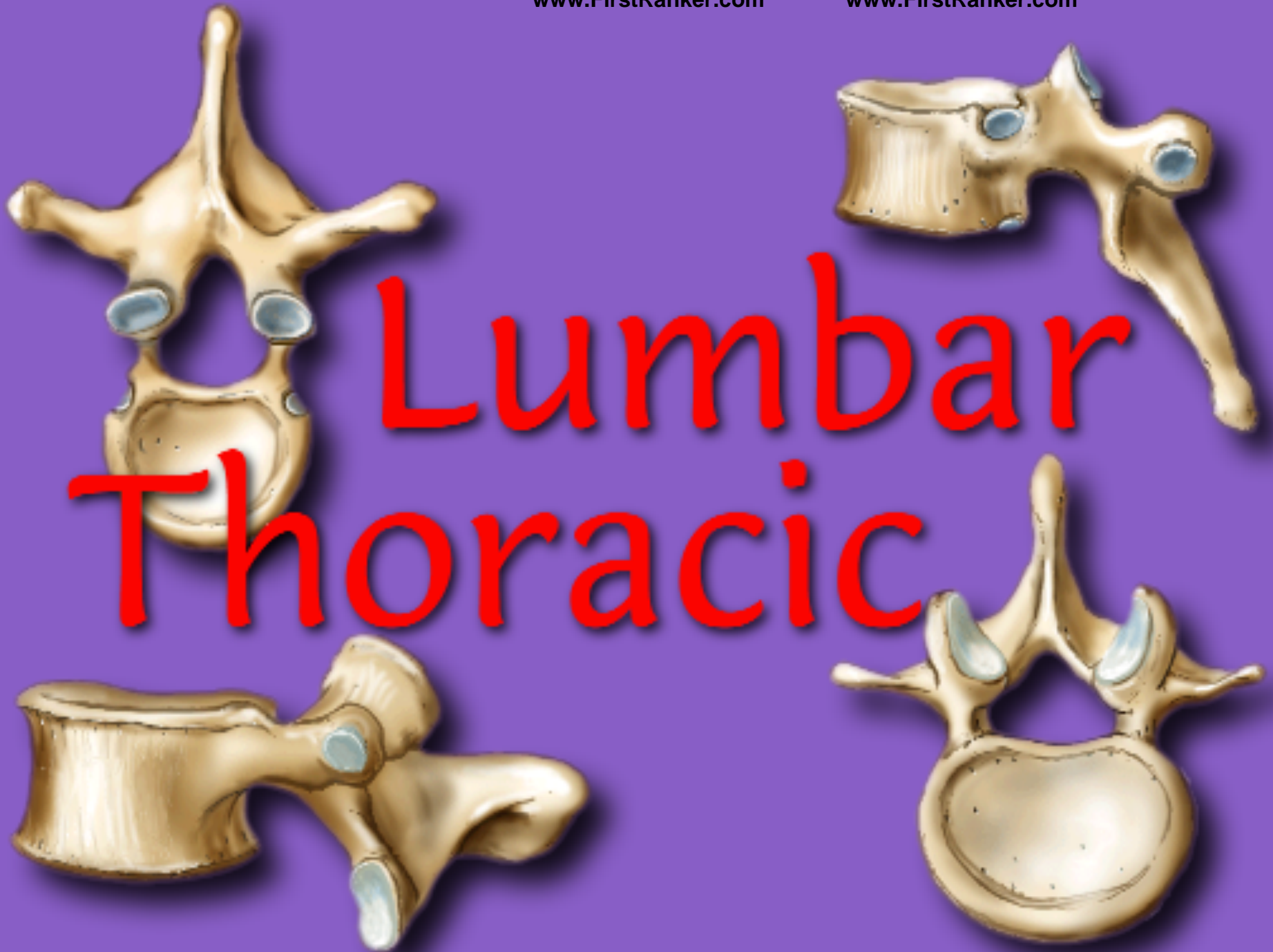
# SCIWORA

- Spinal Cord Injury Without Radiographic Abnormalities
- Involves cervical cord
- More common in children but seen in all age group
- Diagnosed by
  - Thorough exam
  - Normal radiographs
  - **MRI**
- Early surgery beneficial in some
  - Disc herniation



# Neurogenic Shock = 70/70

- Also called vasogenic shock
- Injury to sympathetic outflow
- Unopposed parasympathetic outflow (bradycardia)
- T1 and above
- Unlikely below T4 (r/o other causes of shock)
- Flaccid paralysis below lesion
- Hypotension (neurogenic): treat with fluids
- Loss of autonomic tone
- Loss of reflexes
- Warm, flushed, dry skin (heat loss = hypothermia)
- Distinguish from “Spinal Shock”
  - Loss of sensation and motor paralysis with initial loss or depression of all reflex activity below the level of injury (0-1 day) / initial return of reflexes (1-3 days) / hyperreflexia (1-4 weeks) / Hyperreflexia – spasticity (1-12mo)



# Lumbar Back Pain (1)

## Overview

- Lumbar back pain is second only to URIs as a cause of a symptom-related visit to a physician
- Most cases cannot be given a specific pathoanatomic diagnosis
- Typical onset: age 30-45
- Most common cause of work-related disability
- Most common cause of disability in those under age 45
- Can occur with and without risk factors
- Most (90+ %) resolves within weeks

# Lumbar Back Pain (2)

General approach:

1. Determine if a systemic disease is causing the pain : Search for “Red Flags”
2. Determine if there are conditions that may amplify or prolong the pain (social or psychological factors)
3. Determine whether there is neurologic compromise that may require surgical evaluation

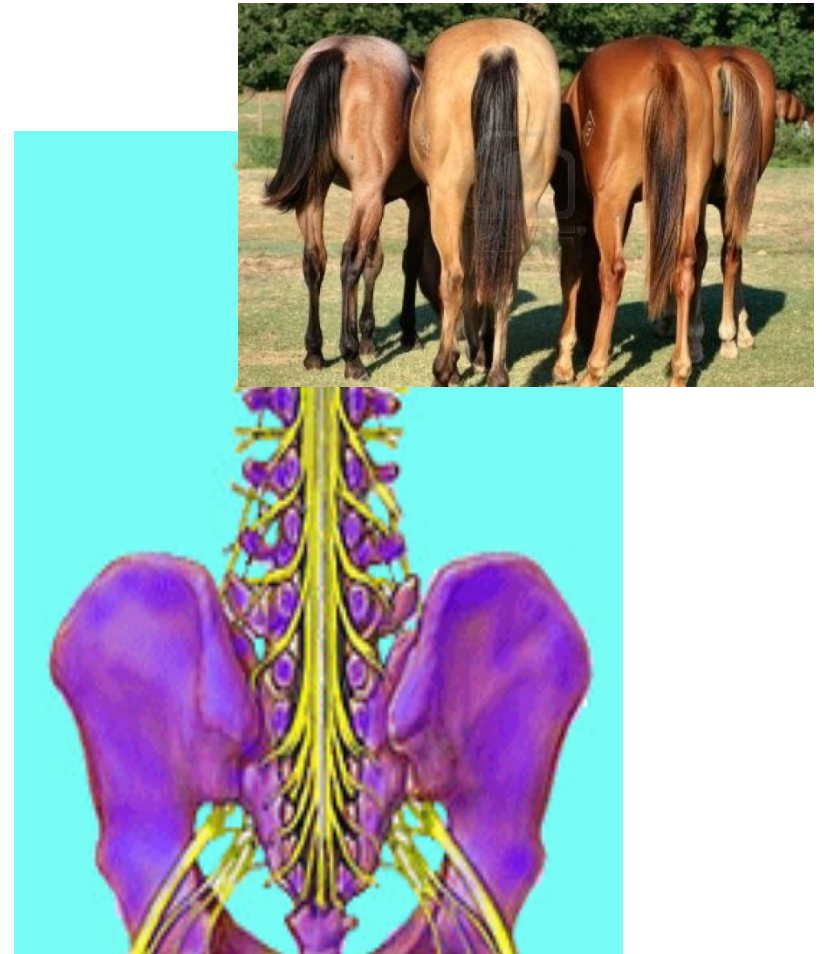
## RED FLAGS in LBP

- Historical clues to exclude serious pathology
  - History of cancer (pain not relieved rest)
  - HIV positive
  - Unexplained weight loss (suggests cancer or other serious disorder)
  - A history of chronic infections or fever
  - Duration of pain (prolonged pain may be associated with treatment failure, depression, somatization, substance abuse, job dissatisfaction, pursuit of disability)
  - Presence of night time pain (may indicate a more serious cause)



# Cauda Equina Syndrome

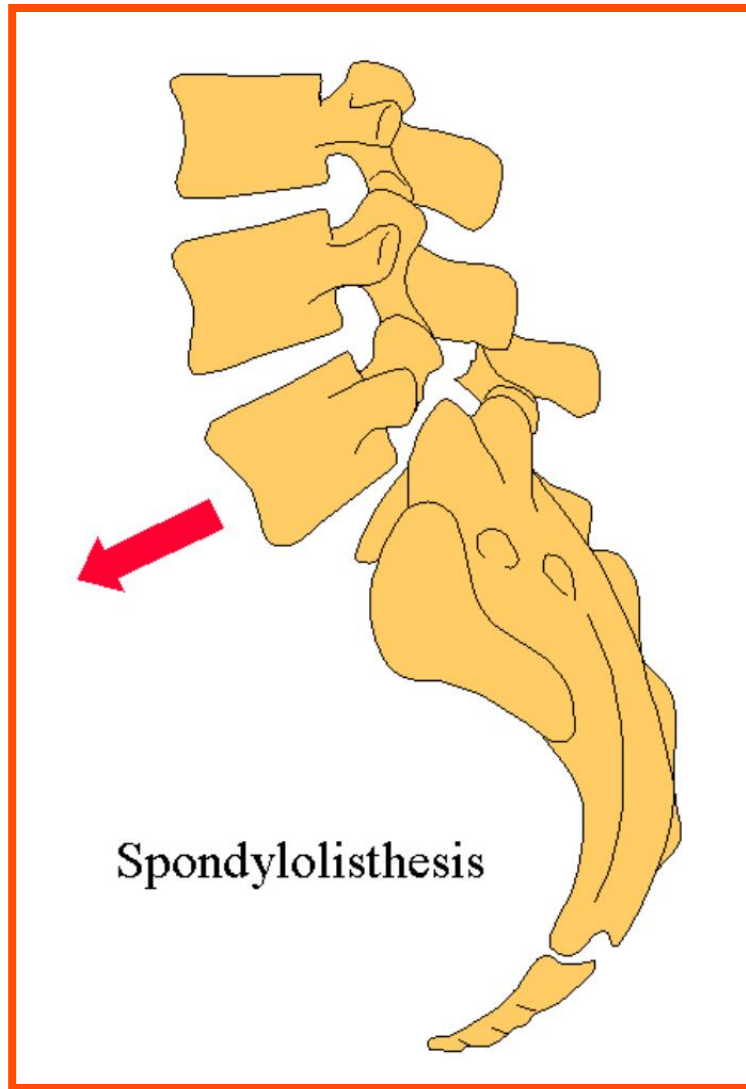
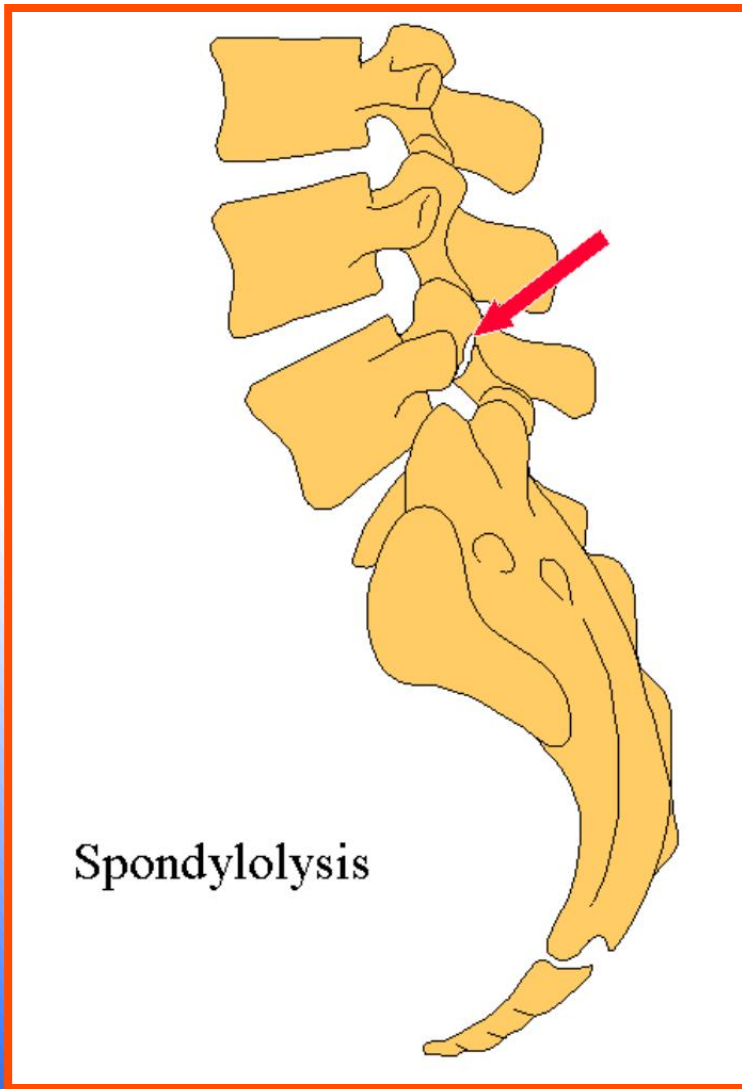
- Cauda equina syndrome = surgical emergency
  - Bowel / bladder dysfunction (from midline disk protrusion / mass)
  - Overflow incontinence is characteristic of bladder dysfunction. May also find perianal anesthesia, bilateral sciatica and leg weakness



# Lumbar Back Causes

- Mechanical (97%)
- Lumbar strain / sprain (70%)
- Degenerated disks / facets (10%)
- Herniated disks (4%)
- Osteoporotic compression fractures (4%)
- Spinal stenosis (3%)
- Spondylithesis (3%)
  - Anterior displacement of one vertebra on another due to a congenital defect in the pars interarticularis
  - Spondylolysis = same defect without slippage (is as common with back pain as without)

# Spondylosis / Spondylolisthesis



# LBP Work-up

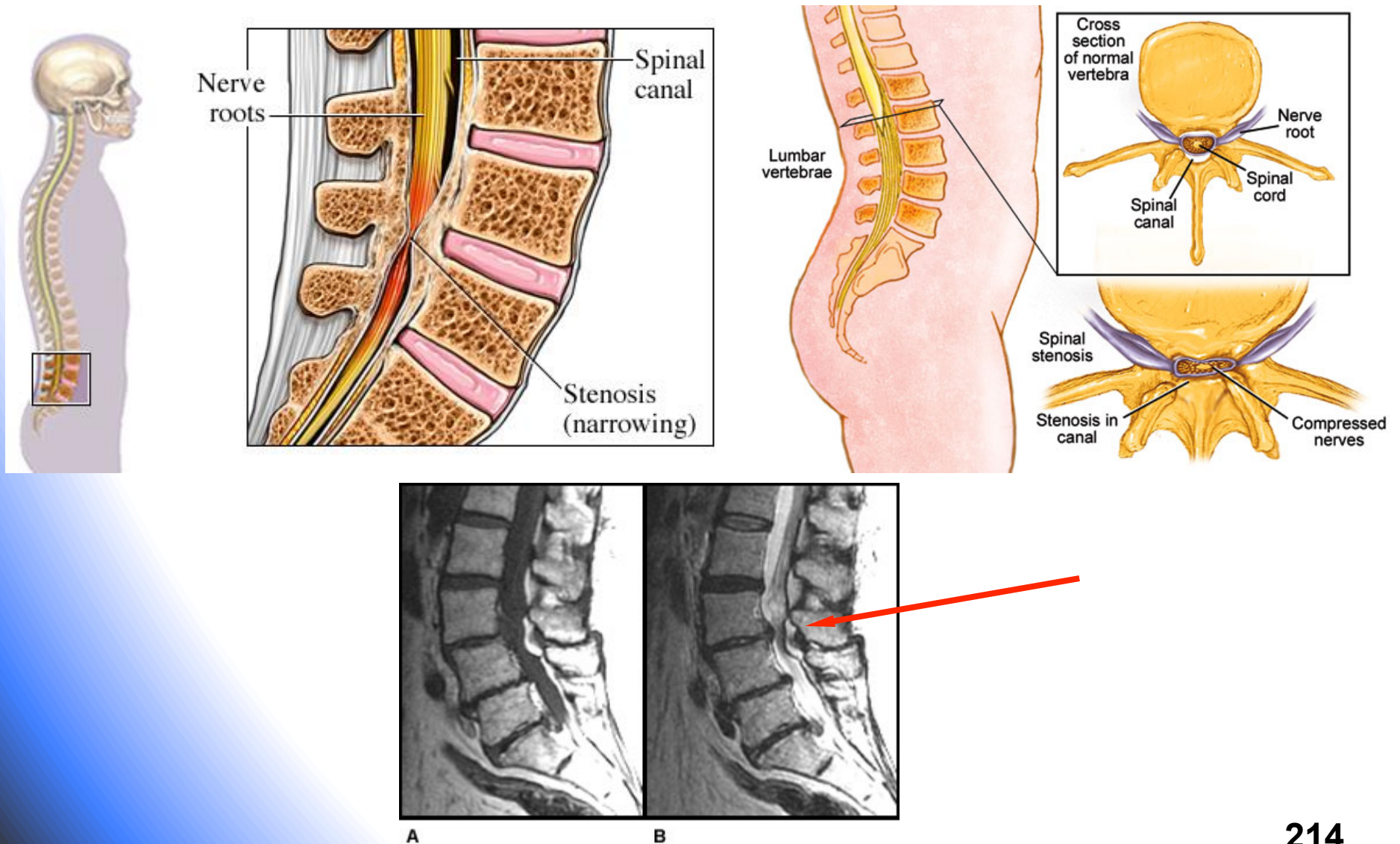
- Image if signs of nonmechanical causes, trauma or failure to improve at 4-6 weeks
- CBC / sed rate may be elevated in patients with infections (CT / MR are more sensitive)
- Early CT / MR are discouraged without serious findings because many asymptomatic patients will have positive findings
- Difficult to establish causality between findings on imaging and symptoms
- MR is superior to CT in finding infections and tumors. Both are comparable regarding herniations and spinal stenosis
- Early imaging is advised in the elderly (over 65)

# Spinal Stenosis (1)

- More common in the elderly
- Caused by facet hypertrophy / ligamentum flavum thickening
- CT / MR are diagnostic
- Pain, numbness and tingling (pseudoclaudication)
  - Can occur in one or both legs
  - Often relieved by flexion and sitting
  - Aggravated by extension
- Remains stable (70%) or worsens (15%) vs. most back pain gets better
- Leg exercises, NSAIDS, PT, epidural steroids
- Decompressive laminectomy is not uniformly successful



# Spinal Stenosis (2)



# Burst Fracture

- Axial load
- Failure of anterior + middle columns (unstable)
- CT to rule out cord injury

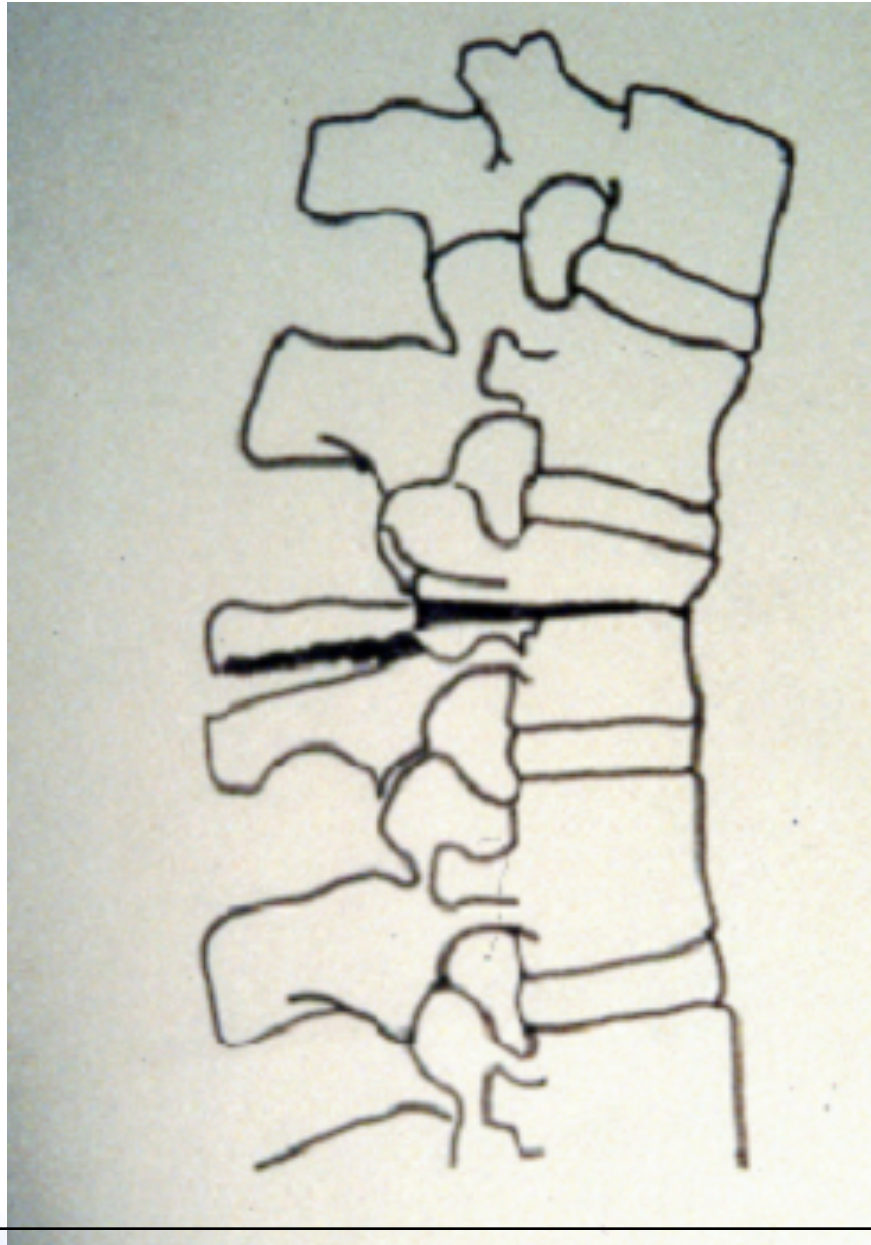
# Chance Fracture

- Flexion, distraction
- Seat belt injury
- Horizontal fracture, usually L1 or L2
- Bowel, liver, spleen injuries are common
- Ileus is common
- Unstable (posterior ligament disruption)

# Burst Fracture



# Chance Fracture



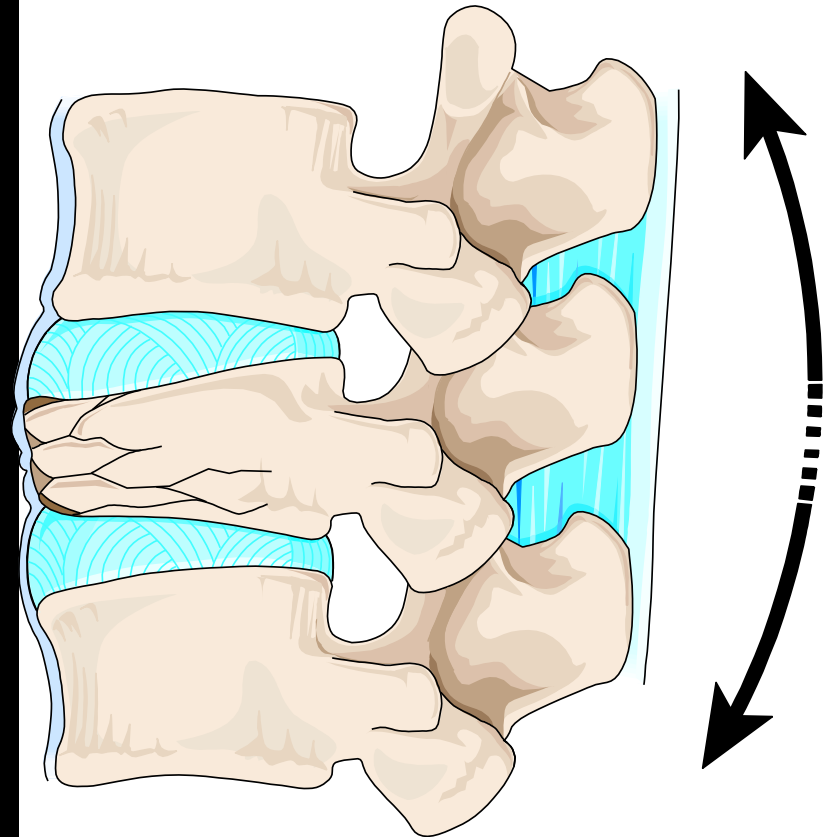
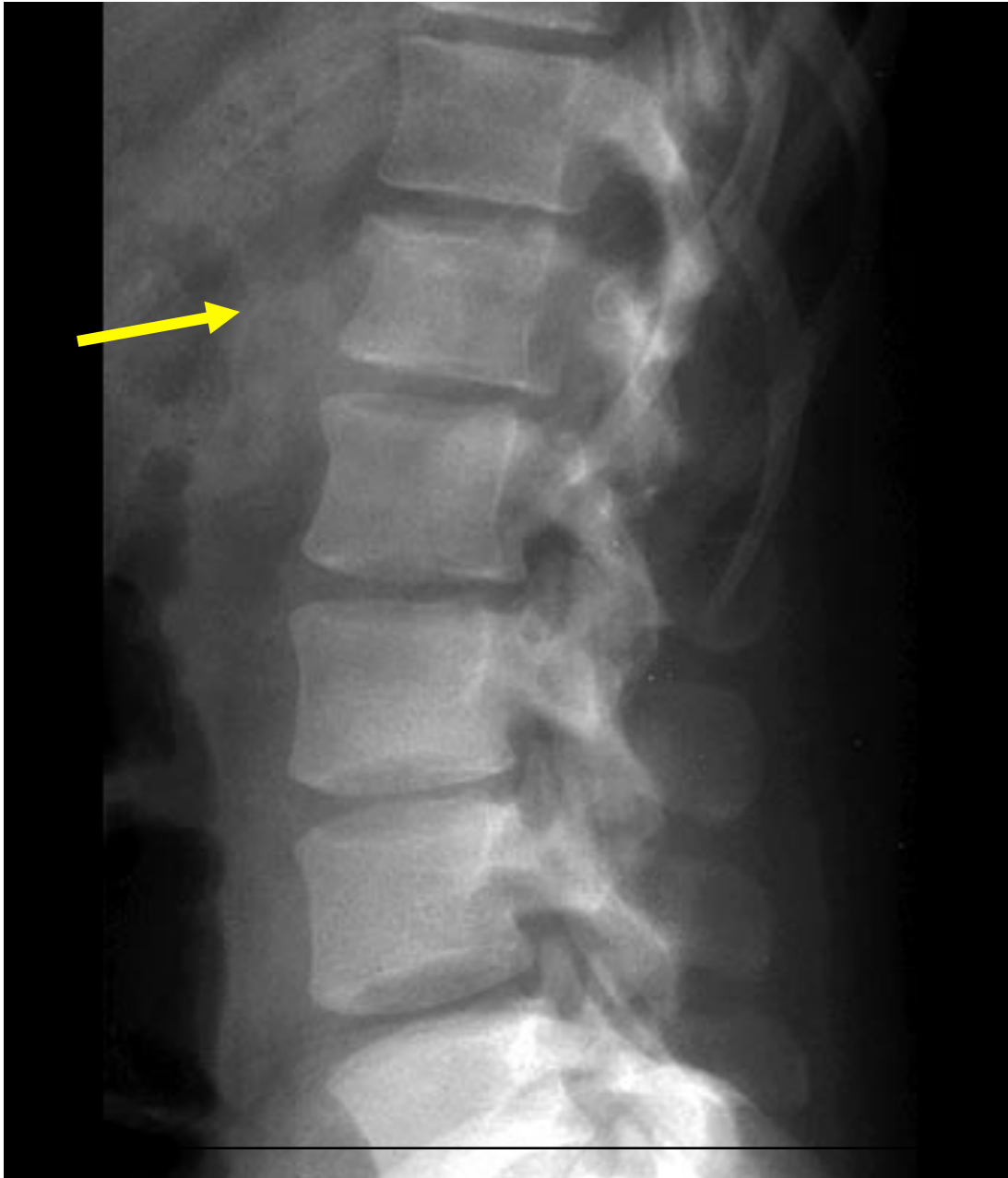


# Wedge Fracture

- Axial load with flexion
- L1 > L2 > T12
- Usually stable
- Unstable if burst (>50% loss of anterior body height)
- Salmon calcitonin spray in addition to other treatments
  - Mechanism of action regarding pain reduction is unclear
  - Inhibits bone removal by osteoclasts and promotes bone formation by osteoblasts

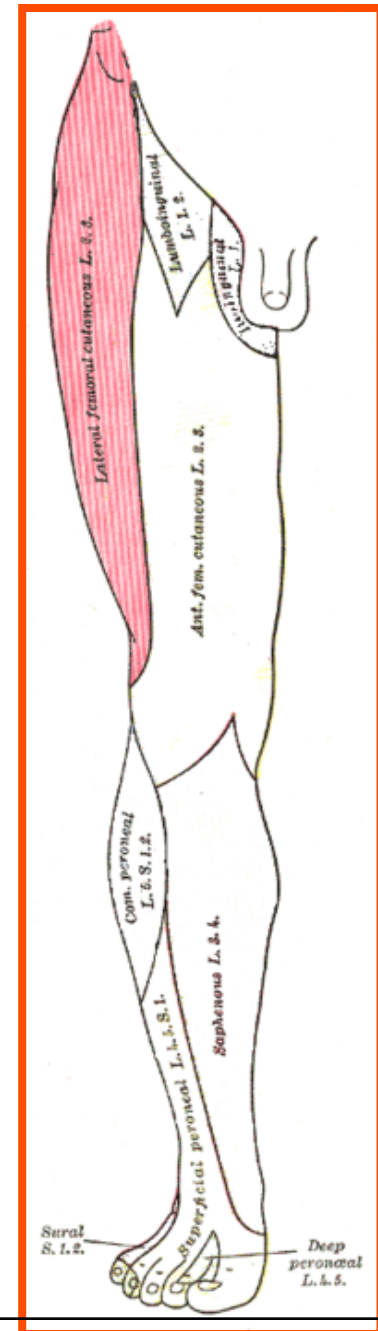


# Compression Fracture



# Ortho Trivia (1)

- Adhesive capsulitis  
Can result from prolonged immobilization of the shoulder
- Congenital hip dislocation
  - Asymmetry of groin
  - Apparent limb shortening
  - Ortolani click test
- Meralgia paraesthetica  
Lateral femoral cutaneous nerve compression where it passes between the ilium and inguinal ligament
  - Pregnant women
  - Workmen with belts
  - Burning lateral thigh pain



## Ortho Trivia (2)

- Pediatric hip problems
  - Legg-Calve-Perthes      4-8 years old
  - Toxic synovitis      4-10 years old
  - SCFE      10-16 years old
  - Septic arthritis      any age
- Torus fracture: cortex buckled but intact
- Greenstick fracture: cortex disrupted on one side and intact on the other
- Lumbar disc syndromes
  - L4 :      Absent knee jerk
  - L5 :      Absent dorsiflexion of great toe
  - S1 :      Absent ankle jerk, numbness of lateral foot

# Ortho Trivia (3)

- Paget's disease of bone
  - Inflammatory condition of skeleton
  - Rapid, chaotic bone resorption followed by chaotic bone formation
  - Enlarged, weak bones
  - Asymptomatic or bone pain
  - Calcium normal, alkaline phos. ↑
  - Bones fracture with minimal trauma
  - Involvement of skull and vertebrae can lead to neurologic symptoms



# ORTHOPEDICS QUESTIONS



## Regarding Salter Harris fractures, which of the following is true?

- A. The epiphyseal plate is stronger than the supporting ligaments
- B. Salter Harris II is the least common
- C. X-rays may be negative in types I and II
- D. Growth complications increase from types I to V
- E. Most involve the growth plate

**A 24 y/o patient was struck with a baseball in the left index finger. The PIP is flexed with the DIP extended. Which of the following is true of this injury?**

- A. This description is consistent with a mallet finger
- B. Avulsion fractures are rarely associated with this injury
- C. This injury is caused by an extensor tendon injury near the DIP
- D. This injury is caused by a central slip extensor hood disruption near the PIP
- E. This description is consistent with a gamekeeper's injury

**OR 2**

**A 68 y/o female complains of hand pain status post cat bite. Puncture wounds are noted on the right index finger and middle finger. Which of the following is consistent with Kanavel's signs?**

- A. Severe pain on flexion
- B. Fever
- C. Pain on palpation of the proximal sheath
- D. Swelling at the puncture wound site only
- E. Digit held in slight extension

**OR 3**

**A 62 y/o patient fell injuring her wrist. She has suffered the most common ligamentous injury of the hand/wrist. Which of the following is true?**

- A. ED Management includes placement of a velcro wrist splint
- B. The radiograph should show  $> 3\text{mm}$  widening of the scapho-lunate space
- C. The most common mechanism is a direct blow from a blunt object
- D. The capitate is aligned and lunate displaced on the lateral radiographic view
- E. This injury is rarely missed

**OR 4**

**A 35 y/o patient fell injuring his wrist. His radiographs show a distal radius fracture with a disrupted radio-ulnar joint. Which of the following statements is true?**

- A. The patient has suffered a Monteggia fracture
- B. This injury includes annular ligament disruption
- C. Radial nerve injury is a known complication
- D. Ulnar nerve injury is not associated with this injury
- E. The patient has suffered a Galeazzi fracture

**OR 5**



**A 36 y/o painter reports intermittent hand paresthesias. With raising his arms above his head and opening and closing his fists for three minutes, his symptoms are reproduced. Which of the following is true?**

- A. The patient's diagnosis is associated with a cervical disc herniation
- B. The diagnostic maneuver described is the Adson's test
- C. The most common type of this anomaly is the vascular type
- D. This pathology may include compression of the brachial plexus and/or subclavian vessels
- E. The least reliable diagnostic maneuver is "EAST"

**OR 6**

**An 8 y/o boy presents with right hip pain for 1 week. His hip x-ray reveals a subchondral fracture. Based on the most likely diagnosis, which of the following is true?**

- A. Typically seen in boys age 8-12
- B. The patient most likely has Legg-Calve-Perthes disease
- C. The typical patient is probably obese
- D. Radiograph should shows a “melting ice cream cone appearance”
- E. Radiographic findings precede the symptoms

**OR 7**

**A 34 y/o presents with pain, pallor, paresthesias and weakness in his right leg after suffering a tibial fracture 3 days prior. Which is the most appropriate next step?**

- A. Reapply the splint and arrange 24 hour orthopedic follow-up
- B. Change his pain medication regimen
- C. Check compartment pressures
- D. Repeat radiographs
- E. Attempt closed reduction of his fracture

**OR 8**

**In diagnosing Achilles tendon rupture, which provocative test is likely to be positive?**

- A. Homan's sign
- B. Romberg
- C. Thompson test
- D. Hoover test
- E. Lachman test

**OR 9**

**A 45 y/o patient presents with ankle pain, describing an inversion injury. Regarding the Ottawa ankle rules, which of the following would be criteria for radiographic evaluation?**

- A. Point tenderness over the cuboid
- B. Point tenderness over the base of the 4<sup>th</sup> metatarsal
- C. Tenderness at the anterior talo-tibial ligament
- D. Inability to bear weight immediately and in the ED
- E. Bony tenderness at the anterior aspect of the distal 6 cm of either maleoli

**OR 10**



**A 19 y/o male roofer fell from 15 feet landing on his feet. He complains of right heel pain and cannot bear weight. Which of the following is true, regarding calcaneal fractures?**

- A. This fracture is the least common of all tarsal bones
- B. Boehler's angle would be expected to be > 40 degrees
- C. This fracture may be associated with LS spine fractures
- D. CT has no utility in making this diagnosis
- E. The mechanism of injury is from rotational forces

**OR 11**

**A 30 y/o female softball player reports an acute onset of foot pain after jumping for a ball. Her radiographs confirm a Jones fracture. Which of the following is true with respect to Jones fractures?**

- A. They are avulsion fractures of the base of the 5<sup>th</sup> metatarsal
- B. They are uncommon in athletes
- C. They are associated with a lower incidence of non-union than avulsion fractures
- D. They are located at the diaphysis of the 5<sup>th</sup> metatarsal
- E. They do not require splinting

**OR 12**

**A 13 y/o sickle cell patient presents with fever and leg pain. His radiographs show signs of periosteal reaction. What is the most likely etiologic agent for the suspected diagnosis?**

- A. Eikenella corrodens
- B. E. coli
- C. Pasteurella multocida
- D. Salmonella
- E. Methicillin resistance Staph aureus

**An 18 y/o patient presents with neck pain status post MVC. Which of the following findings is most suggestive of c-spine fracture?**

- A. Predental space > 2 mm
- B. Neck pain and weakness with shoulder abduction
- C. Prevertebral space > 10 mm @ C6
- D. Predental space > 10 mm @ C4
- E. Prevertebral space > 3mm @ C2

**An 84 y/o patient presents a cervical spine injury. The patient has 2/5 muscle strength at the upper extremities and 3/5 at the lower extremities bilaterally. Which is the most likely diagnosis?**

- A. Anterior cord syndrome
- B. Complete cord transection
- C. Posterior cord syndrome
- D. Central cord syndrome
- E. Brown-Sequard syndrome



**A 16 y/o was involved in a MVC. He complains of neck pain. You suspect this patient is in neurogenic shock. Which of the following is most consistent with that diagnosis?**

- A. Hypertension
- B. Pale, warm, diaphoretic skin
- C. Warm, flushed, dry skin
- D. Cool, pale and diaphoretic skin
- E. Sparing of reflexes

## Which of the following are true of compression or wedge fractures?

- A. More common at T9 than L2
- B. They are stable with 50% loss anterior vertebral body height
- C. They are usually unstable
- D. More common at L1 than T12
- E. They are always caused by flexion

## Regarding pediatric hip problems, which is true?

- A. SCFE occurs between 3-7 years
- B. Septic arthritis occurs most often between 6-10 years
- C. Toxic synovitis occurs between 8-10 years
- D. Legg-Calve-Perthes occurs between 4-8 years
- E. Osgood Schlatter disease occurs between 10-14 years

**OR 18**

**A pediatric patient with a GCS of 15 has upper extremity weakness after falling and injuring her head and neck. Which pair best describes the diagnosis and the confirmatory test?**

- A. SCIWORA – MRI of the cervical spine
- B. Eaton Lambert syndrome - CSF protein
- C. Guillain-Barré-CSF protein
- D. Subdural hematoma – CT of the brain
- E. Clay shoveler's fracture - cervical CT scan

**A 35 y/o patient presents with neck pain following an MVC. He has a unilateral facet dislocation C6 on C7. Which of the following is most consistent with his injury?**

- A. Decreased shoulder abduction
- B. Medial arm numbness
- C. Elbow extension weakness
- D. 5<sup>th</sup> finger paresthesias with 5<sup>th</sup> finger adduction weakness
- E. Wrist extension weakness



## Orthopedics Answer Key

- |       |       |
|-------|-------|
| 1. D  | 11. C |
| 2. D  | 12. D |
| 3. C  | 13. D |
| 4. B  | 14. B |
| 5. E  | 15. D |
| 6. D  | 16. C |
| 7. B  | 17. D |
| 8. C  | 18. D |
| 9. C  | 19. A |
| 10. D | 20. C |