# Brant & Helms: MSK

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Brigham and Women's Radiology

# MSK Rotation

**Responsibilities:**

- First-years read plain films only.
- Observe two shoulder and two hip arthrograms.
- Shadow one of the techs for half a day .
-

**Recommended Reading:**

- Arthritis in Black & White by Brower – start with this
- Musculoskeletal Imaging: The Requisites
- Fundamentals of Skeletal Radiology by Helms
- Musculoskeletal Imaging by Pope
- Musculoskeletal MRI by Helms, Kaplan, et al.

+ RADPrimer questions

**Review Reading:**

- Core Radiology by Jake Mandell

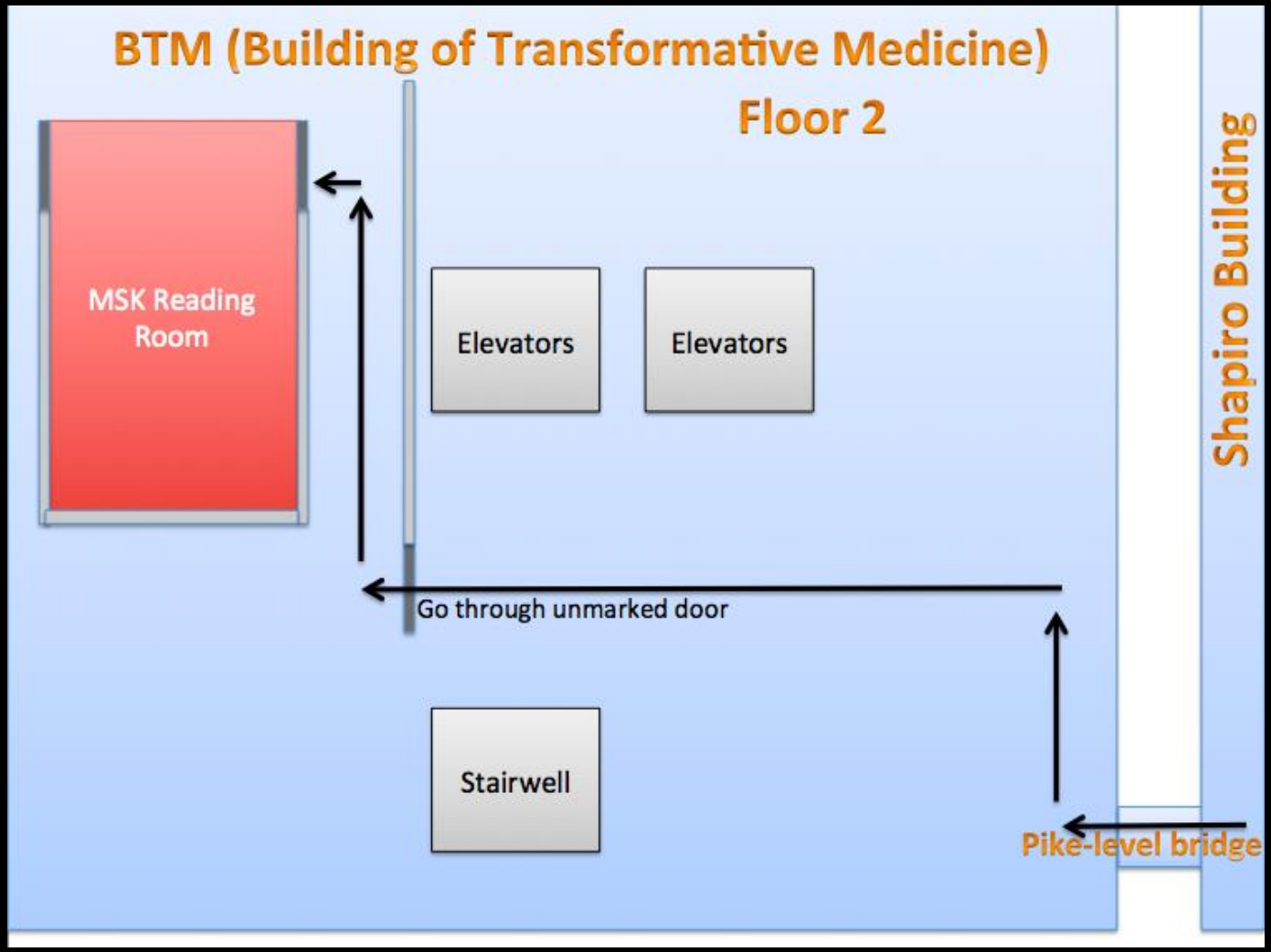
**OSCE**:

- Go over a bunch of cases with Jake

**Note**: Fridge under the counter near where the reading room secretary (Calvin) sits. Water, coffee and tea down the hall in the staff break room.

**Contact**: Jake Mandell, M.D.

# MSK Rotation



# Common Views

- Hand/Finger/Wrist/Forearm/Foot/Toe

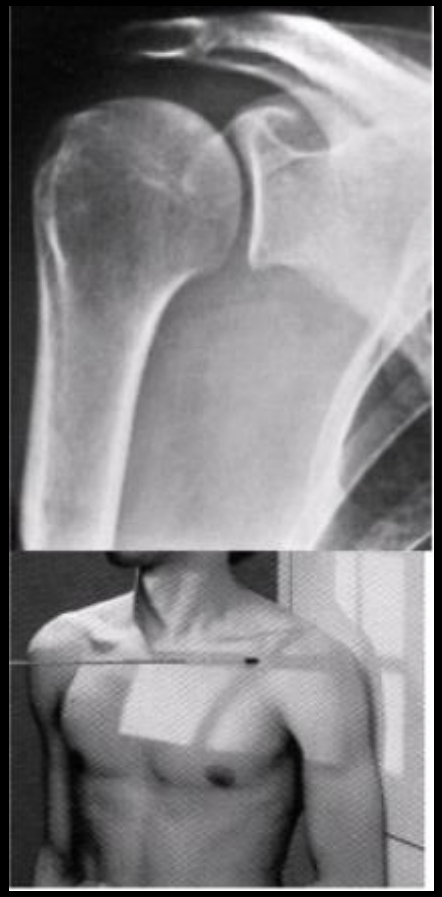

FRONTAL


OBLIQUE


LATERAL

# Common Views


FRONTAL



GRASHEY


TRANSCAPULAR -Y

# Common Views

- Hip

AP

FROG LEG LATERAL

# Common Views

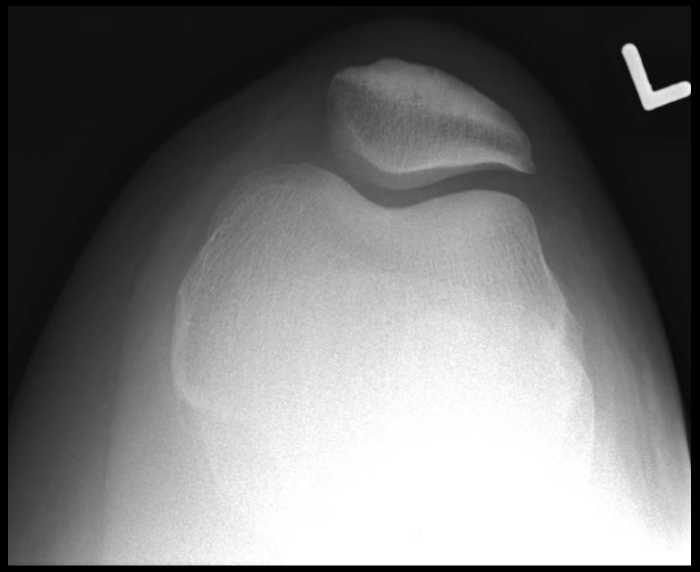
- Cervical spine
  - AP
  - Lateral
  - Open mouth odontoid
  - Flexion/Extension
  - Swimmers

# Common Views

- Knee

LATERAL


FRONTAL




SUNRISE

# SEARCH PATTERN RADIOGRAPHS

# ALIGNMENT

- Technical requirement
  - Minimum 2 views at right angles
  - Need to see joints at both ends

- Displacement:
  - Describe relative to proximal bone or fragment
- Angulation:
  - Describe relative to the proximal fragment
  - Describe direction of angulation

# ALIGNMENT

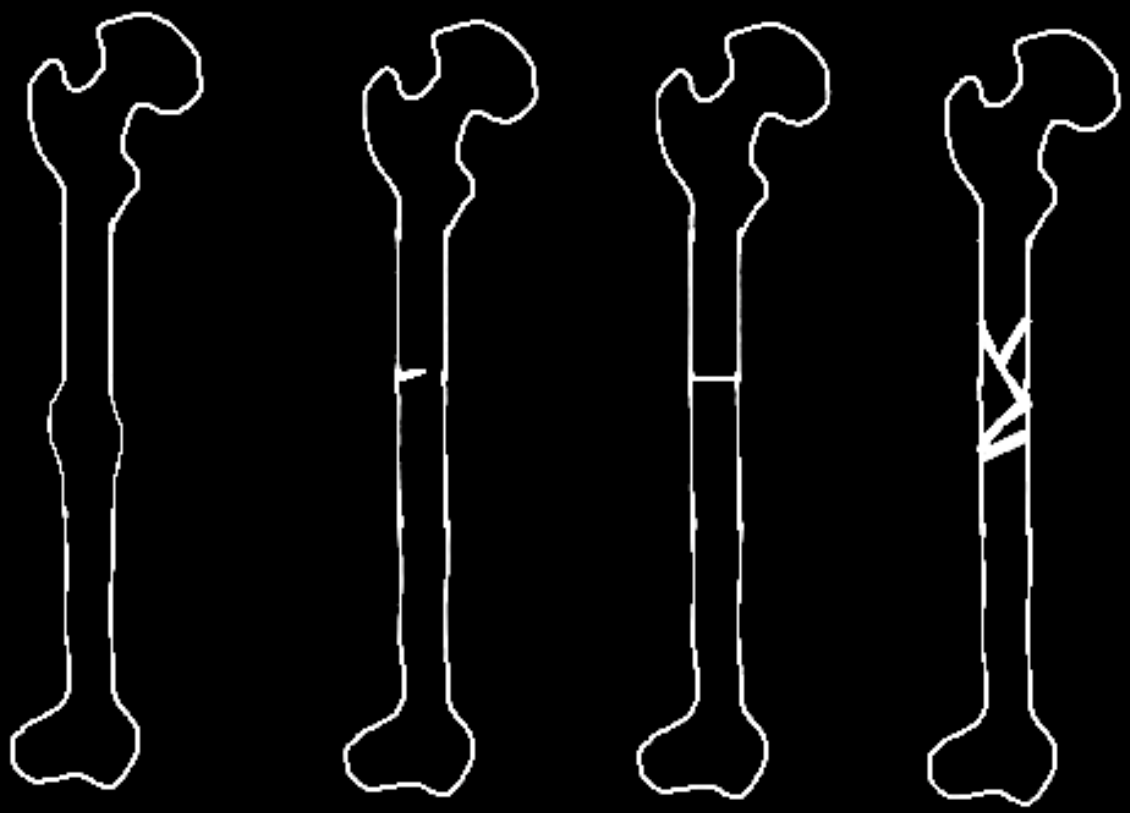
- Dislocation
  - Abnormal separation at a joint
- Subluxation
  - Partial dislocation
  - Common causes:
    - Ligamentous injury
    - Osteoarthritis
    - Rheumatoid arthritis
    - SLE

# ALIGNMENT

- Apex volar (palmar) angulation.
- Dorsal angulation of the distal fragment relative to the proximal fragment

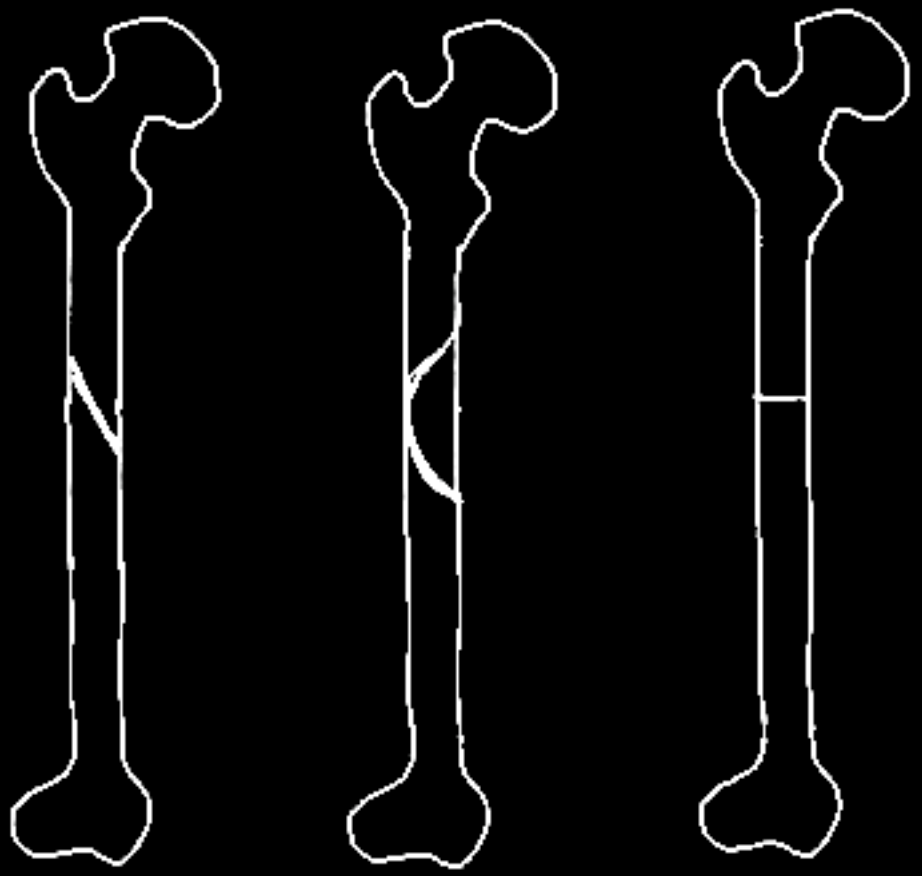
# FRACTURE: TYPES

- Torus
- Greenstick
- Complete
- Comminuted



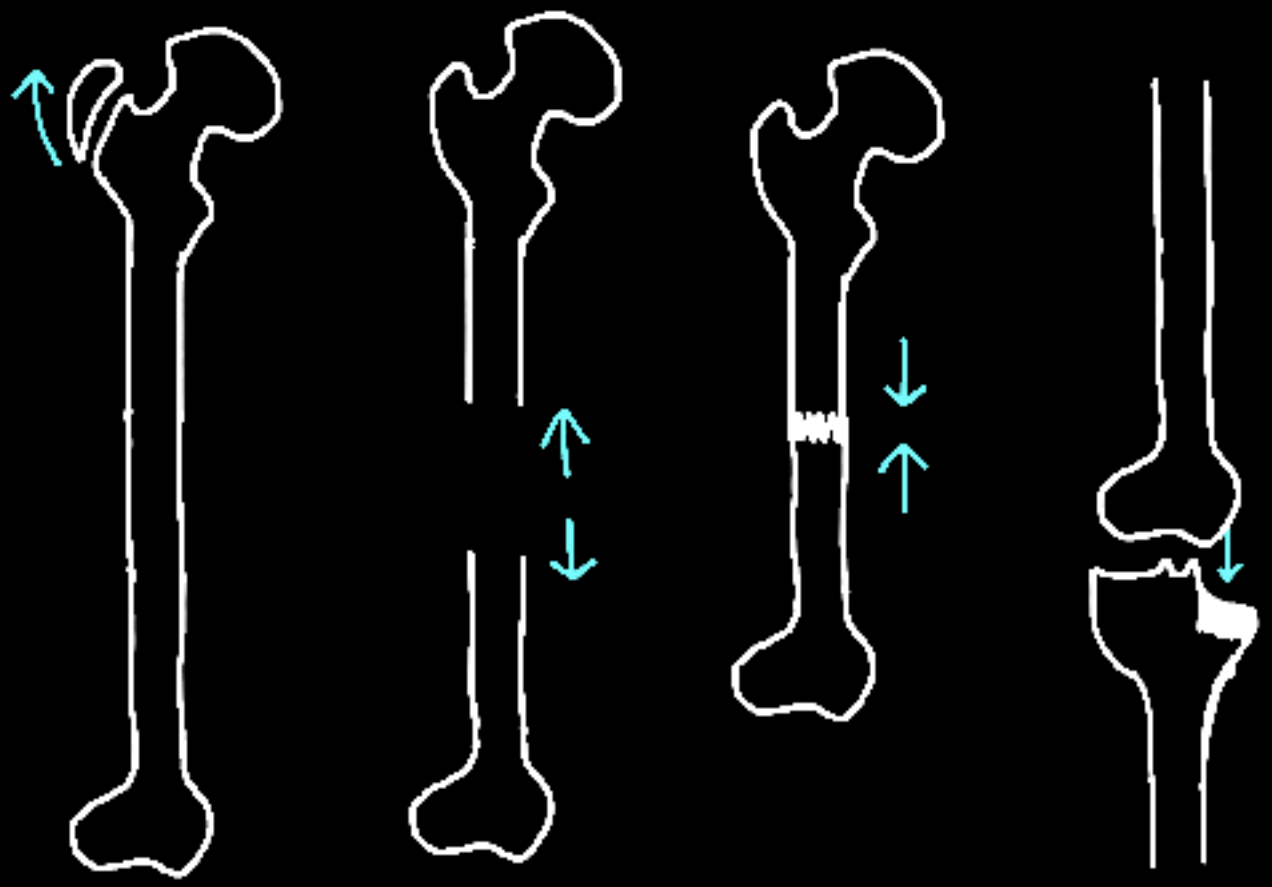
# FRACTURE: ORIENTATION

- Oblique
- Spiral
- Transverse



# FRACTURE - SEPARATION/OVERLAP

- Avulsion
- Distraction
- Impaction
- Depression



# FRACTURE: ARTICULAR INVOLVEMENT

- Intra-articular involvement
  - Associated damage to the cartilage space
  - Increased risk for secondary osteoarthritic changes
  - Implications for treatment

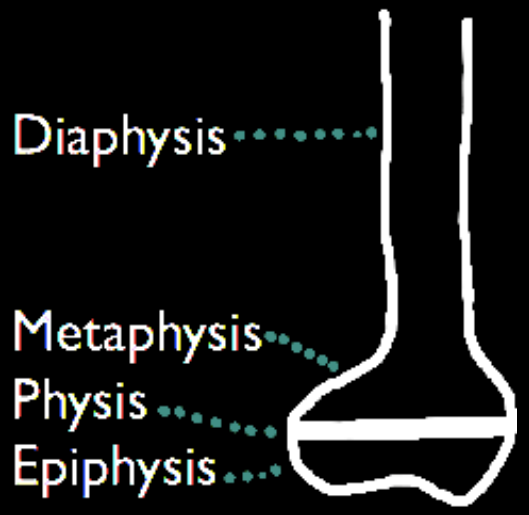
# FRACTURE- HEALING

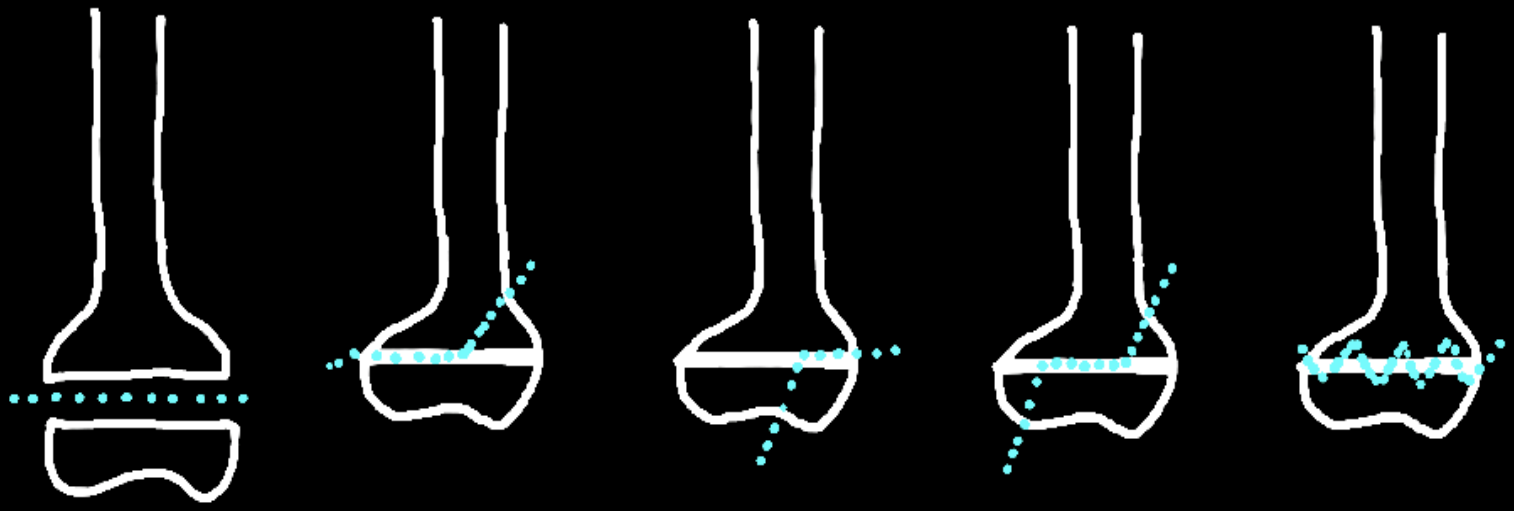
- Expected changes:
  - Resorption
  - Bone formation
    - Blurring across fracture lines
    - Subperiosteal bone formation
    - Sclerosis
    - Callus
- Complications:
  - Nonunion
  - Malunion
  - Avascular necrosis

# FRACTURES IF PHYSES NOT CLOSED

Salter Harris Classification

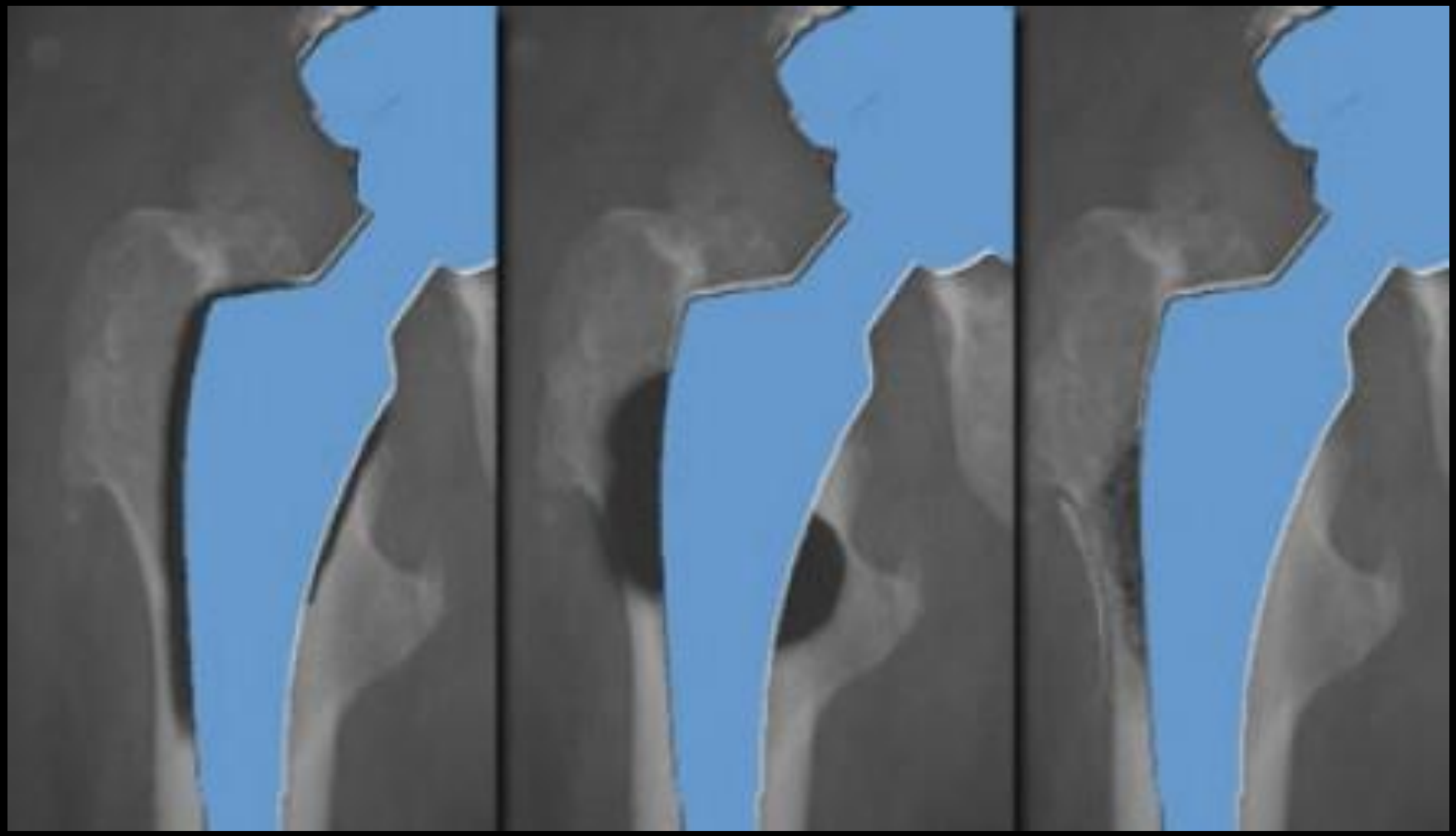
- 1 – Physis
- 2 – Physis/Metaphysis
- 3 – Physis/Epiphysis
- 4 – Physis/Epiphysis/Metaphysis
- 5 – Crush Physis



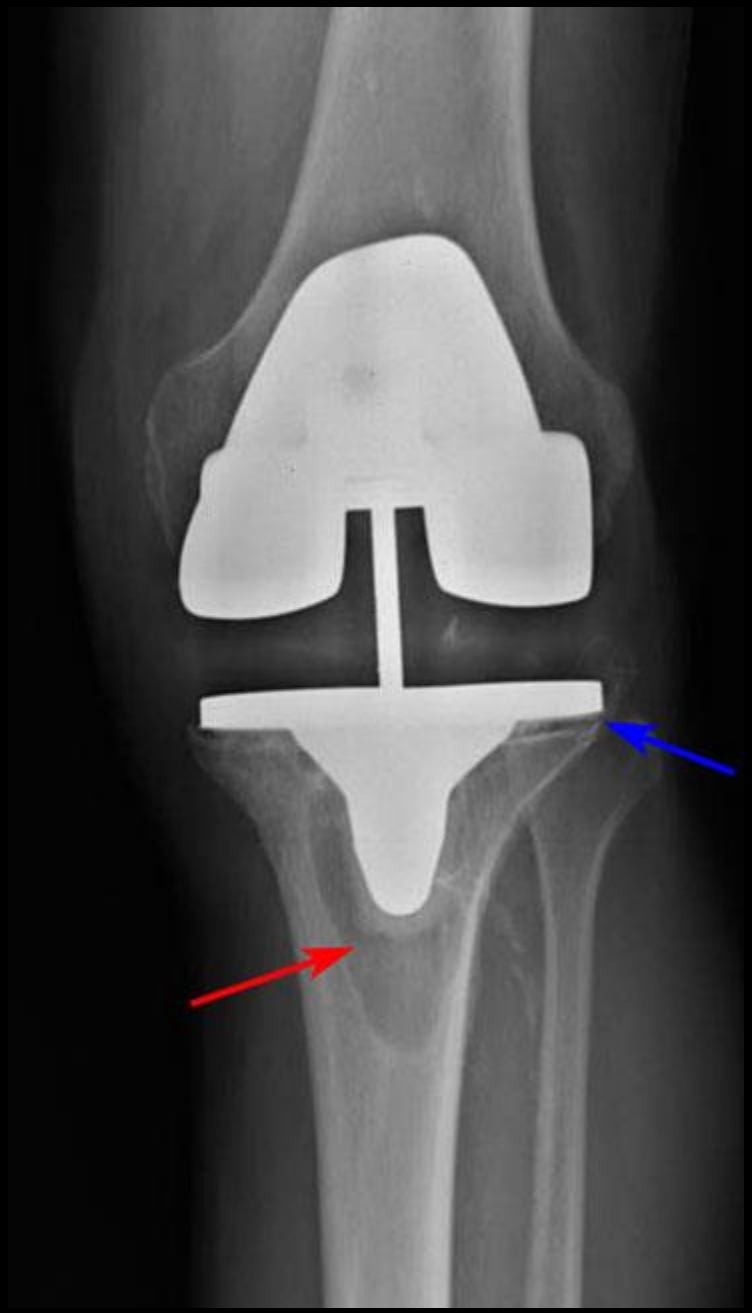
# HARDWARE

- Loosening
  - Look for lucent rim > 2mm or displacement of the components
- Fracture
  - Look on multiple views



Loosening (left) - Particle disease (middle) - Infection (right)

http://www.radiologyassistant.nl/en/p431c8258e7ac3/hip-arthroplasty.html



http://orthoinfo.aaos.org/figures/A00712F03.jpg

https://radiologykey.com/wp-content/uploads/2017/01/image00837-1.jpeg


http://image.wikifoundry.com/image/1/mGRYJNzPk4h_W201Uxb6Sw142301/GW450H600

http://d2y3mehm86iyu9.cloudfront.net/content/jbjsbr/96-B/12/1699/F2/graphic-2.large.jpg

# ABCDEs for Arthropathy

**ALIGNMENT**

**BONE DENSITY**

**CARTILAGE SPACE**

**DISTRIBUTION**

**EROSIONS**

**SOFT TISSUES**

# BONE DENSITY

- Definitions
  - Osteopenia: lack of osteoid (bone marrow density T-score -1 to -2.5)
  - Osteoporosis:  lack of osteoid (bone marrow density T-score < -2.5)
  - Osteomalacia:  lack of calcium hydroxyapatite deposition on osteoid
- Site to objectively assess
  - Second or third metacarpal
  - Sum of the cortices should be ¼ to 1/3 the thickness of the metacarpal

# CARTILAGE SPACES

- Pattern
  - Uniform narrowing
  - Nonuniform narrowing
- Narrowing
  - Mild
  - Moderate
  - Severe (bone on bone appearance)
- Widening
  - Resorption

# CARTILAGE SPACES

- Cartilage space destruction is hallmark of arthritis
  - Degenerative
    - Osteoarthritis
  - Inflammatory
    - Rheumatoid arthritis
    - Spondyloarthropathies
  - Crystal deposition
    - Gout
  - Hematologic
    - Hemophilia
  - Metabolic

# DISTRIBUTION

- Hands: DIP and PIP --- OA, psoriatic arthritis
- Hands: MCP and PIP --- RA
- Wrist: CMC --- OA or gout
- Wrist: Diffuse --- inflammatory

# EROSIONS

- Etiologies
  - Rheumatoid arthritis
  - Spondyloarthropathies
  - Erosive osteoarthritis
  - Infection
- Aggressive features
  - Dot-dash appearance
  - Pencil-in-cup deformity
- Nonaggressive features
  - Sclerosis

# SOFT TISSUES

- In the setting of trauma:
  - Subcutaneous tissues
    - Swelling
      - Obliteration/Displacement of fat planes
    - Hematoma
    - Lacerations/ soft tissue defects
    - Foreign body
  - Muscles
    - Hematoma
  - Joint
    - Effusion
      - Displacement of fat pads
    - Lipohemarthrosis

# SOFT TISSUES

- Non-trauma setting
  - Soft tissue swelling
    - Asymmetric
    - Diffuse
    - Lumpy bumpy
  - Calcifications
    - Subcutaneous tissues
    - Muscle
    - Tendon
    - Disc
  - Joint effusion

# EXAMPLE CASES

# Case 1

# Case 1

- Mid diaphyseal fracture of the left humerus with marked apex medial angulation.

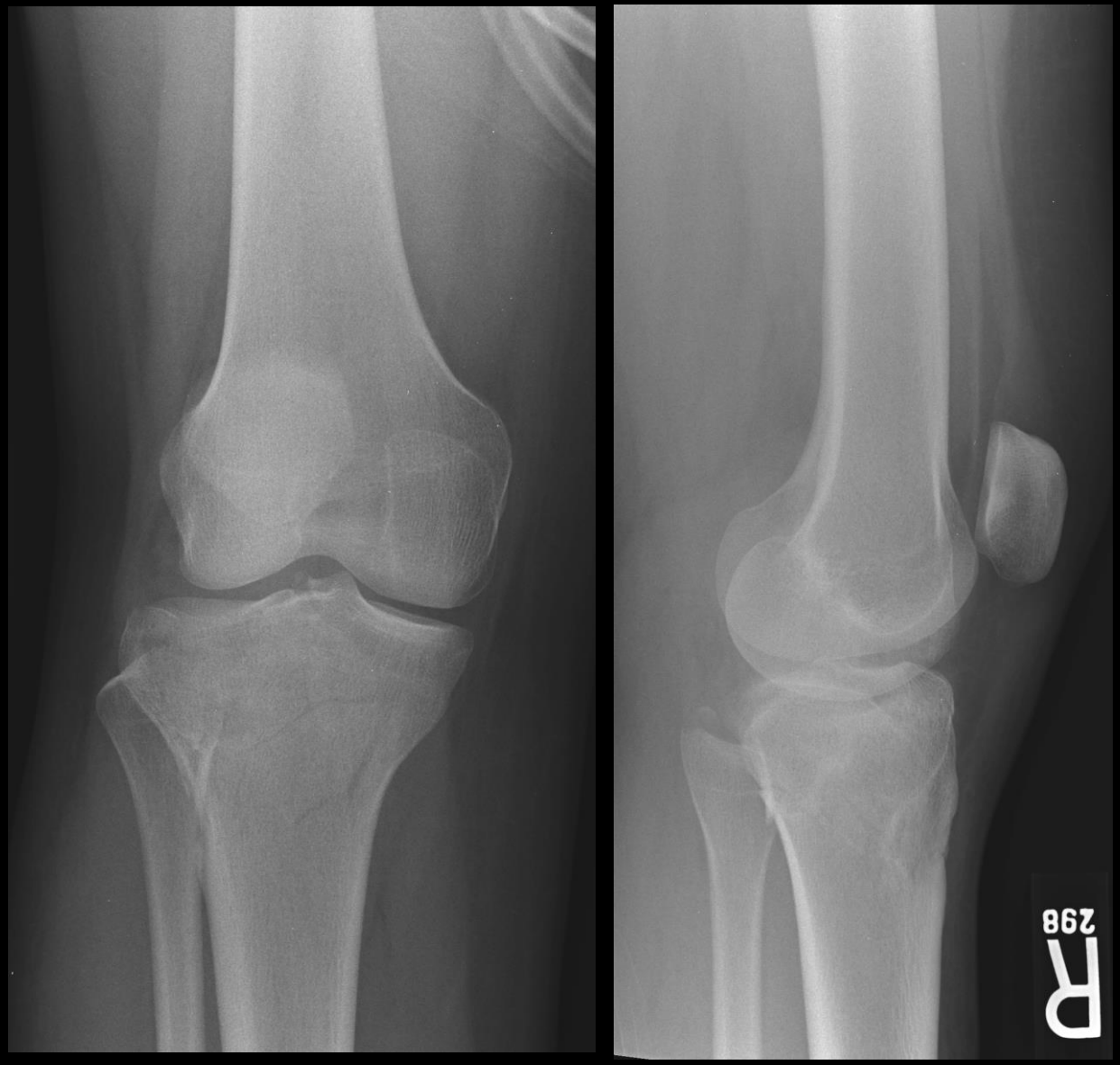
# Case 2

# Case 2

- Avascular necrosis of the lunate-Kienböck malacia
  - sclerotic and abnormal in shape of the lunate
  - Lunate collapse due to aseptic necrosis.
  - Associated with negative ulnar variance

# Case 2

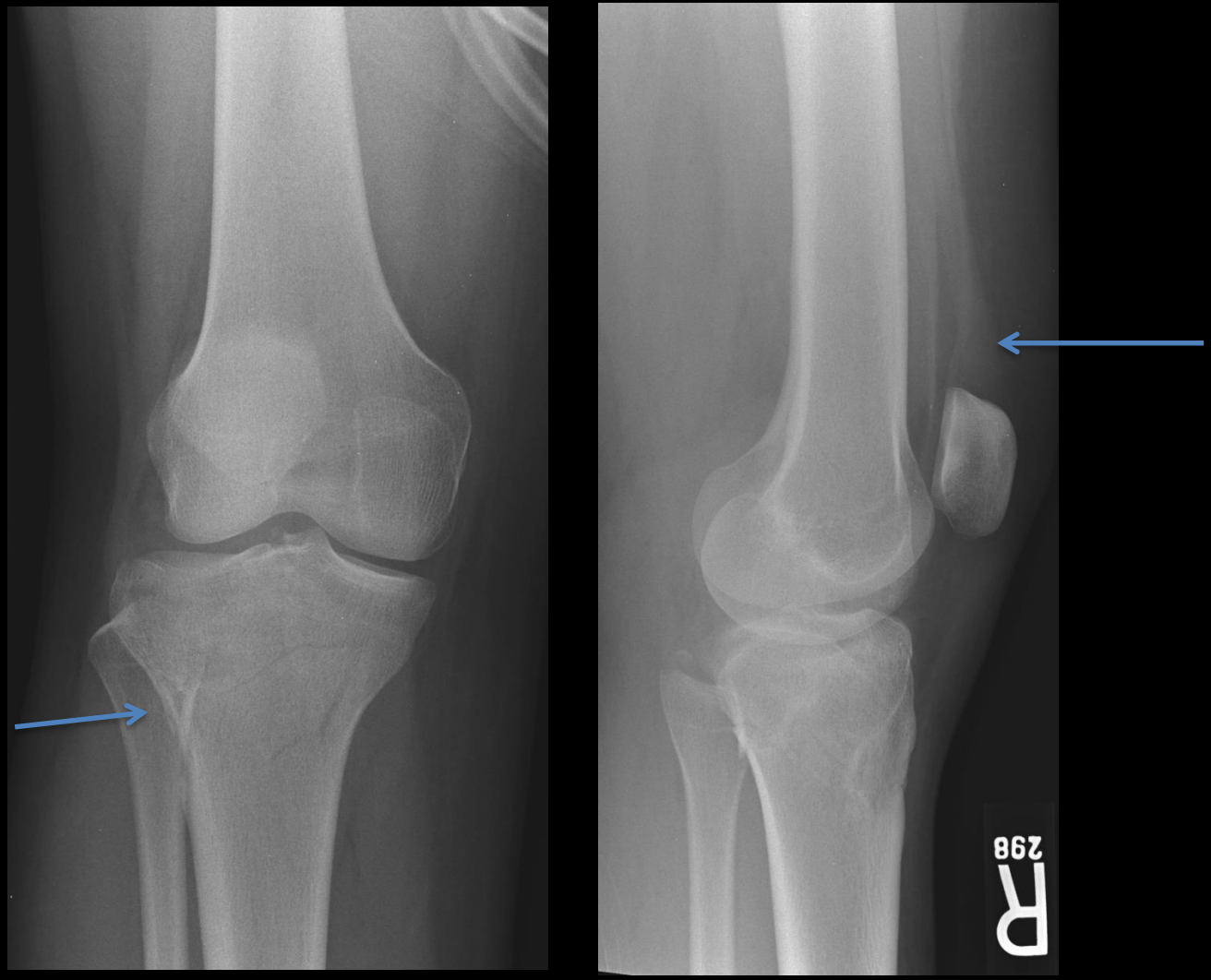
# Case 3



# Case 3

- LIPOHEMARTHROSIS
  - Fat admixed with joint fluid and blood due to fracture
  - Superior layer is fat, central layer is fluid, dependent layer is blood cells
  - Demonstrate on cross-table lateral view of knee
  - If do not see a fracture, can consider CT for further evaluation.

# Case 3



# Case 4

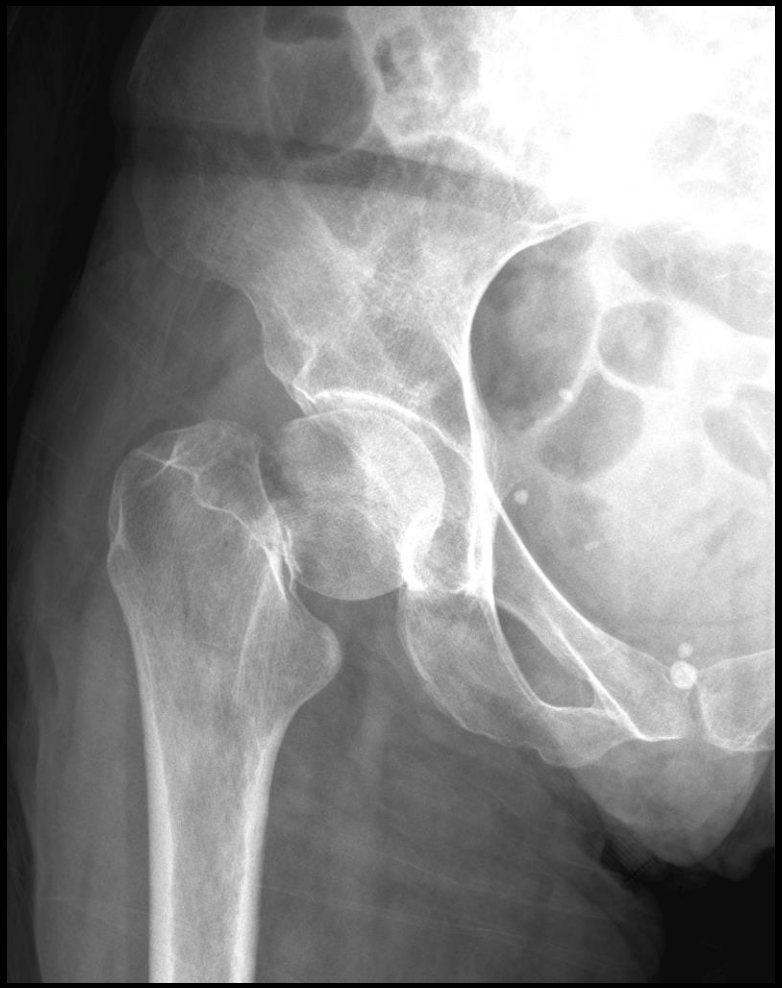
# Case 4

- EROSIVE OSTEOARTHRITIS
  - Subchondral new bone
  - Osteophytes
  - Cysts
  - Subluxation
  - Non-uniform loss of joint space
  - To distinguish from psoriatic arthritis
    - Central erosions with erosive OA (seagull)
    - **P**eripheral erosions with **P**soriatic arthritis (mouse ears) at ITPs
    - RA = peripheral erosions at MCPs

# Case 4

# Comparison: Rheumatoid Arthritis


# Case 5A



# Case 5A

- SUBCAPITAL FRACTURE OF THE RIGHT HIP:
  - Types of hip fractures

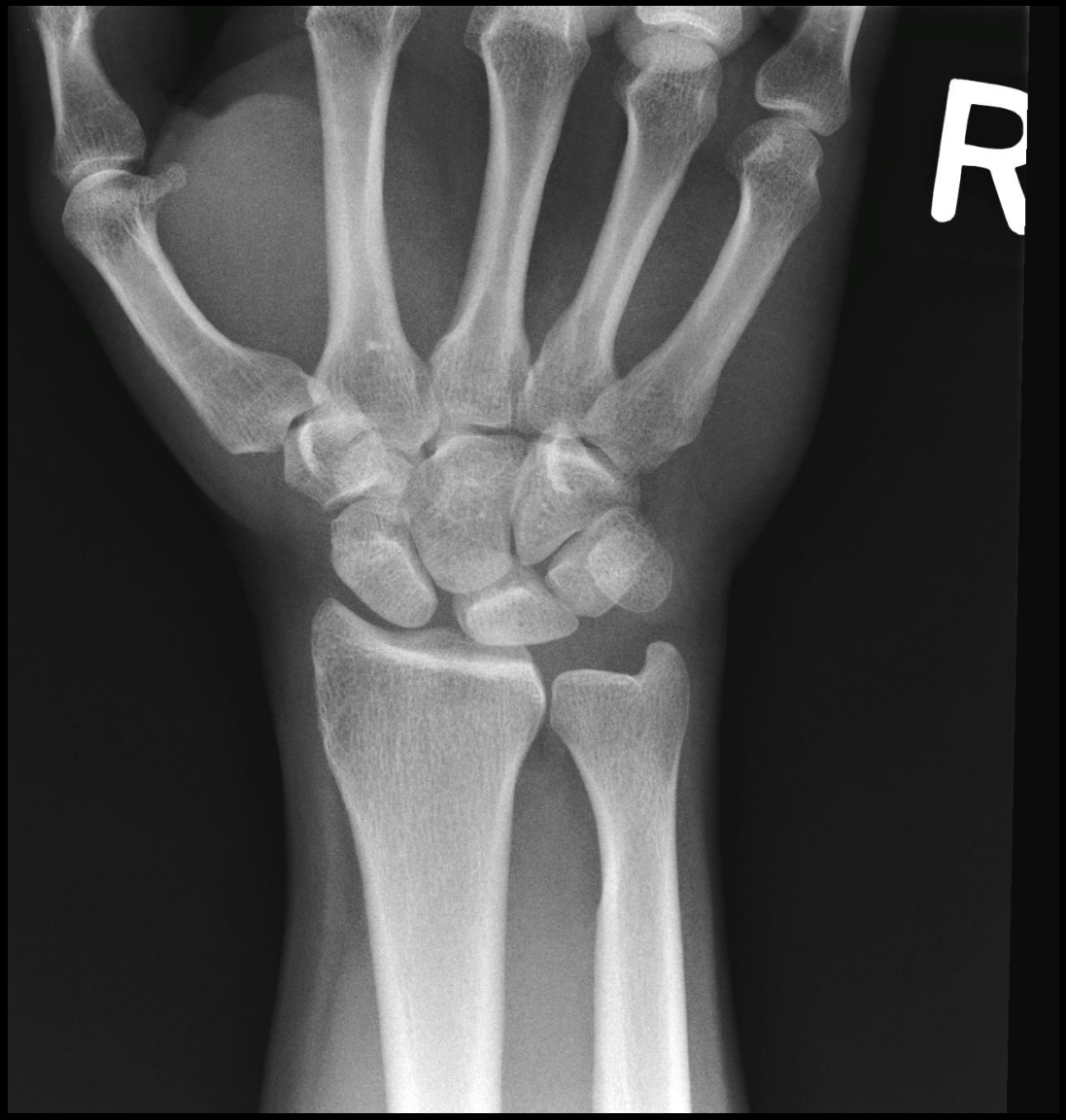

  - Implications for treatment if displaced with subcapital fx

# Case 5B


# Case 5B

- Intertrochanteric fracture with mild lateral displacement

# Case 6



# Case 6

- Scapholunate dislocation
  - Scapholunate widening of greater than 3 mm
  - Indicative of disruption of the scapholunate ligament resulting in carpal instability
  - Terry Thomas or David Letterman sign

# Case 6

# Case 6

- Stress fracture of mid-distal diaphysis of the second metatarsal.
  - Periosteal bone formation.
  - Stress fracture versus insufficiency fracture:
    - Stress fracture: Abnormal/Excessive stress on normal bone.
    - Insufficiency fracture: Normal stress on abnormal bone.

# Case 7

# Case 7

- Left 5th Metatarsal Fracture with volar and radial angulation.
  - Also known as a boxer's fracture.

# Case 8

# Case 8

- Periprosthetic left femoral fracture with medial and posterior displacement.
  - Concern for vascular injury.

# Case 9

# Case 9

- Odontoid C2 fracture
  - Types of dens fractures:
    - Type 1: Avulsion of tip of dens
    - Type 2: Fracture through base of odonotid UNSTABLE
    - Type 3: Fracture through the base of odontoid into the body.
  - Secondary signs: prevertebral soft tissue swelling

# Case 10

# Case 10


# Case 10

- Dislocation of the second PIP joint

# Case 11

# Case 11

- Hill Sachs deformity of the left shoulder
  - Sequelae of shoulder dislocation.
  - Most radiographs of the shoulder are post-reduction films.
  - Important to assess for secondary signs of dislocation:
    - Hill Sachs deformity
    - Bankhart fracture of the glenoid

# Case 12

# Case 12

- Base of fifth metatarsal fracture extending into intermetatarsal joint.
  - Usually involves metaphyseal-diaphyseal junction.
  - Remember to always look at the base of the fifth metatarsal on trauma foot film

# Case 13


# Case 13

- Trimalleolar fracture
  - Fracture of the distal fibula, distal medial tibia, and distal posterior tibia.

# Case 14

# Case 14

- Comminuted fracture at the base of the first metacarpal bone extending into the first CMC joint.
  - Also known as a Rolando fracture.
  - If fracture is not comminuted, known as a Bennett fracture.