

# GENERAL

Accurate description of injury includes location, angulation, displacement, apposition and articular surface involvement.

Common types of hardware are described with an emphasis on common complications of the plates, screws and wires. Ne should realize that ORIF is reserved for fracture fixations w an actual longitudinal skin incision and application of plates and screws.

Wrist: distal radioulnart joint, prox and distal carpal rows, carpometacarpal joints

Hand: MC bones, MCP joints, phalanges, and IP joints.

Ligament types in the wrist:

- Intrinsic / interosseus: those that connect 1 carpal bone to another
  - Scapholunate ligament: resists volar flexion of scaphoid and dorsal flexion of lunate.
  - Lunotriquetral ligament: balances prox carpal row motion in opposite direction
- Extrinsic / capsular: connect carpal bones to adjacent structures like the distal radius/ulna and MCs
- Triangular fibrocartilage complex: composed of fibrocartilage b/n distal ulna and prox carpal row, dorsal and volar radioulnar ligaments, ulnomeniscal homologue, volar ulnotriquetral and ulnolunate ligaments, and ulnar collateral ligament.
  - Integral to stability of the DRUJ.

The radial and ulnar arteries branch into deep and superficial arches in the palmar aspect of the hand. The ulnar artery is at particular risk for injury in a 2-cm segment as the superficial branch leaves Guyon canal and passes over the flexor retinaculum prior to entering the palmar aponeurosis. The radial artery is at risk as its superficial branch runs deep to the abductor pollicis brevis tendon just over the trapezoidal ridge.

Imaging:

- Radiologic evaluation is essential for evaluation of the injured distal upper extremity. The posteroanterior (PA), oblique, and lateral XR of the wrist, hand, and thumb are essential for adequate evaluation.
- Additional scaphoid, clenched-fist, ulnar- or radial-deviated views, and the like may be added as deemed necessary. True PA and lateral views of each injured digit are essential; an additional oblique view commonly is recommended.

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# Search Pattern

## MINI

[The Radiology Assistant : Carpal instability](#)

## WRIST RADIOGRAPH

PA / FRONTAL VIEWS are to assess what is wrong

LATERAL VIEW shows in what direction the bones move.

OBLIQUE VIEW is best for looking at trapezium-trapezoid joint in profile.

FRONTAL / OBLIQUE / Lateral / Look at bones for fractures

- Trace cortex of all bones bottom to top.
- Assess shape of scaphoid (smooth borders) and lunate (triangle) carpal bones

FRONTAL / Look for dislocation

- Assess scapholunate interval
- Trace the three carpal arcs of Gilula
- Assess carpal joint spaces
  - Capitulum joint is considered the baseline joint width for comparison
- Trace carpometacarpal joints and ensure M pattern
- Assess the first carpometacarpal joint and ensure no overlap with trapezium on all 3 views.
- Assess radial inclination
- Ulnar variance
- ST

## LATERAL

- Assess lateral technique
  - Volar aspect of pisiform is equidistant between the volar borders of the scaphoid tuberosity and capitate head.
- Assess for triquetral fracture dorsal to proximal carpal row.
- Assess distal radius
- Assess carpal stability (capitate, lunate, distal radius must be coaxial)
  - Lunate or perilunate dislocations (what is centered over the radius?)
  - Assess scapholunate angle
    - Scaphoid axis: draw line along inferior border of scaphoid
    - Lunate axis: draw line perpendicular on midline lunate
    - Normal: 30 - 60 degrees

- Maybe abnormal 60 - 80 degrees
- Abnormal >80 degrees = wrist instability
- Assess capitolunate angle
  - Draw lunate axis. Drawn capitate axis down midportion
  - Normal <30
- Assess angulation of lunate relative to other carpal bones
  - Dorsiflexion carpal instability / dorsal intercalated segmental instability: lunate tilted backwards 2/2 scapholunate ligament tear or scaphoid problem.
  - Volarflexion carpal instability / volar intercalated segmental instability: lunate tilted forwards 2/2 lunotriquetral ligament tear.
- Assess volar tilt for radial fx and deformity
- ST

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## FULL

Common indications: pain, trauma, arthritic etiologies, and many other reasons

Check indication, hx, priors

Assess technique and overall extent of abnormality

- Make sure lateral is well positioned, with pole of scaphoid superimposed on pisiform
  - True lateral: anterior surface of pisiform should lie halfway between anterior surface of capitate and scaphoid.
- Obtain a "scaphoid" (ulnar-deviated) view if there is suspicion for a scaphoid fx
- Get gestalt view of pathology
- Consider bone morphology and mineralization
- Consider that the carpal coalition is most commonly lunotriquetral

Assess any hardware

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## FRONTAL & OBLIQUE

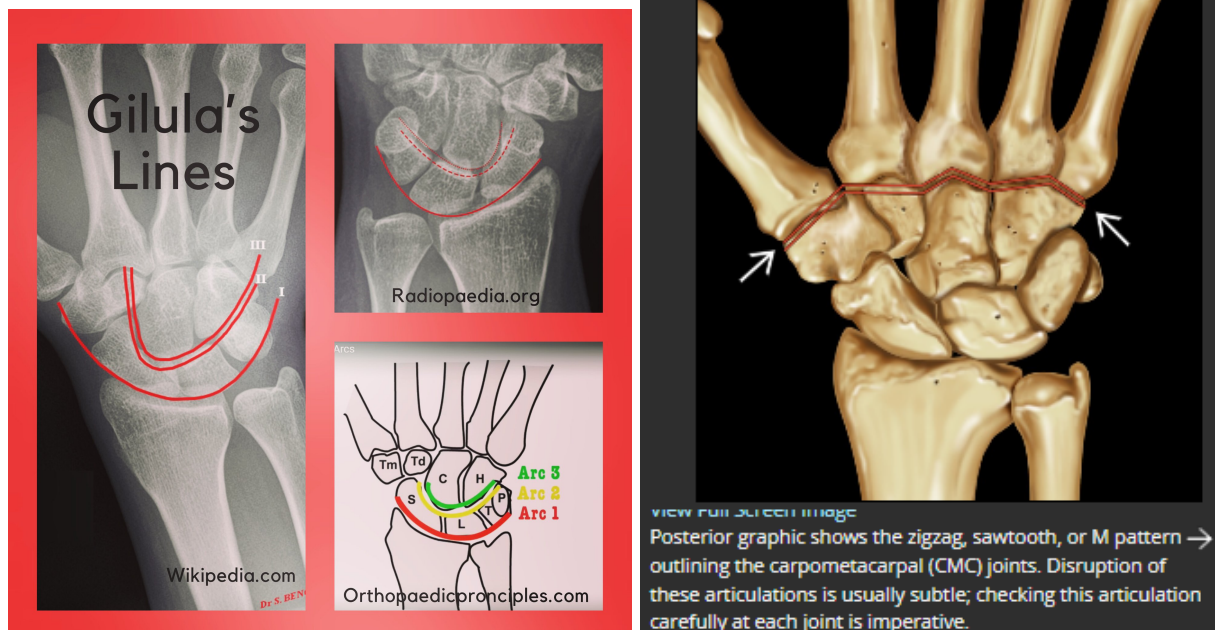
Look for fractures (Frontal and oblique views)

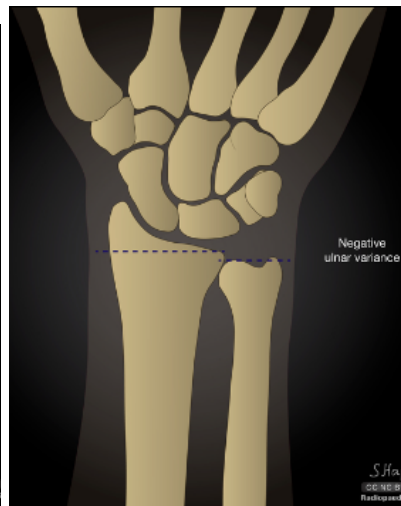
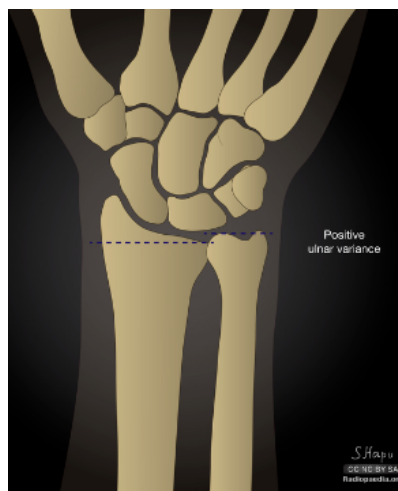
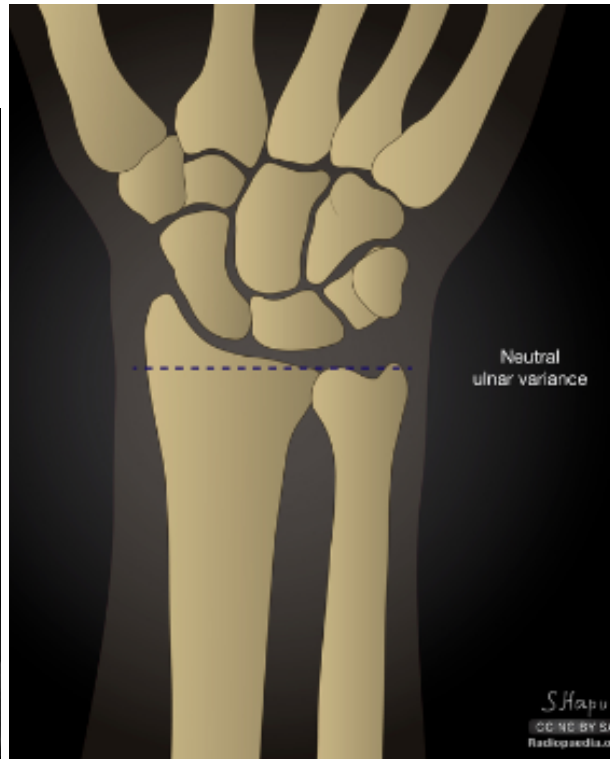
- Trace each cortices and look carefully for small osseous fragments about digits.
- Look carefully at the scaphoid. The medial border of scaphoid should be absolutely smooth on all projections. If not, suspect fx.

Look for dislocation and instability (frontal)

- Trace the three carpal arcs of Gilula

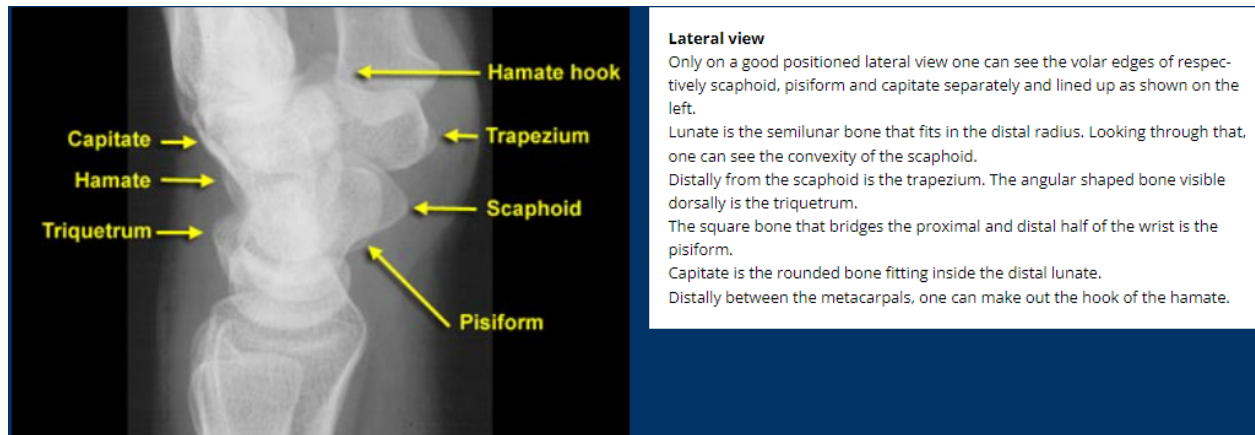
- Look for abnormal overlap (carpometacarpal dislocation)
  - The first carpometacarpal joint normally appears to be subluxated but the MCP base should NOT overlap with the trapezium on all 3 views.
- Look at the shape of the carpal bones.
  - Is the lunate triangular in appearance?
- Assess the scapholunate interval (>3mm abnormal in adults)
  - Scapholunate ligament (dorsal, central, volar components) are important for carpal stability and can result in increased distance of SLI resulting in DISI deformity if dorsal component disrupted -> SLAC
- Assess radial inclination
  - <15 degrees indicates distal radius fx
  - Nml 21 - 25 degrees
  - >25 degrees = madelung deformity
- Assess for positive / negative ulnar variance
  - Positive = ulna >2.5 mm beyond radius margin at DRUJ
    - Associated w ulnar impaction syndrome
  - Negative = ulna <= 2.5 mm than radius at the DRUJ
    - Associated w Kienbock dz and ulnar impingement syndrome





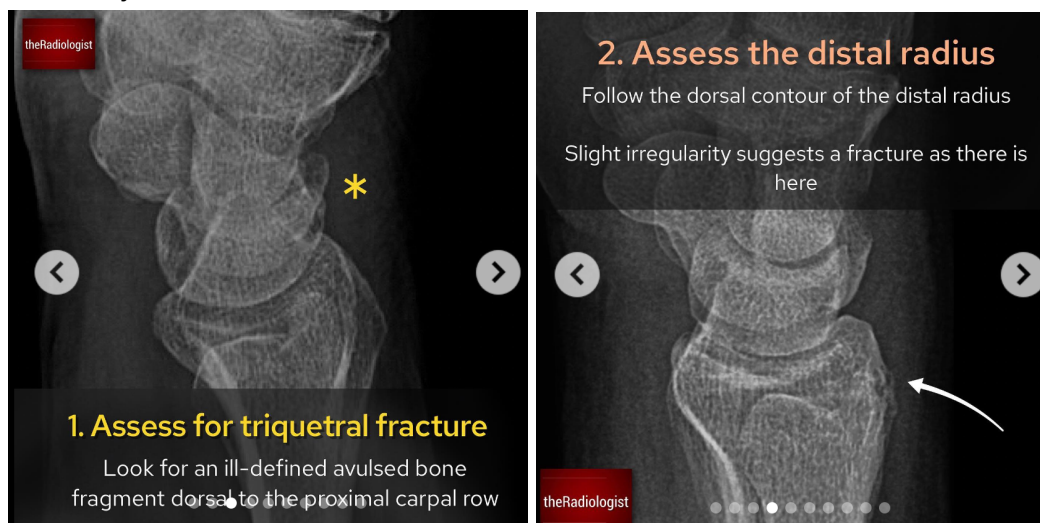

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LATERAL



Look for fractures

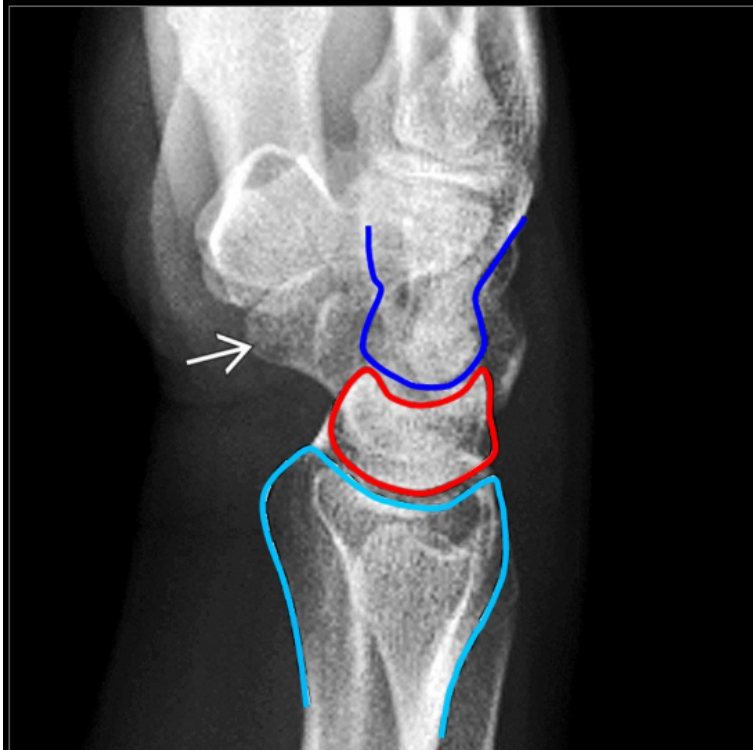
- [ASSESSING LATERAL XRAY](#)
- Look for an osseous fragment at dorsal aspect of hand (common for triquetral fx)
  - Triquetral avulsion fx is 2nd MC carpal bone fx after scaphoid.
- Fx of hook of hamate may be seen best on lateral view.
- Look carefully for small osseous fragments about the digits which can indicate avulsion injuries



Look for dislocation and instability

- Look for lunate and perilunate dislocations
  - The radius, lunate and capitate must be coaxial.
- Assess volar tilt for distal radius fx and radial deformities
  - Nml 7-15 degrees
  - >10 dorsal tilt
  - >20 degrees of volar tilt = unstable fx
  - >25 degrees volar tilt = contributes to dorsal intercalated segment instability (DISI)
- Assess for angulation of the lunate on the lateral view relative to the other carpal bones (DISI/VISI)

- Dorsiflexion carpal instability (DISI)
  - Lunate tilted backwards 2/2 scapholunate ligament tear or scaphoid problem
- Volarflexion carpal instability (VISI)
  - Lunate tilted forwards 2/2 lunotriquetral ligament tear

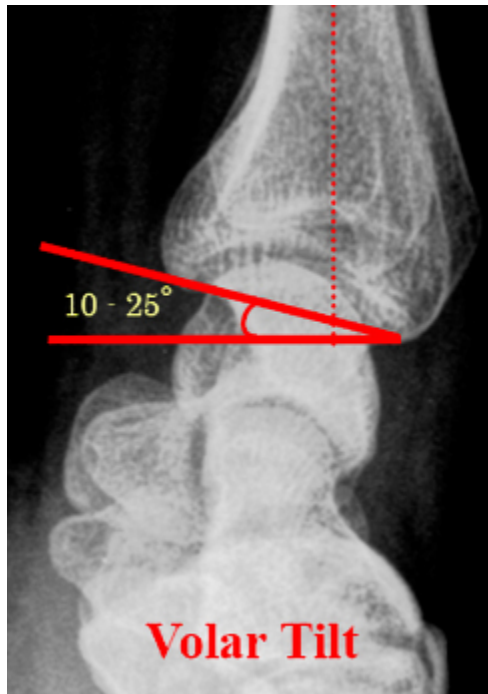


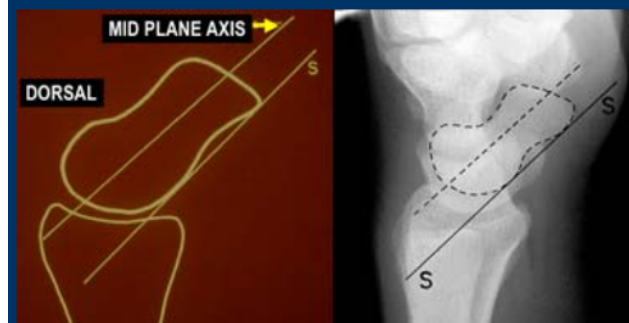
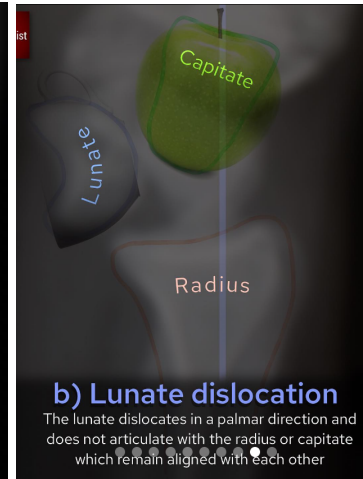
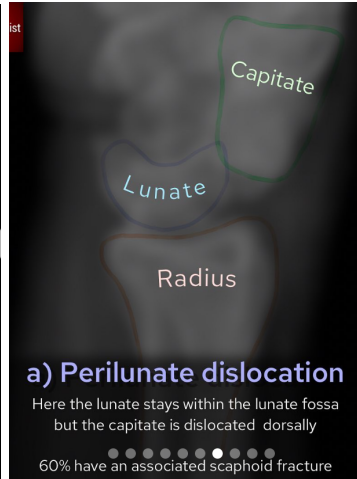
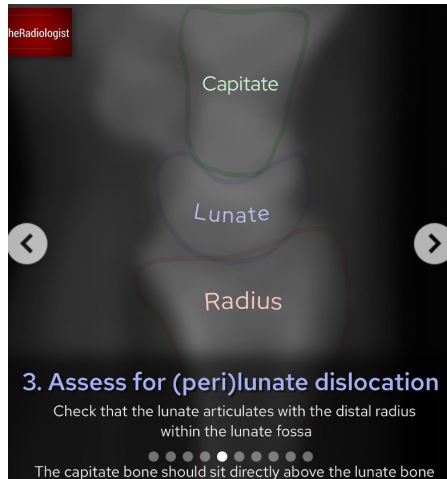
Lateral XR allows evaluation of carpal stability by identifying the capitate (dark blue line), lunate (red line), distal radius (light blue line), and scaphoid → to measure key carpal angles.



Lateral wrist XR is properly positioned when the volar aspect of the pisiform ⇄ is equidistant between the volar borders of the scaphoid tuberosity → and capitate head →. This view is obtained with the wrist in neutral position and the ulnar (medial) aspect of the wrist on the image receptor.

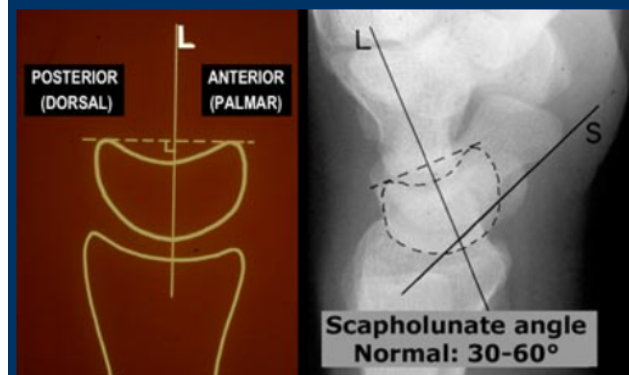
- DISI: axes of radius, lunate, and capitate assume zigzag configuration
  - Dorsal angulation of lunate relative to radius
  - Volar angulation of capitate relative to lunate
  - Rotary subluxation of scaphoid frequent
  - Lateral ligament abnormalities, including SLL, volar radioscaphocapitate ± dorsal intercarpal ligament
  - Results in abnormal angulations: lateral capitolunate angle  $> 30^\circ$ , scapholunate angle  $\geq 80^\circ$
- VISI: axes of radius, lunate, and capitate assume reverse zigzag configuration
  - Volar angulation (volar flexion) of lunate relative to radius
  - Dorsal angulation of capitate relative to lunate
  - Volar-sided ligament abnormalities, including LTL ± medial arcuate (triquetrohamatocapitate), dorsal radiocarpal
  - Dynamic instability (PMCI) may progress to static instability (VISI)
  - Results in abnormal angulations: scapholunate angle  $< 30^\circ$  ± capitolunate angle  $> 30^\circ$





#### Scaphoid axis

The true axis of the scaphoid is the line through the midpoints of its proximal and distal poles. Since the midpoint of the proximal pole is often difficult to appreciate, an almost parallel line can be used that is traced along the most ventral points of the proximal and distal poles of the bone (figure).



#### Lunate axis

The axis of the lunate runs through the midpoints of the convex proximal and concave distal joint surfaces and can best be drawn by finding the perpendicular to a line joining the distal palmar and dorsal borders of the bone as demonstrated on the left.

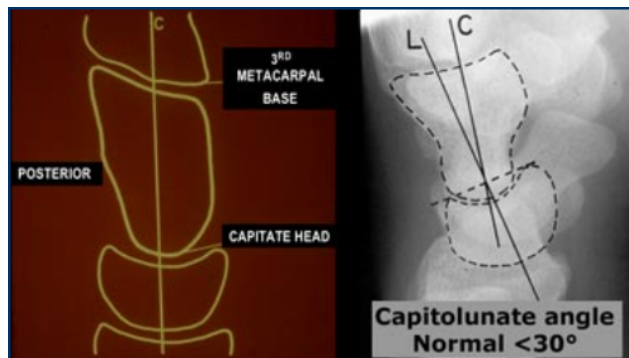
#### Scapholunate angle

Normal: 30 - 60°

Questionably abnormal: 60 - 80°

Abnormal: > 80° This indicates instability of the wrist.

LEFT: Lunate axis drawn perpendicular to a line joining the distal palmar and dorsal bordersRIGHT: Radiograph with lunate and scaphoid axis drawn.



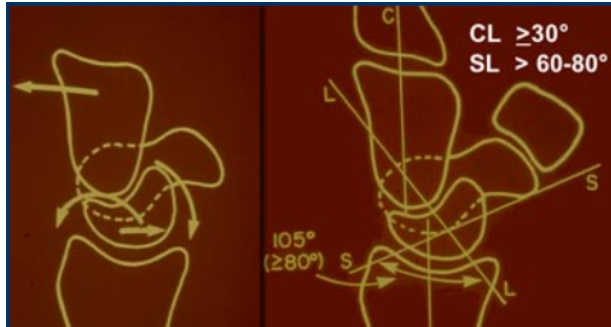
#### Capitate axis

The capitate axis joins the midportion of the proximal convexity of the third metacarpal and that of the proximal surface of the capitate.

#### Capitolunate angle

Normal: Abnormal: > 30°. This indicates instability of the wrist.

LEFT: Capitate axisRIGHT: Radiograph with lunate and capitate axis drawn.



LEFT: Dorsal tilting of the lunate in DISI RIGHT: Scapholunate angle is  $> 80^\circ$

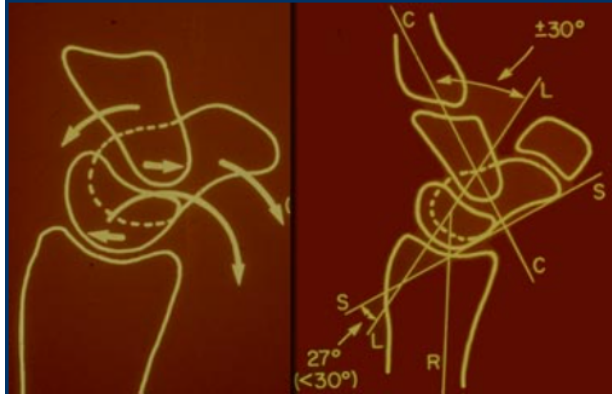
#### DISI or dorsiflexion instability

DISI is short for dorsal intercalated segmental instability.

The intercalated segment is the proximal carpal row identified by the lunate. The term 'intercalated segment' refers to it being the part in between the proximal segment of the wrist consisting of the radius and the ulna and the distal segment, represented by the distal carpal row and the metacarpals.

So all this means is that in DISI or dorsiflexion instability the lunate is angulated dorsally.

If you think lunate is tilted, measure the scapholunate angle (30-60° is normal, 60-80° is questionably abnormal,  $> 80^\circ$  is abnormal) and the capitulate angle (In the figure on the left the scapholunate angle is measured: it is 105 degrees. As mentioned before this angle is considered abnormal if greater than 80 degrees.



LEFT: Volar tilting of the lunate in VISI RIGHT: Scapholunate angle is  $\pm 30^\circ$

#### VISI or volarflexion instability

Volar intercalated segmental instability or palmar flexion instability is when the lunate is tilted palmarly too much.

While most DISI is abnormal, in many cases VISI is a normal variant, especially if the wrist is very lax.

Look for degenerative changes and erosions

Look for other osseous lesions

- On every view look for lucent / sclerotic lesions

Assess ST

- Look for displacement of fat planes (pronator quadratus fat pad sign)
- Look for swelling around the ulnar styloid, as may be seen w erosive arthritis

# Anatomy / Images

[Wrist bones and alignment | Radiology anatomy part 1 prep | Wrist X-ray interpretation](#)



🏠 Hand x-rays are performed in cases of patients with suspected arthritis to try and evaluate the cause but more commonly are performed in cases of trauma

🏠 When it comes to trauma there are a few areas I look at in particular every time - these review areas have helped me become more confident when looking at these X-Rays and hopefully they can do the same for you:

- Always start any trauma related X-Ray by looking at the soft tissues - the site of swelling can lead you to the fracture
- Check the metacarpal heads - an indented 4th or 5th metacarpal is common after a punching injury - termed a Boxer's fracture. Don't stop there in these patients - draw a line across the base of each metacarpal and this should join up. Sometimes the 4th/5th metacarpals can dislocate and travel downwards so they overlap the carpal bones - here your line won't join up. Overlapping bones on a hand X-Ray should always make you think!
- Outline the base of the thumb metacarpal - forced abduction can cause an intra-articular fracture known as Bennett's fracture (or Rolando fracture if comminuted)
- Do all of the fingers look well aligned? Check for subluxation and dislocation - you may need further views to be sure
- When it comes to carpal bones, scaphoid injuries are most common but you will need a whole scaphoid series. A normal X-Ray can't exclude a scaphoid fracture. Practice varies with what to do next, some bring back people with snuffbox tenderness in 7-10 days to do an X-Ray, some to do a repeat clinical assessment whilst in some institutions they come back for an MRI
- The spaces between the carpal bones should be equal, if you see a widened distance between the scaphoid and lunate consider scapholunate dissociation (Terry Thomas sign)

▼ As always take your time, zoom up and outline the cortex of each bone, use a system and check two views!

