

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

# **Wrist intrinsic ligaments MRI**

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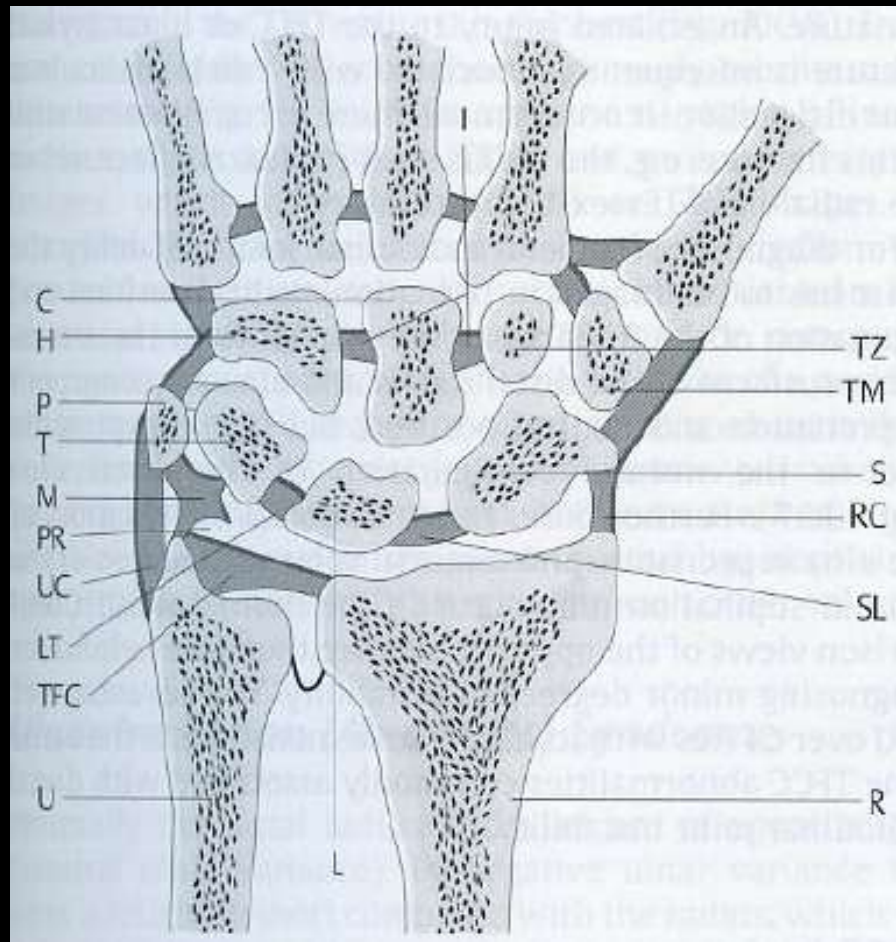
# Ligaments

## Wrist ligaments

- Intrinsic carpal ligaments -- connect carpal bones to one another.
- Extrinsic ligaments -- connect forearm bones to wrist bones.

# **Intrinsic ligaments**

# **Scapho-lunate & luno-triquetral ligaments**



### Wrist Ligaments (C- Coronal section)

**C** = capitate, **CT** = capito-triquetral ligament, **H** = hamate, **I** = interosseous ligaments (distal carpal row). **L** = lunate, **LT** = luno-triquetral ligament, **M** = meniscus homologue, **P** = pisiform, **PR** = prestyloid recess, **R** = radius, **RC** = radial collateral ligament, **RLT** = radio-luno-triquetral ligament, **RSC** = radio-scapho-capitate ligament, **RSL** = radio-scapho-lunate ligament, **S** = scaphoid, **SL** = scapho-lunate ligament, **T** = triquetrum, **TFC** = triangular fibrocartilage, **TM** = trapezium, **TZ** = trapezoid, **U** = ulna, **UC** = ulnar collateral ligament, **UL** = ulno-lunate ligament, **ULT** = ulno-luno-triquetral ligament.

-The scapho-lunate ligament and luno-triquetral ligament are the most important intrinsic carpal ligaments.

-Disruption of these ligaments may cause instability and pain.

### On MRI

-Both are best evaluated on gradient echo coronal images.

-They are horseshoe / band like / triangle shaped structures.

-Low signal with areas of intermediate signal traversing (normal).

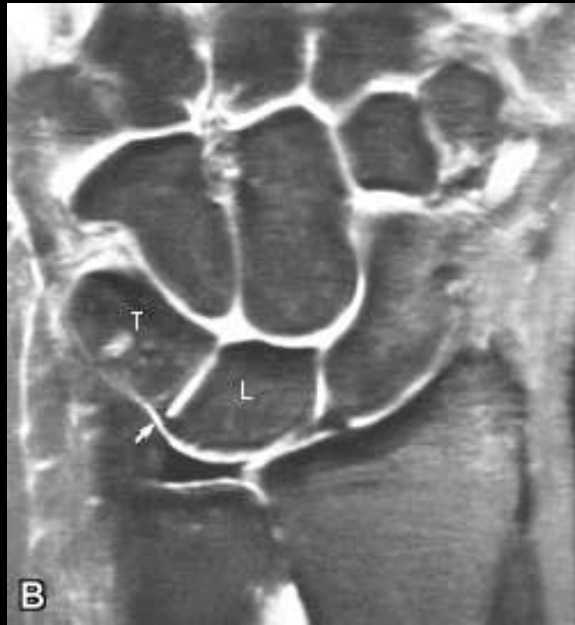
-They lie on the proximal aspects of the carpal bones to which they attach.





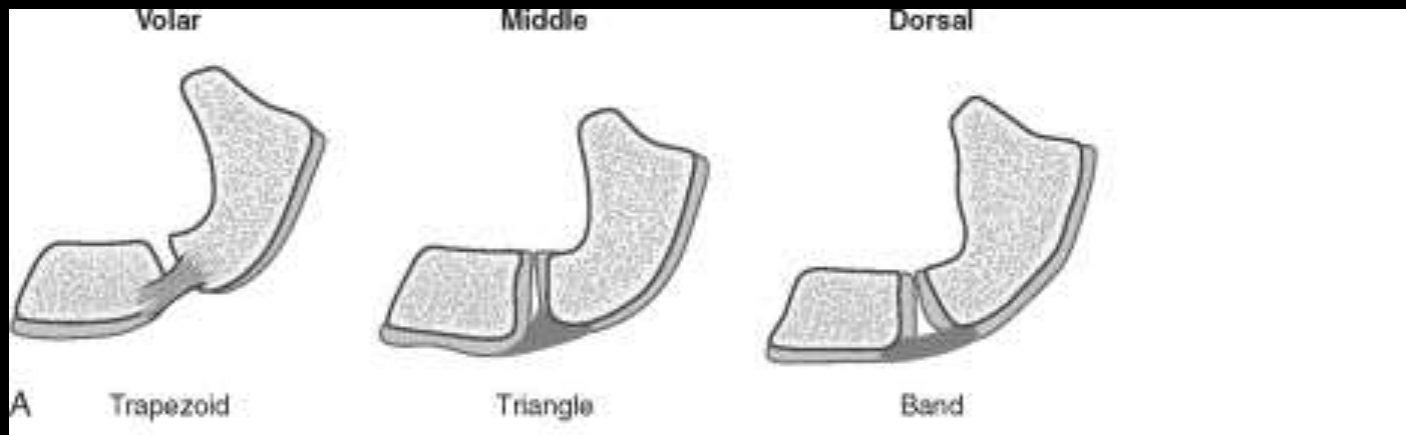
**Normal intrinsic carpal ligaments (Coronal GE)**

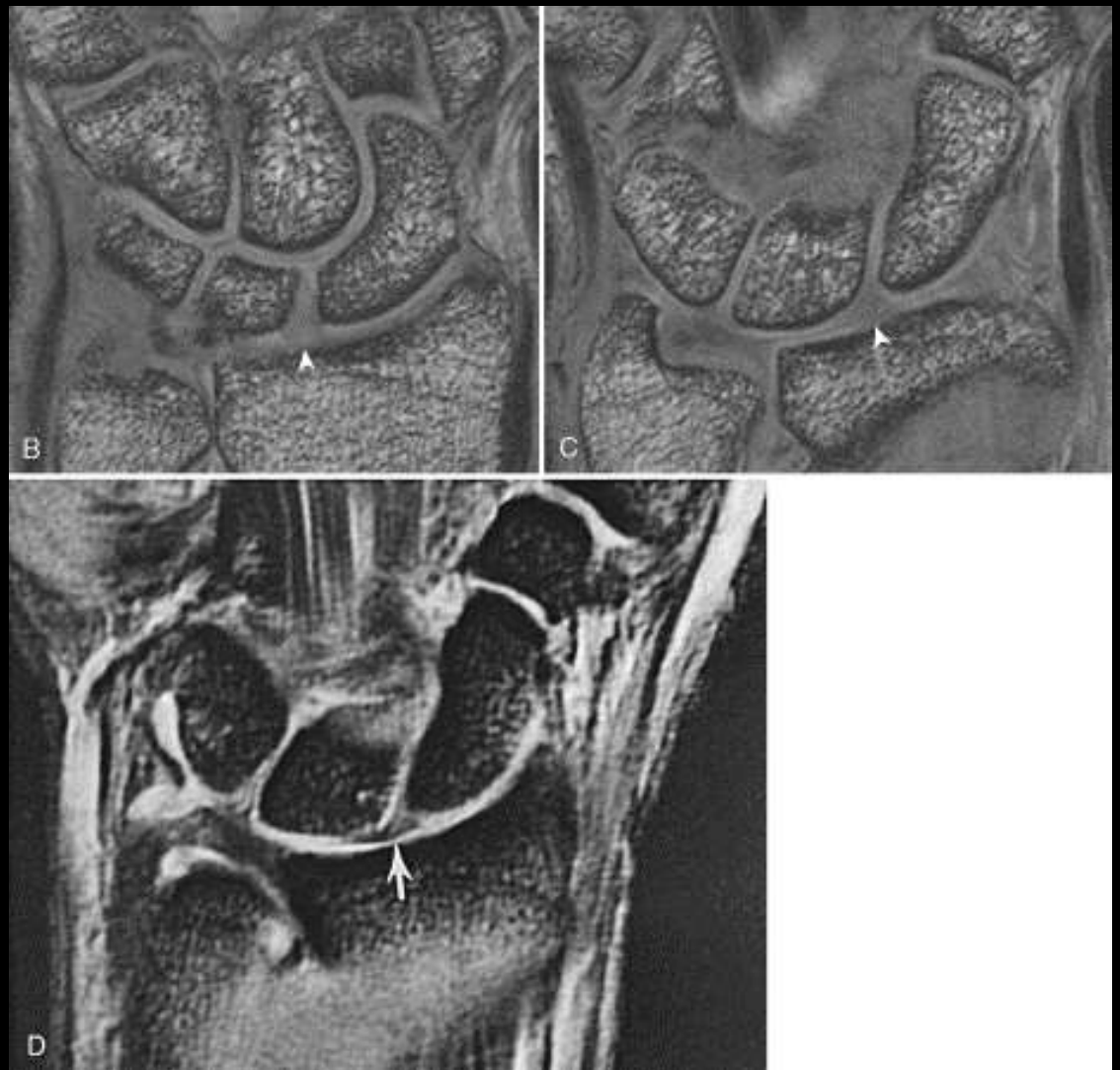
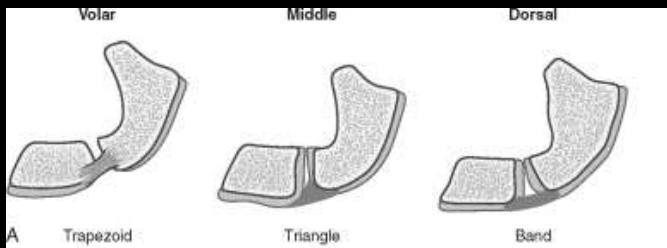
The scapholunate (*arrow*) and lunotriquetral (*arrowhead*) ligaments are located on the proximal aspects of the carpal bones to which they attach.



## The scapho-lunate ligament

- Has volar, middle and dorsal portions.
- Perforations (or communicating defects) in the middle portion are common normal finding.
- The volar portion is trapezoidal with intermediate signal on GE.
- The middle portion is triangular with lower signal.
- The dorsal portion band like and is of low signal.
- The volar portion attaches to cortical bone.
- The middle and dorsal portions attach to cartilage or a combination of cartilage and cortical bone.





### Normal scapho-lunate ligament (Coronal GE)

**B**, The volar portion of the ligament (*arrowhead*) is trapezoidal and intermediate signal. **C**, The middle portion (*arrowhead*) is lower in signal than the volar portion and triangular. **D**, The dorsal portion (*arrow*) is a band like and of lower signal.



**Scapholunate ligament: normal variation** (Coronal FS T2)

Intermediate signal traversing the intercarpal ligaments is a normal finding (*arrowhead*) because it does not become as high signal as fluid.

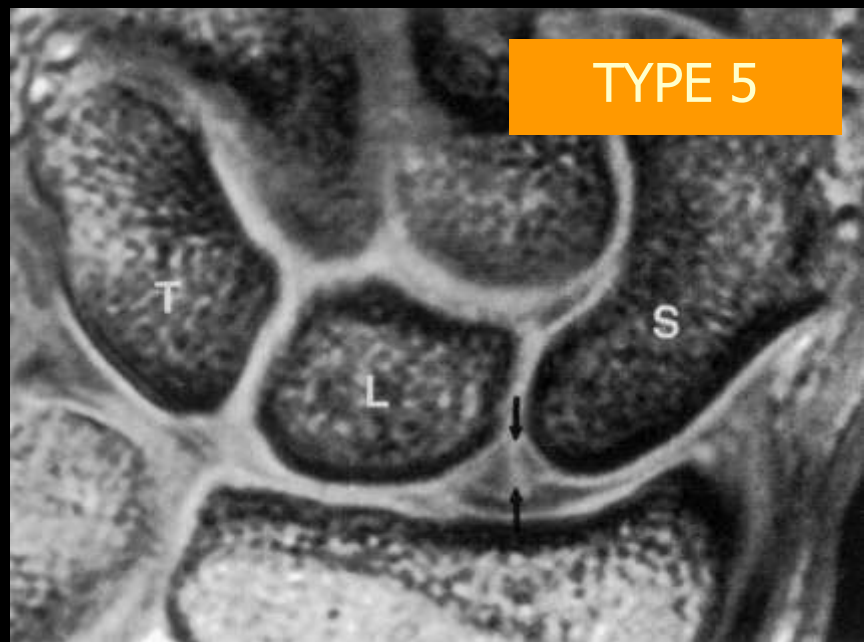
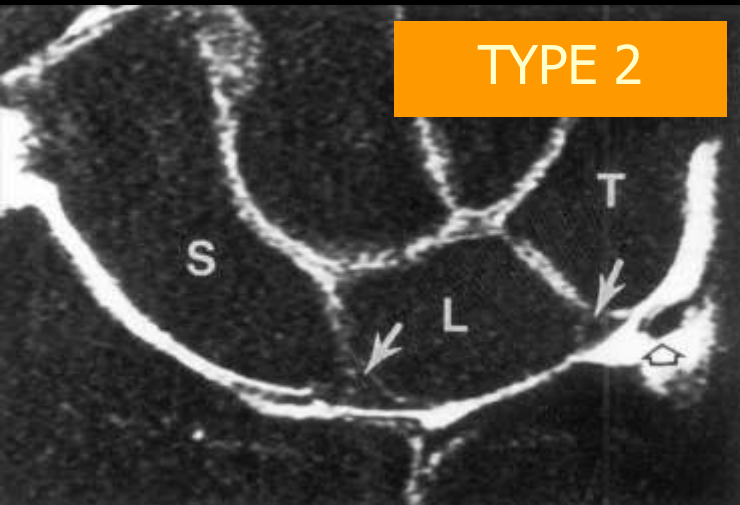
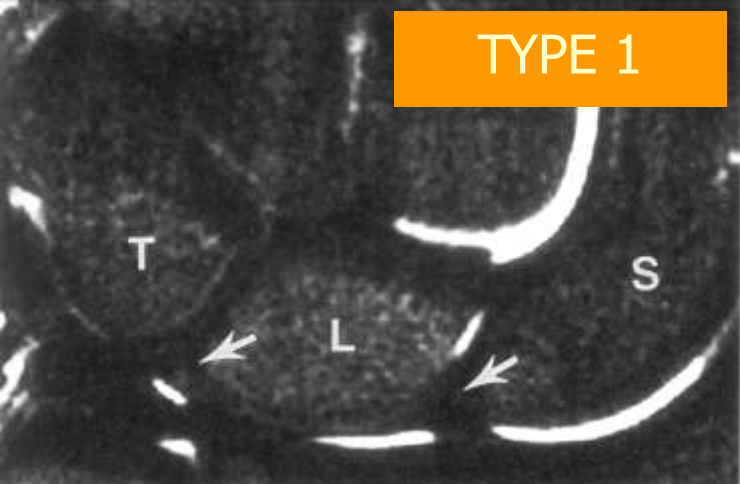
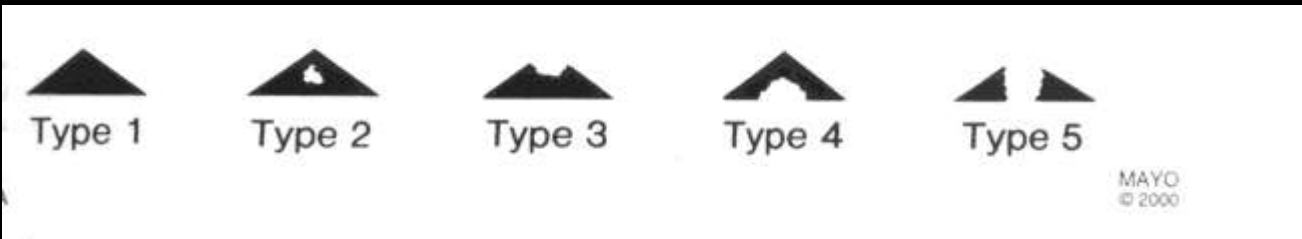
## Scapho-lunate instability

- Occurs when the scapholunate ligament is completely torn or stretched, allowing the scaphoid and lunate bones to dissociate and rotate.
- Rotatory subluxation is the most common instability pattern in the wrist.
- Partial tears more commonly affect the weaker volar ligamentous attachment.
- The scaphoid tilts in a volar direction (rotatory subluxation).
- The lunate tilts in a dorsal direction (dorsal intercalated segmental instability).
- The relationship of the osseous structures can be detected on sagittal MRI.

### MRI signs

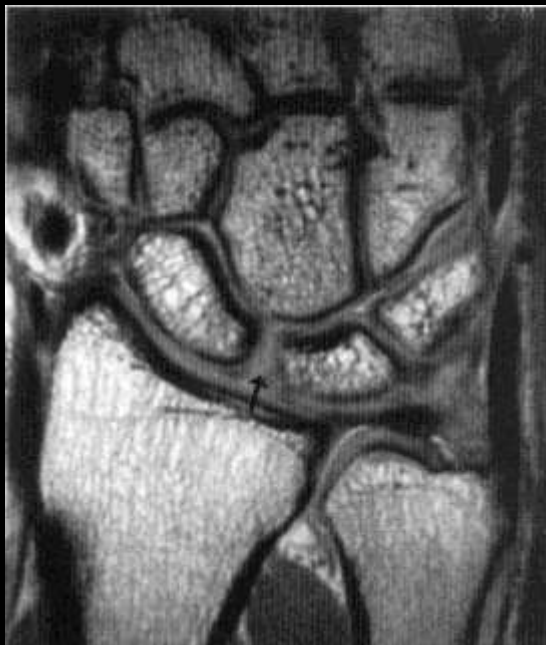
1. Discontinuity of the ligament +/- wide scapho-lunate distance + fluid signal within ligament defect.
2. Complete absence of scapholunate ligament
3. Distorted morphology with fraying, thinning and irregularity
4. Elongated (stretched) undisrupted ligament with wide intercarpal space.







**Normal**



**Scapholunate tear**





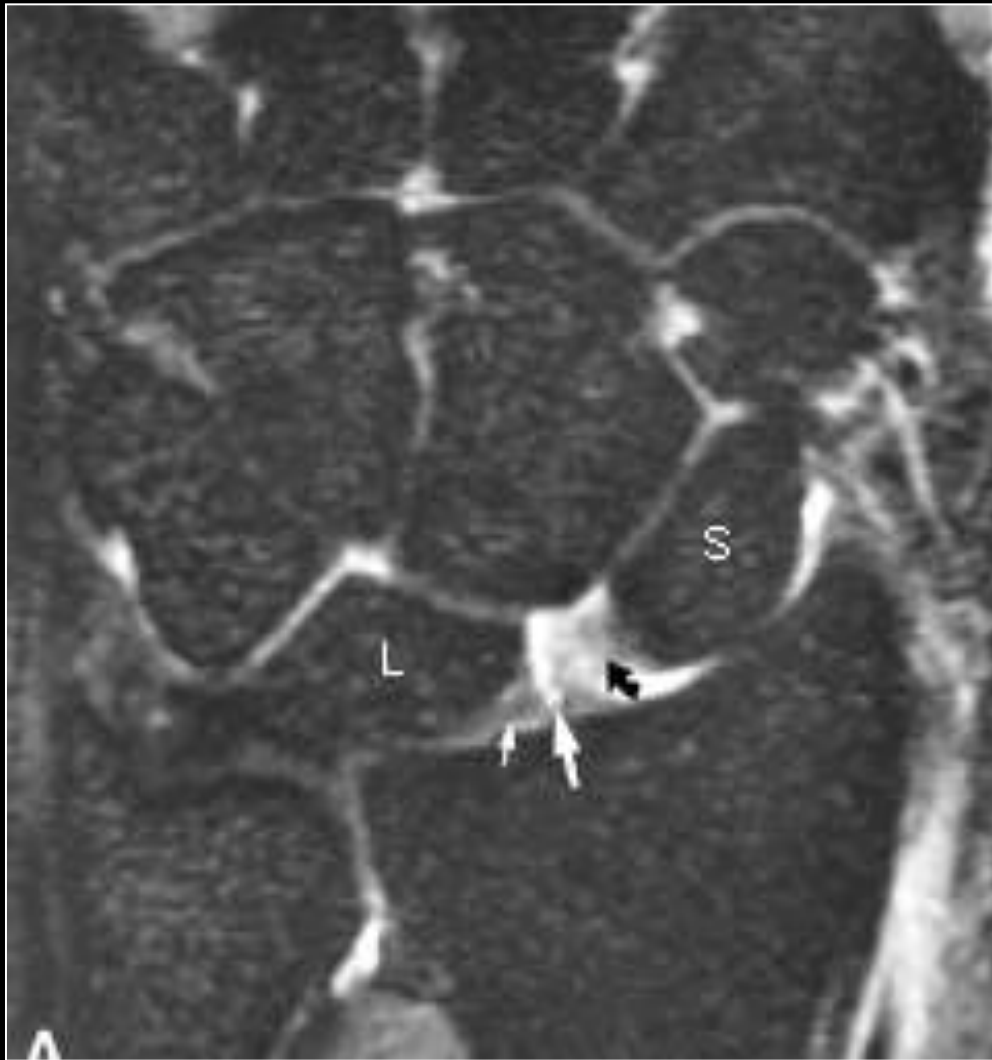
**Intact scapho-lunate ligament (Coronal FS T1 arthrogram)**

Medium signal in scapholunate ligament.



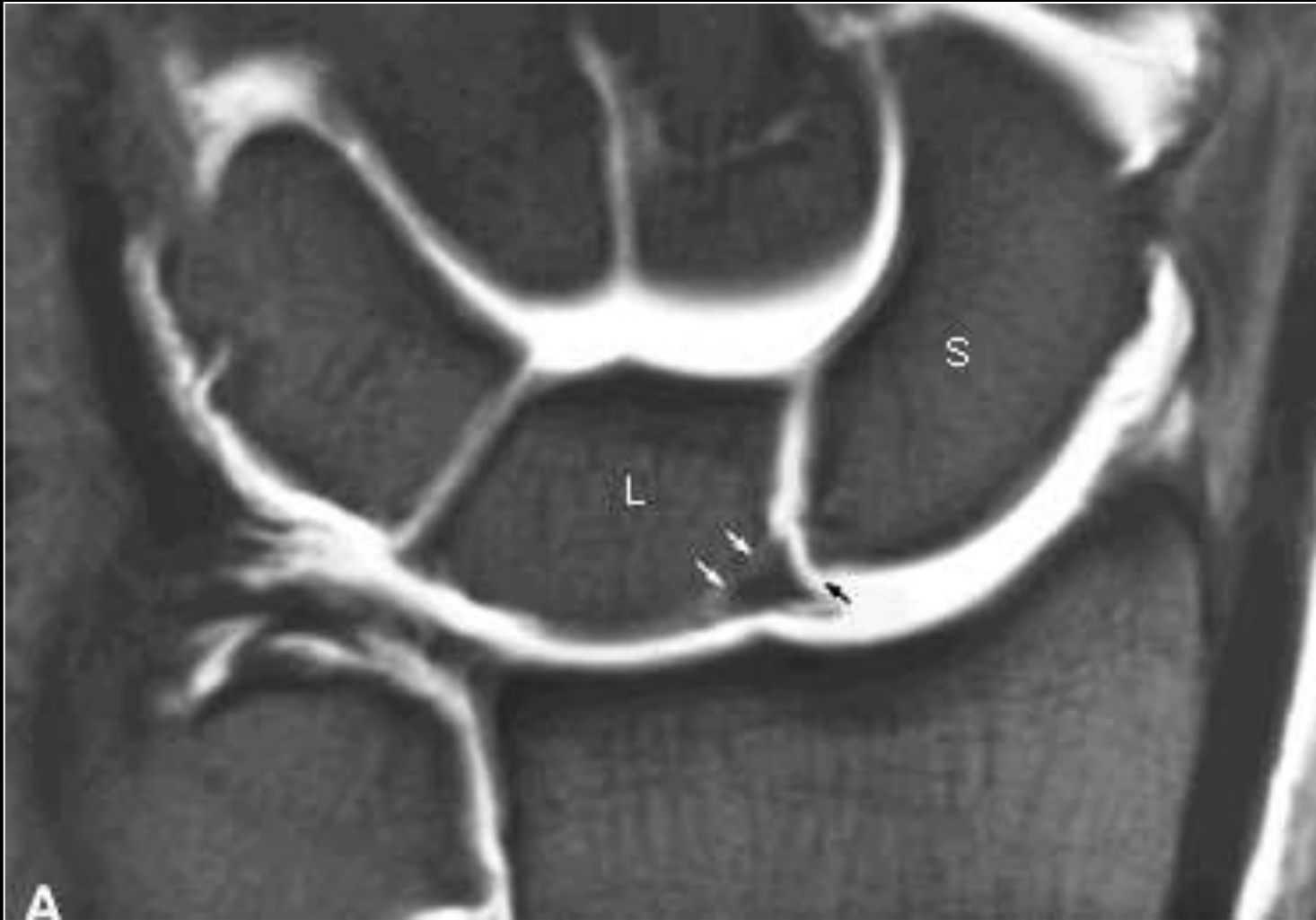
**Scapho-lunate ligament vertical tear without carpal instability (Coronal FS T1 arthrogram)**

The luno-triquetral ligament is absent.



**Scapho-lunate ligament traumatic avulsion (Coronal STIR)**

The scapho-lunate interval is wide.



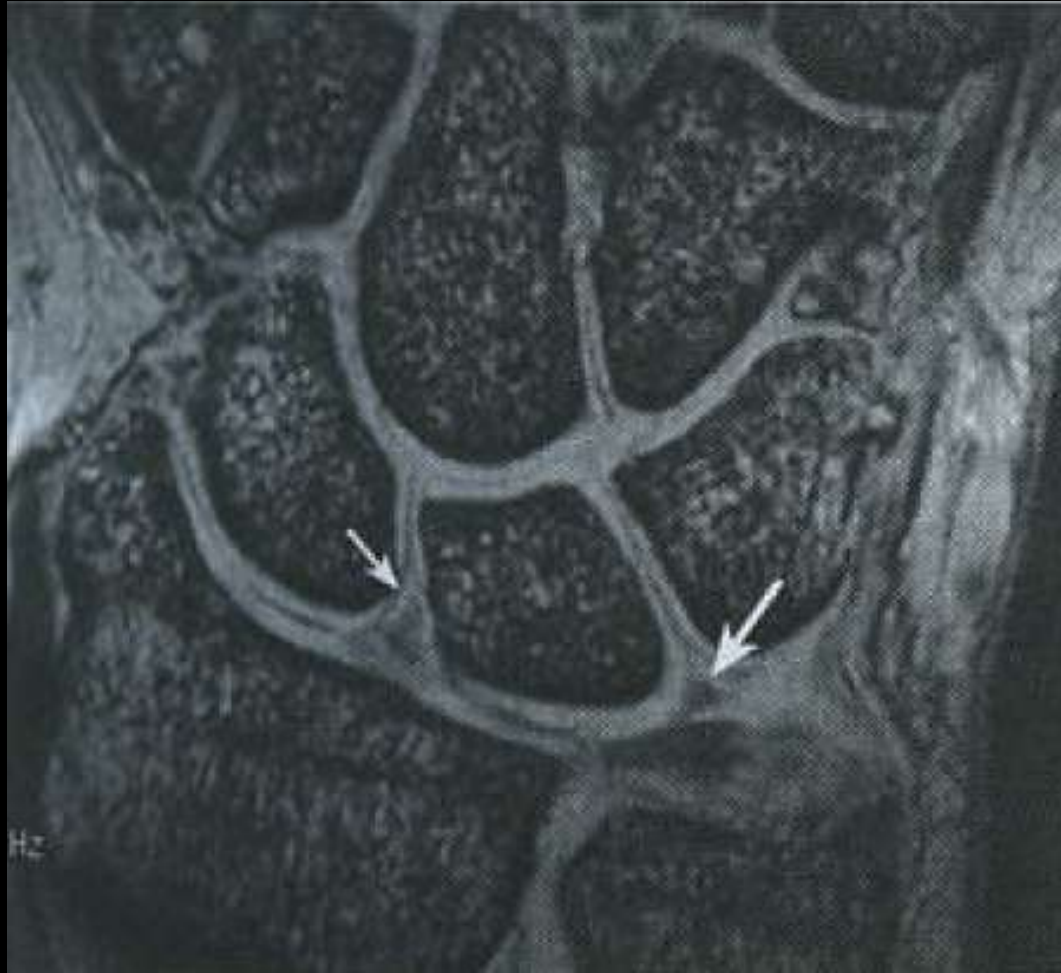
**Scapho-lunate ligament tear**

Tear at its weaker attachment of scaphoid.



**Scapholunate ligament abnormality (Coronal FS T2)**

Fluid signal between scaphoid & lunate (*arrow*). Scapho-lunate distance is wide.



**Scapho-lunate ligament partial tear (Coronal GE T2)**

Incomplete hyperintense line (small arrow) seen in scapho-lunate ligament. A complete tear (large arrow) traversing the entire luno-triquetral ligament is also seen.



**Scapholunate ligament abnormality Coronal Fast FS T2**

Distortion of the morphology of scapholunate ligament which is frayed and shows a vertical high signal tear through it (*arrows*).



### **Scapholunate ligament abnormality Coronal GE**

Wide space between scaphoid and lunate, the ligament (*arrow*) is stretched but intact.

Pt with Rht arthritis. Multiple bone erosions, subchondral cysts, and a triangular fibrocartilage tear also are present.

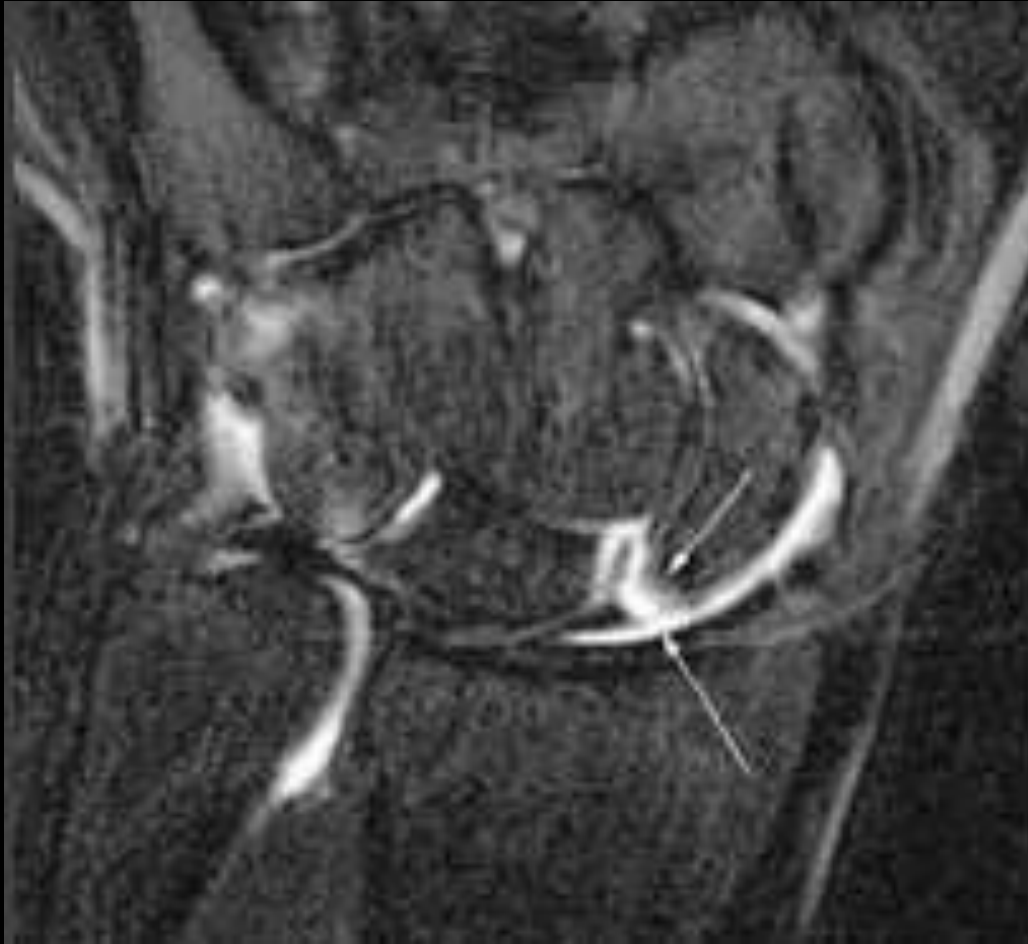




### **Scapholunate ligament dissociation**

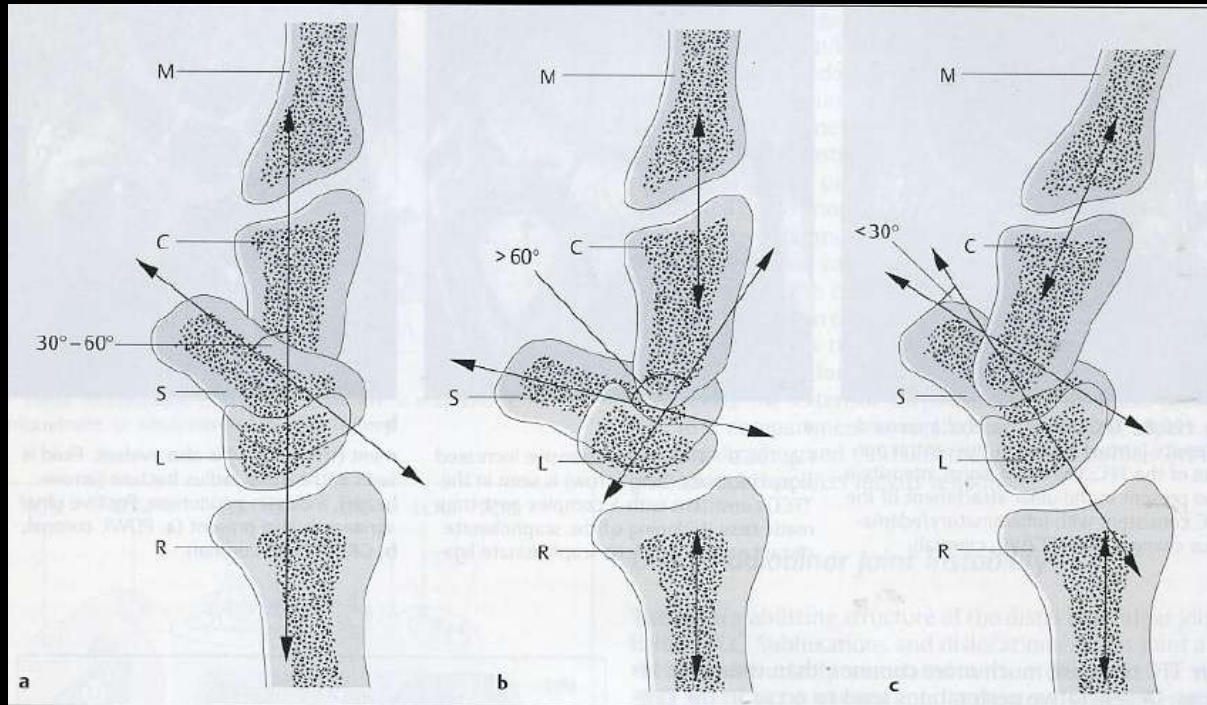
Coronal FS T2 shows fluid signal between scaphoid and lunate.

Sagittal PD shows rotation of the lunate with the concave surface facing dorsally suggesting dorsal intercalated segment instability.



**Scapho-lunate ligament tear** (Coronal FS T2)

Tear of the SLL (arrow).



## DISI & VISI (Lat. Projection)

A- Normal. A continuous line can be drawn through the longitudinal axis of the capitate, lunate and radius and this line intersects a 2<sup>nd</sup> line through the longitudinal axis of scaphoid at an angle of 30-60.

B- DISI. The lunate is flexed towards the back of the hand and the scaphoid is tilted volarly. The longitudinal axis connecting capitate, lunate and radius is interrupted, and the angle between lunate and scaphoid axes is more than 60,

C- VISI. The lunate is flexed towards the palm, the angle between lunate and scaphoid is less than 30. The longitudinal axis connecting capitate, lunate and radius is again interrupted with dorsal tilt of capitate.

C = capitate, L = lunate, M = 3<sup>rd</sup> metacarpal, R = radius, S = scaphoid.



**Dorsal intercalated segmental instability (Sagittal FS T2)**

The lunate (L) is tipped in a dorsal direction relative to the capitate (C) and radius (R) because of rotatory subluxation of the scaphoid 2ry to disruption of scapholunate ligament.



**Scapholunate ligament dissociation** (Coronal PD)

Fluid signal in the wide gap between scaphoid and lunate.

## **D.D.**

### **• Luno-triquetral ligament tear**

Contrast or fluid in the radio-carpal joint will enter the common carpal joint through the tear of luno-triquetral ligament.

### **• TFCC tears**

Arthrogram shows contrast injected in the radio-carpal J. leak into distal radio-ulnar recess.

### **• Distal radio-ulnar joint (DRUJ) injury**

Injuries to distal radio-ulnar ligament with subluxation are best detected by CT / MRI.

### **• Ulnar impaction**

This may lead to TFCC tear or osteochondrosis of lunate. +ve ulnar variance and ulnar impaction can be associated with LTL tear and can be seen on radiograph.

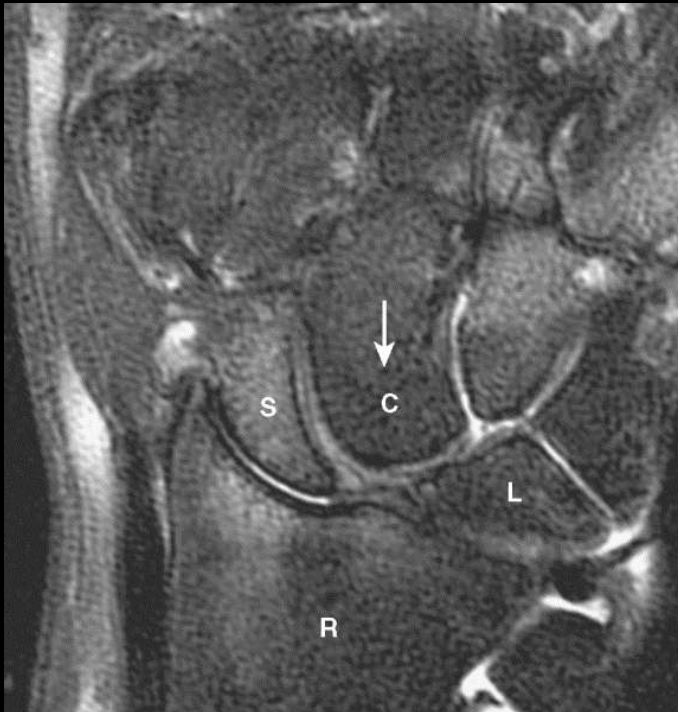
### **• Scapho-lunate advanced collapse (SLAC)**

A pattern of severe osteoarthritis and mal-alignment that results from radial-sided wrist pathologies such as scapho-lunate dissociation with rotatory subluxation of the scaphoid. Other etiologies include inflammatory arthritis such as idiopathic calcium pyrophosphate dihydrate (CPPD) crystal deposition disease.

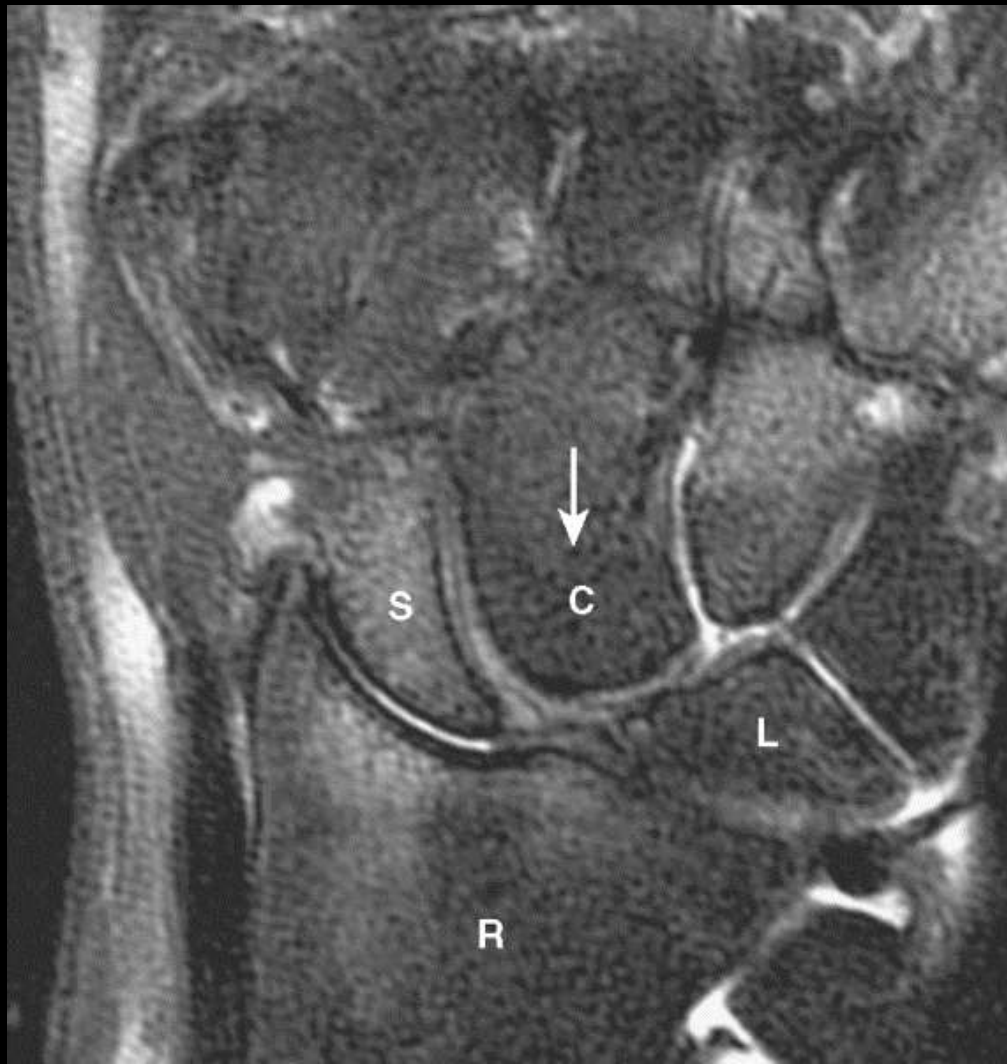
# Scapholunate Advanced Collapse (SLAC)

## Consists of

- 1-Scapholunate ligament disruption.
- 2-Narrow space between scaphoid and distal radius.
- 3-Proximal migration of capitate between scaphoid and lunate.







**Scapholunate advanced collapse wrist (Coronal FS T2)**

The scapholunate ligament is absent, wide scapho-lunate space. The capitate is migrating proximally between the two bones (*arrow*). There is loss of cartilage and a decreased space between the scaphoid and radius.

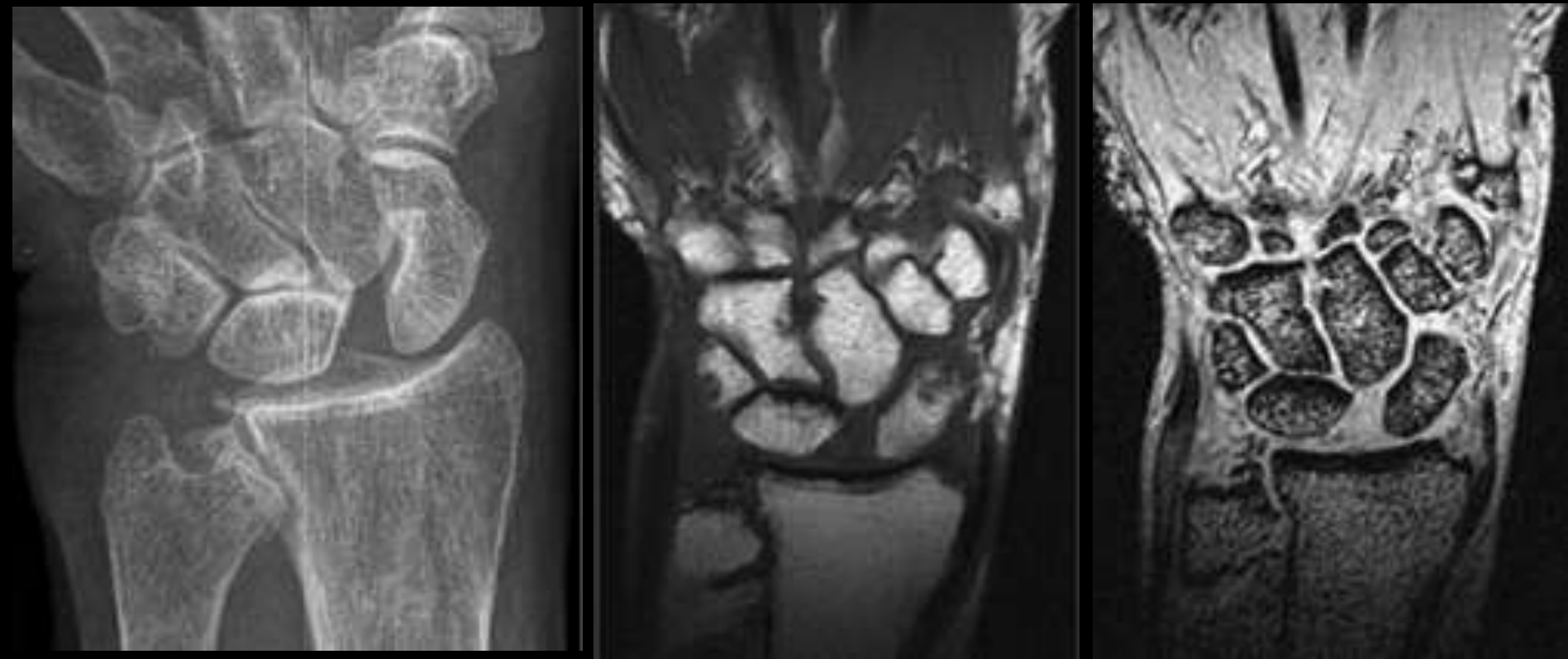




**Scaphoid nonunion advanced collapse** (Coronal GRE & T1)

Marked widening of the scapho-lunate joint space with extensive proximal migration of the capitate. Note the diffuse low marrow signal in proximal portion of scaphoid. Note also the characteristic radio-carpal osteoarthritis and elongation of the radial styloid as well as the small ossicle lateral to the distal scaphoid.

X-Ray shows fracture line, 2ry osteoarthritis and fragmentation of distal scaphoid.



**Early scaphoid-lunate advanced collapse (X-Ray, coronal T1 & FS GRE)**

Widening of scapho-lunate joint space, mild migration of capitate proximally.



**Scapholunate advanced collapse (SLAC)**

X-Ray shows typical SLAC because of ch. SLL tear. Arthritic changes at the radio-scaphoid articulation and widening of the scapho-lunate ligament are typical of SLAC (arrows). Coronal 3D GE shows tear of SLL and ulnar attachment of the TFCC (arrows).

## The luno-triquetral ligament

- ❖ Smaller and more taut than the scapholunate ligament.
- ❖ Has a similar shape.
- ❖ Heterogeneous low signal on coronal GE.
- ❖ Attach to articular cartilage / cortical bone.
- ❖ Its stronger and thicker volar component blends with the TFC.



**Normal intrinsic carpal ligaments (Coronal GE)**

The scapholunate (*arrow*) and lunotriquetral (*arrowhead*) ligaments are located on the proximal aspects of the carpal bones to which they attach.

## Luno-triquetral ligament tear

- ❖ It is the 2<sup>nd</sup> most common cause of carpal instability.
- ❖ It results in lunate tilting in a volar direction (volar intercalated segmental instability).
- ❖ There is a strong association between TFC tear & luno-triquetral ligament tear.

## Important imaging pitfalls

### Signal pitfalls

- ❖ Intermediate signal may partially or completely traverse the substance of the lunotriquetral & scapholunate ligaments in asymptomatic individuals.
- ❖ It should be considered an abnormal finding (torn ligament) only if this signal is as bright as fluid on any T2 sequence.
- ❖ High signal between articular cartilage and the ligament should indicate an avulsed ligament only if the signal is as bright as fluid.

## Important imaging pitfalls

### Positioning pitfalls

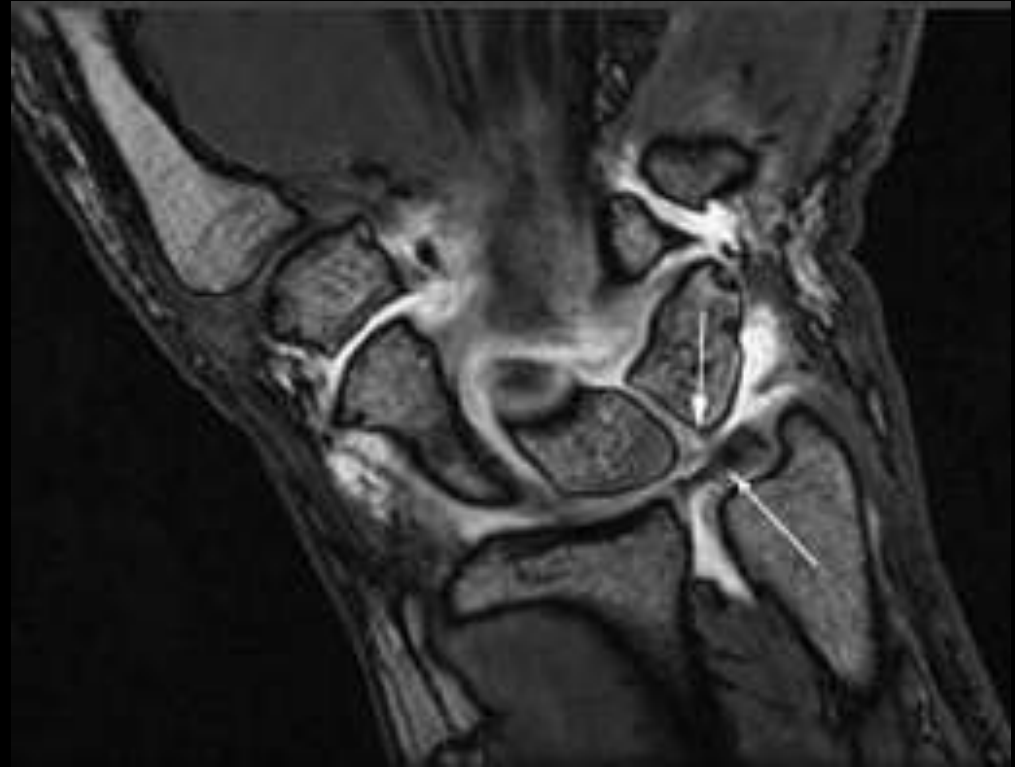
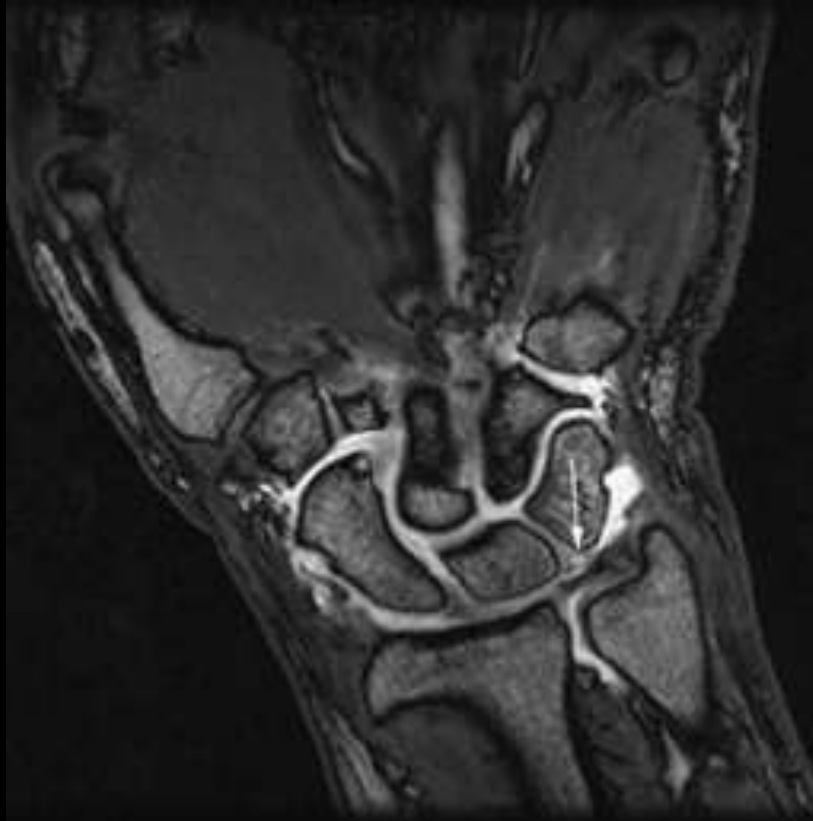
- ❖ Normally, the distal radius, lunate, and capitate all align colinearly.
- ❖ The alignment of the carpal bones on sagittal images depends on wrist position.
- ❖ Lunate show volar flex relative to radius when wrist is placed in radial deviation.
- ❖ Lunate show dorsiflex relative to radius when wrist is placed in ulnar deviation.
- ❖ Proper positioning of the hand in the magnet is important to prevent this pitfall.





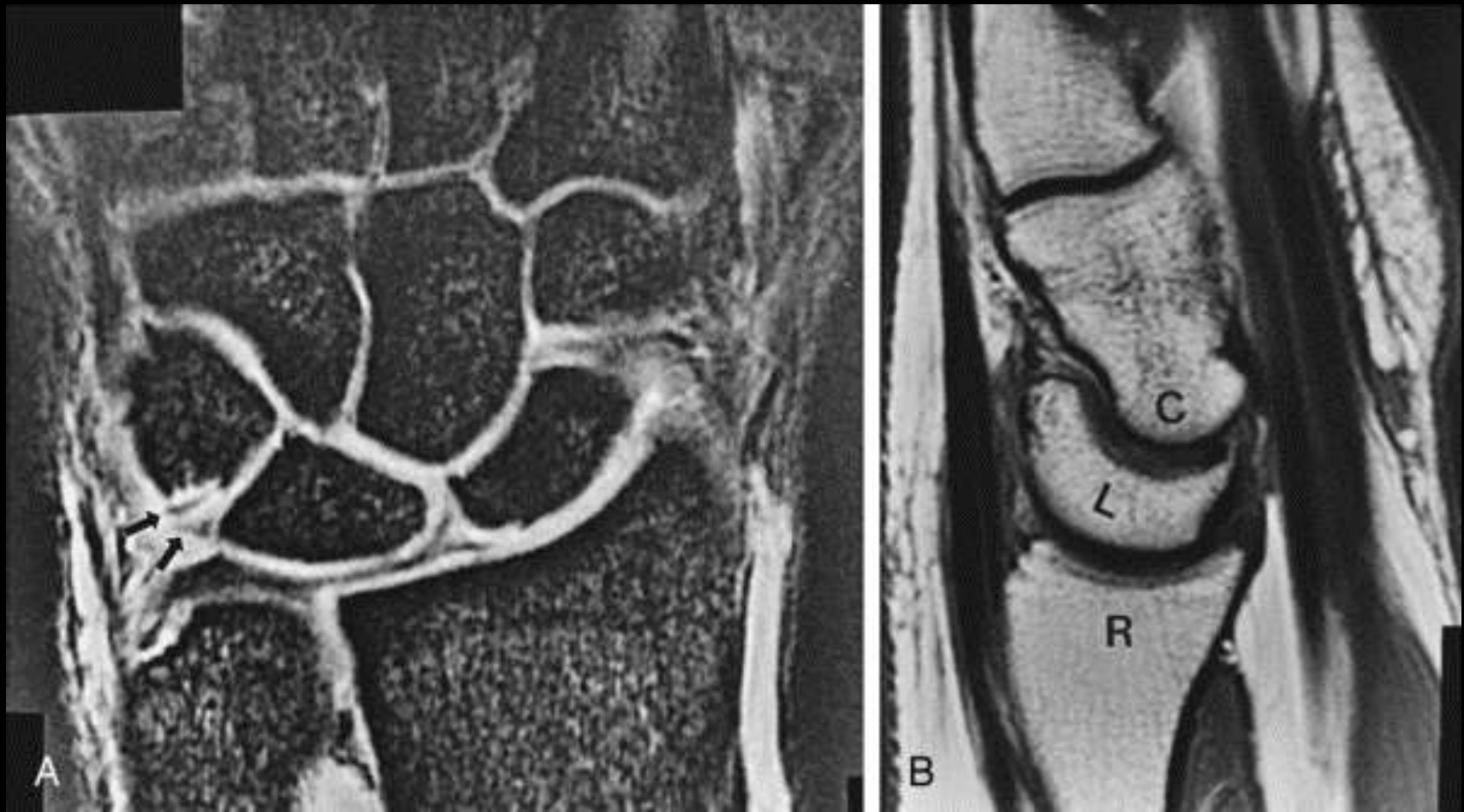
**Luno-triquetral ligament tear (Coronal GRE T2)**

A hyperintense line (arrow) is seen in luno-triquetral ligament.



**Luno-triquetral ligament tear** (Coronal GE)

Shows tear of luno-triquetral ligament (arrow). TFCC is intact (arrow).



**Lunotriquetral tear and consequent volar intercalated segmental instability**

**A**, Coronal GR, high signal through a disruption of the lunotriquetral ligament with fragments of the ligament (*arrow*) seen on either side of the tear.

**B**, Sagittal T1, lunate (L) is tipped in a volar direction relative to capitate (C) and radius (R) 2ry to lunotriquetral ligament tear.

A photograph of a sunset over a mountain range. The sky is filled with soft, pink and orange clouds, with a bright yellow sun partially obscured by a cloud. The mountains in the foreground are dark and silhouetted against the bright sky. The text "Thank You" is overlaid in the center in a white, serif font with a drop shadow.

**Thank You**