Imaging of Ulnar Sided Wrist Pain

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April 1st 2010

Ulnar Sided Wrist Pain

- Often equated with low back pain due to chronic and vague symptomatology
- Can present a diagnostic challenge for hand surgeons and radiologists
- May be accompanied by a history of worker’s compensation claims
- Despite these issues, many patients do have pathologic lesions
- Understanding of clinical findings and pertinent imaging anatomy considerably aids in making accurate diagnoses

Overview

- Osseous Injuries (fractures, and Kienbock’s disease)
- Joint Disease (distal radioulnar joint, and pisotriquetral joint)
- Triangular fibrocartilage complex
- Ulnar impaction/abutment and impingement syndromes
- Tendon pathology (extensor and flexor carpi ulnaris)
- Ulnar nerve and Guyon’s Canal
- Radial and ulnar bursae of the wrist

Osseous Injuries

Triquetral Fractures

- second most common carpal bone fracture after the scaphoid bone
- divided into surface and body fractures

Surface fracture

- dorsal surface fractures predominate
- better evaluated on lateral or oblique projections of the wrist

Mechanism

- contact with the hamate or ulnar styloid process
- ligamentous avulsion fracture in extreme hyperflexion

Treatment

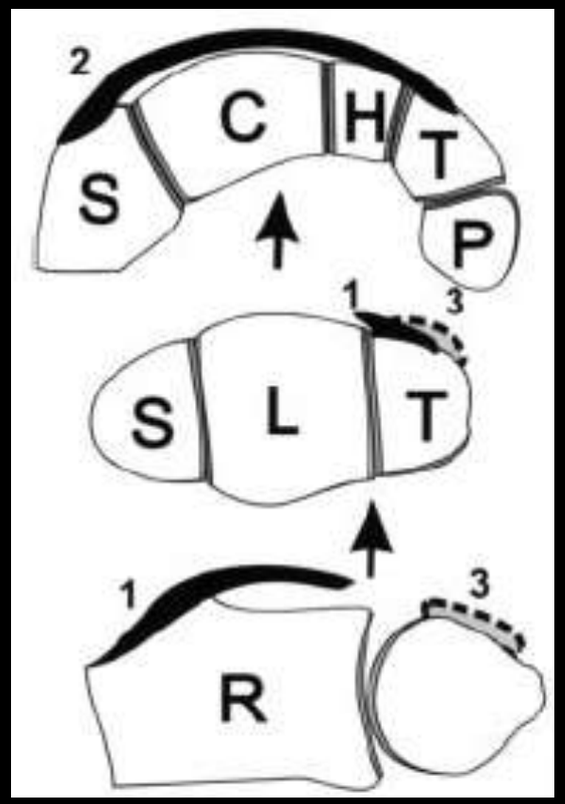
- heal well with 6 weeks of immobilization
- fragment excision is performed for refractory pain

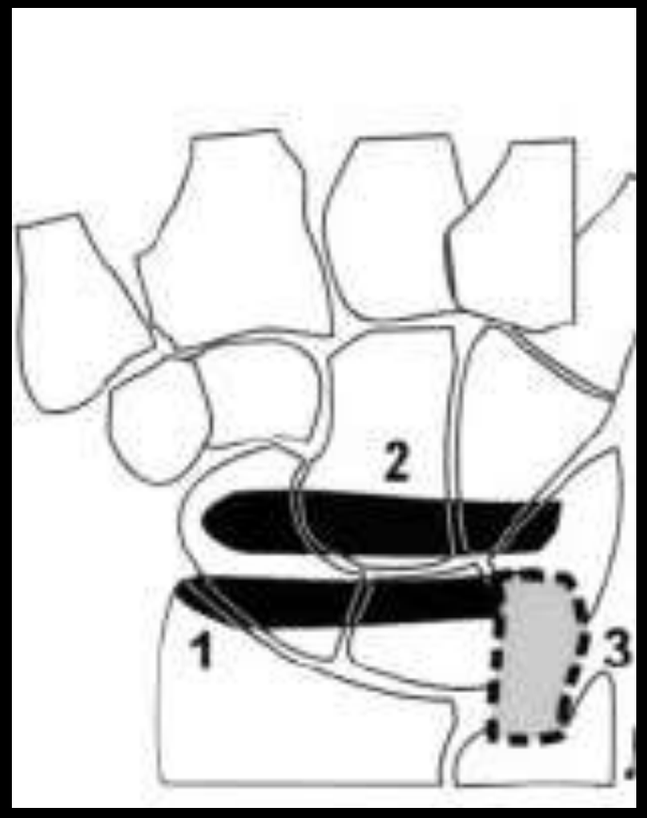
Osseous Injuries

Triquetral Fractures

Surface fracture

Ligamentous Avulsion





1 = Dorsal extrinsic radiotriquetral ligament

2 = Dorsal intrinsic scaphotriquetral ligament

(3 = Dorsal ulnotriquetral ligament)

Theumann Nh, Pfirrmann CWA, Antonio GE, Chung CB, Gilula LA, Trudell DJ, Resnick D. Radiology; 2003: 226:171-179

Amadio PC et al: Fractures of the Carpal Bones. *In* DP Green et al. Green's Operative Hand Surgery. 5th ED. 2005, p 756

Osseous Injuries

Triquetral Fractures

Fractures of the body

- rare

Treatment

- heal well with conservative treatment
- surgical stabilization required in cases of perilunate fracture dislocations

**Palmar lunate
trans-scaphoid trans-triquetral
fracture dislocation**

Harrington P et al. Journal of Hand Surgery (British and European Volume, 1999) 24B: 4: 493-496

Osseous Injuries

Hamate Fractures

- 1.7% of all fractures

- Hook fracture
  - ✓ direct blow by golf club, baseball bat, racquet
  - ✓ may present with median or ulnar nerve symptoms:
    - as hook forms the ulnar border of median nerve and the radial border of Guyon's canal
  - ✓ acts as a pulley for the flexor tendons to the 4th and 5th fingers
  - ✓ CT may help distinguish it from an accessory bone
  - ✓ progress to non-union if not immobilized - requires excision

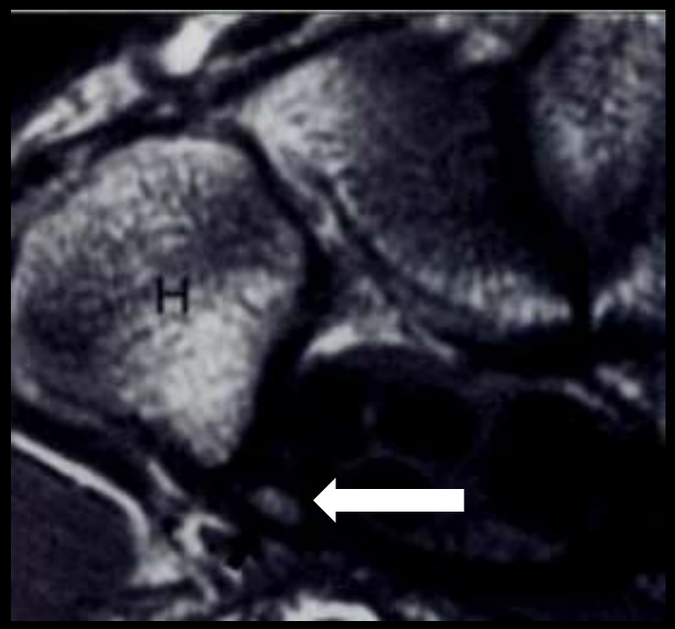
- Body fracture
  - ✓ generally stable
  - ✓ associated with # or # - dislocation of 4th or 5th metacarpal bases

Osseous Injuries

Hamate Fractures

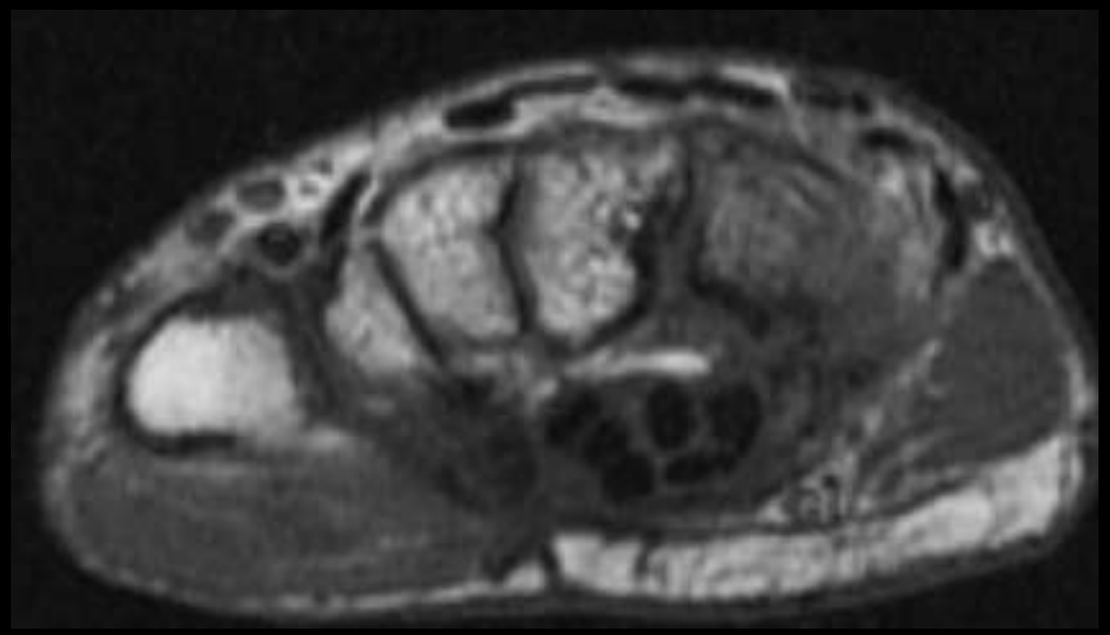
Os Hamulus Proprius

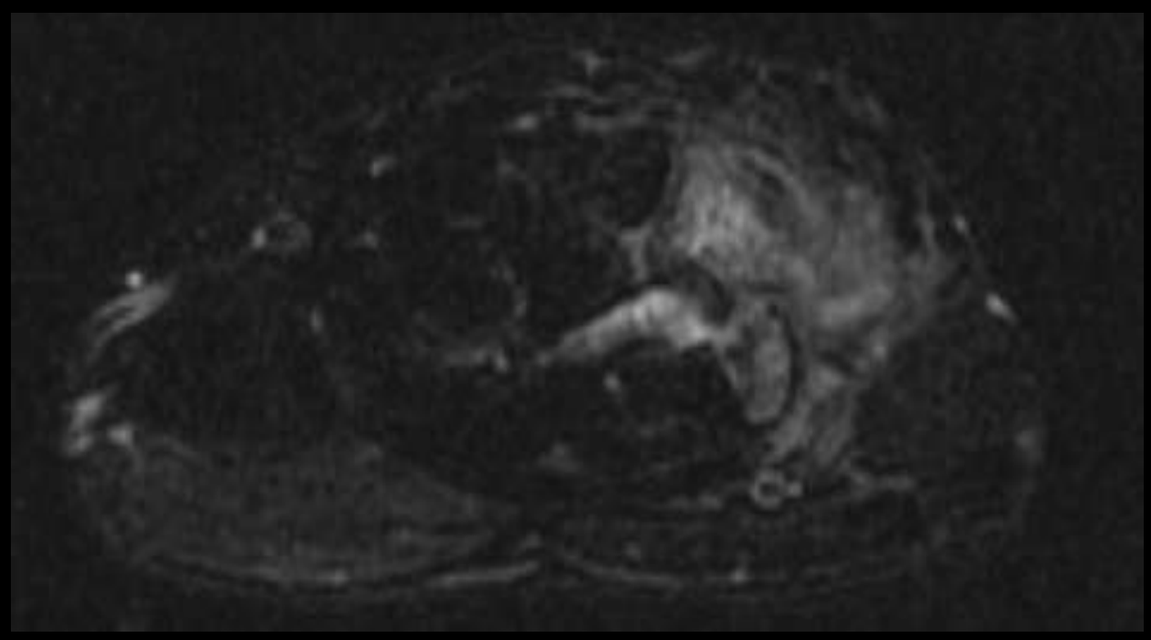
Small and round



Hook of Hamate Fracture

Irregular and edematous





Osseous Injuries

Hamate Fractures

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Small and round

Hook of Hamate Fracture

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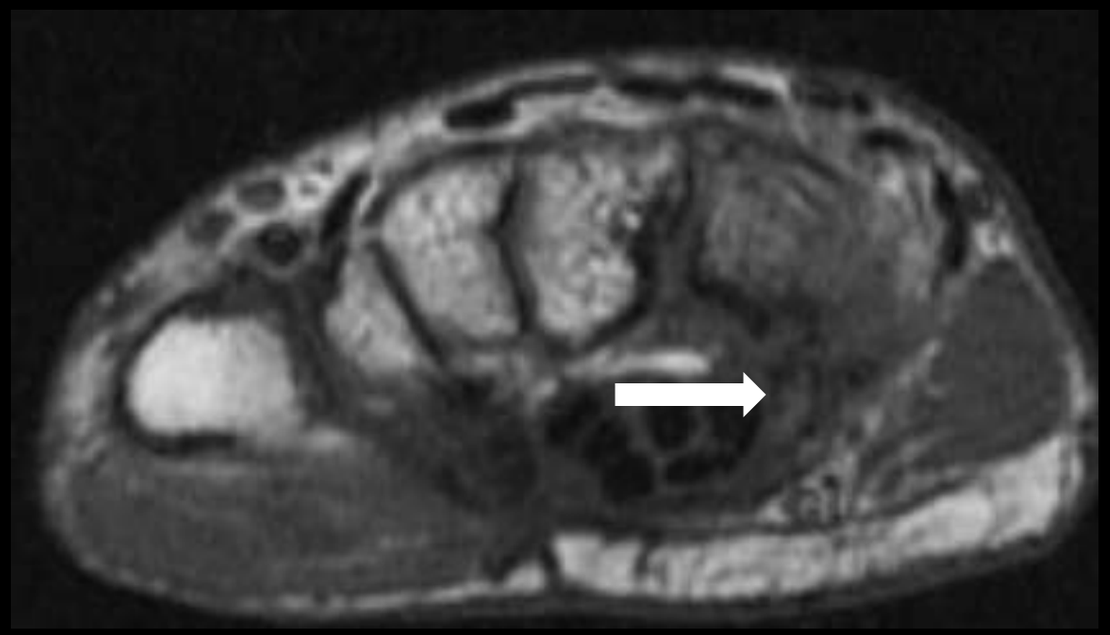
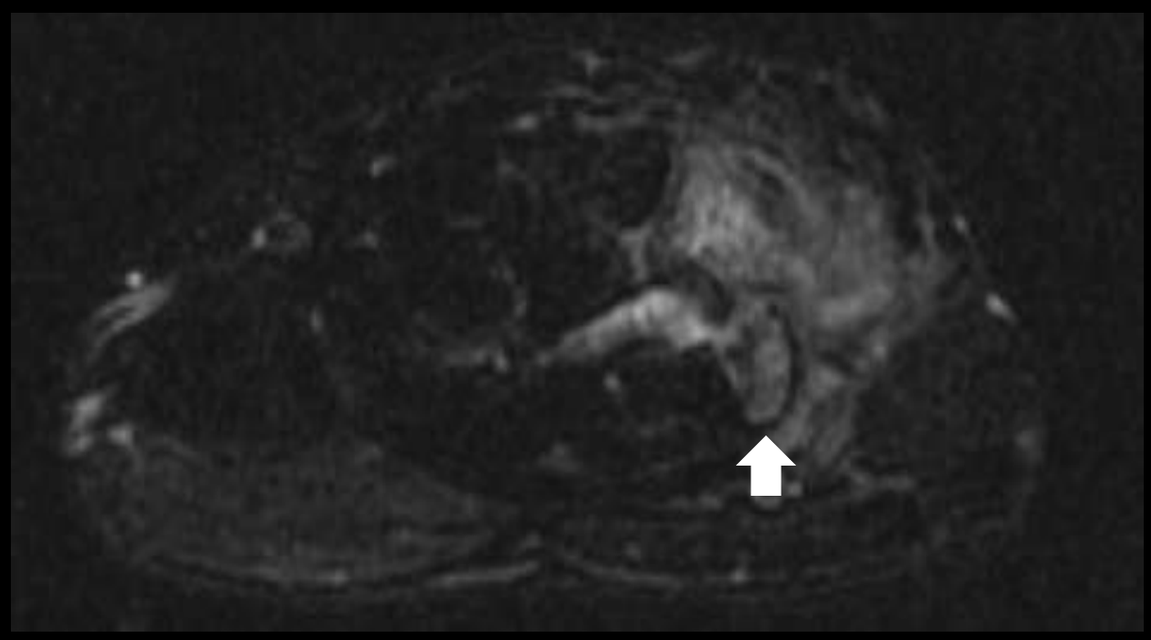




Osseous Injuries

Pisiform Fractures

- sesamoid bone enclosed within the flexor carpi ulnaris (FCU)
- uncommon fracture (1%), but high association with other fractures

Mechanism

- direct trauma, or FCU avulsion during forced hyperextension

Complications

- pisotriquetral joint osteoarthrosis
- ulnar nerve injury due to close proximity to the ulnar nerve

Treatment

- conservative
- surgical resection of fragment in cases of chronic pain

Ulnar Variance

Anatomy

- length between the distal end of the ulna and the radius as measured on an AP radiograph in neutral position

Neutral Variance

- 20 % of the load across the wrist is imparted to the ulna

Cerezal L et al. Radiographics 2002; 22: 105-121

Ulnar Variance

Anatomy

Minus Variance

- leads to increased load on radial aspect of the wrist
- TFC is thicker
- abnormalities of the TFC are uncommon
- association with Kienbock’s disease

Cerezal L et al. Radiographics 2002; 22: 105-121

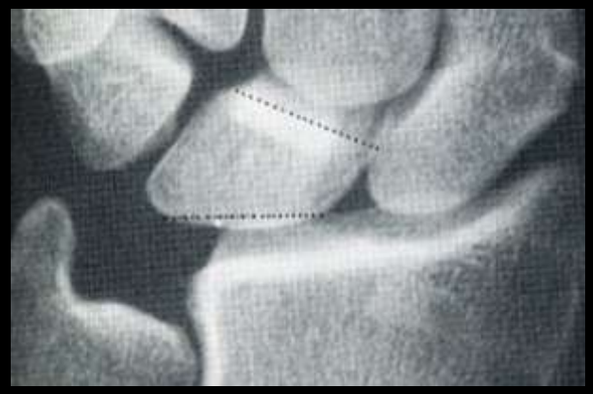
Kienbock's Disease

- osteonecrosis of the lunate bone
- twice as frequent in men than in women; more common in those 20-40 years of age
- occurs in dominant hand

Causes

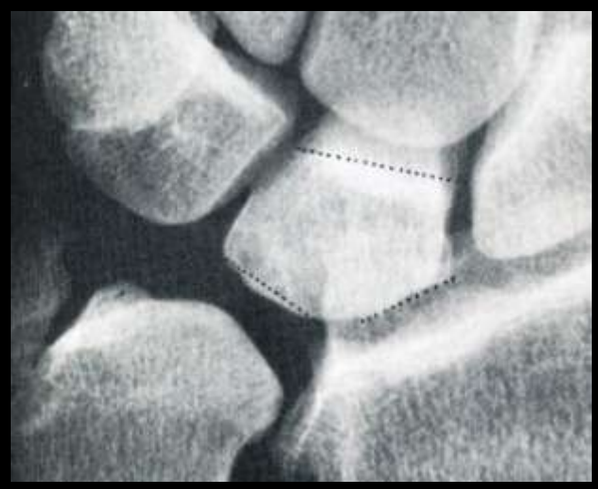
- largely unknown
- multiple hypotheses: Mechanical and Vascular
- Mechanical:
  - ✓ ulnar negative variance leads to increased load transmission onto the lunate bone
  - ✓ lunate shape – type 1
  - ✓ flattened radial inclination

Lunate Shapes



Type 1 – weaker bone

Type 2



Type 3

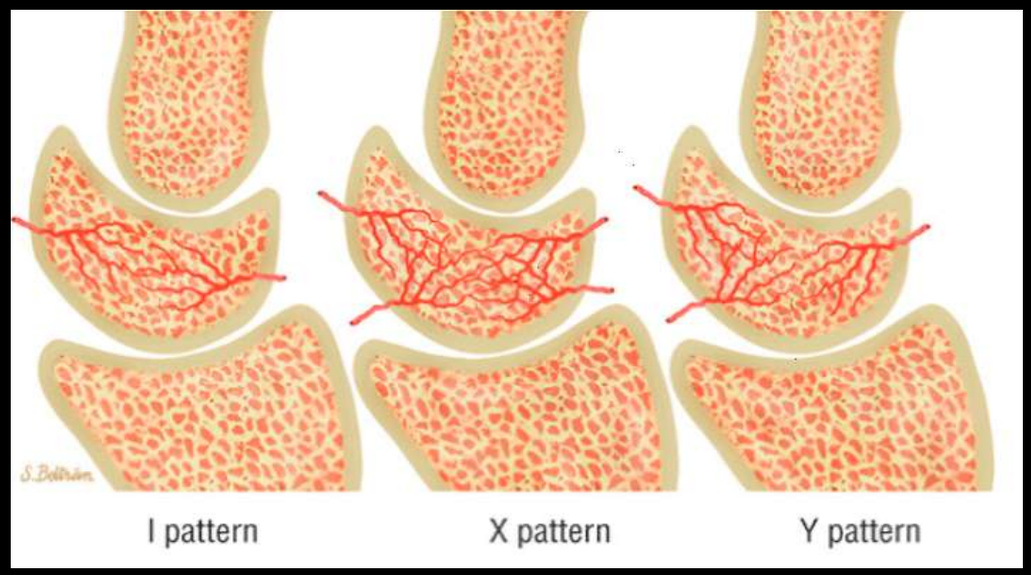
Amadio PC et al: Fractures of the Carpal Bones. *In* DP Green et al. Green's Operative Hand Surgery. 5th ED. 2005, p 756

Kienbock's Disease

Causes

- Vascular:

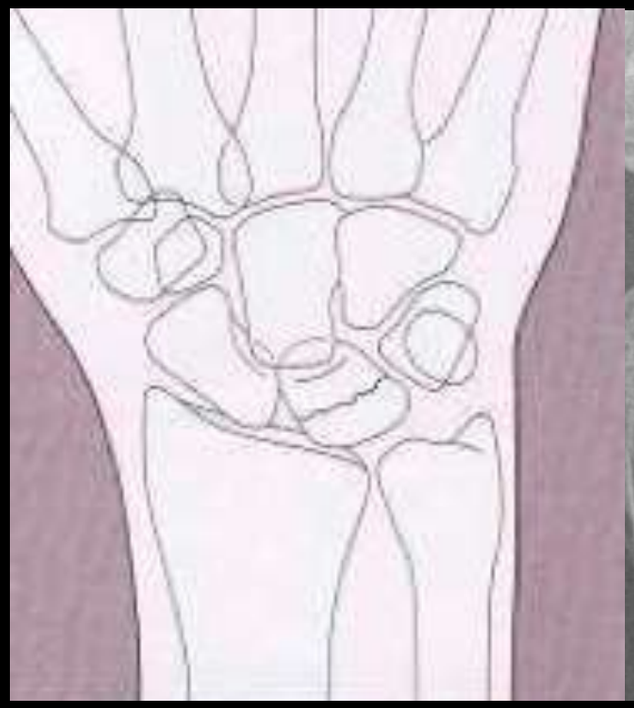
  - ✓ limited intraosseous blood
  - ✓ 20 % have a single palmar artery
  - ✓ traumatic interference with circulation occurs from repetitive stress



Kienbock's Disease

Lichtman's Four Stages of Osteonecrosis of the Lunate Bone

Stage 1 - MRI very useful for diagnosis



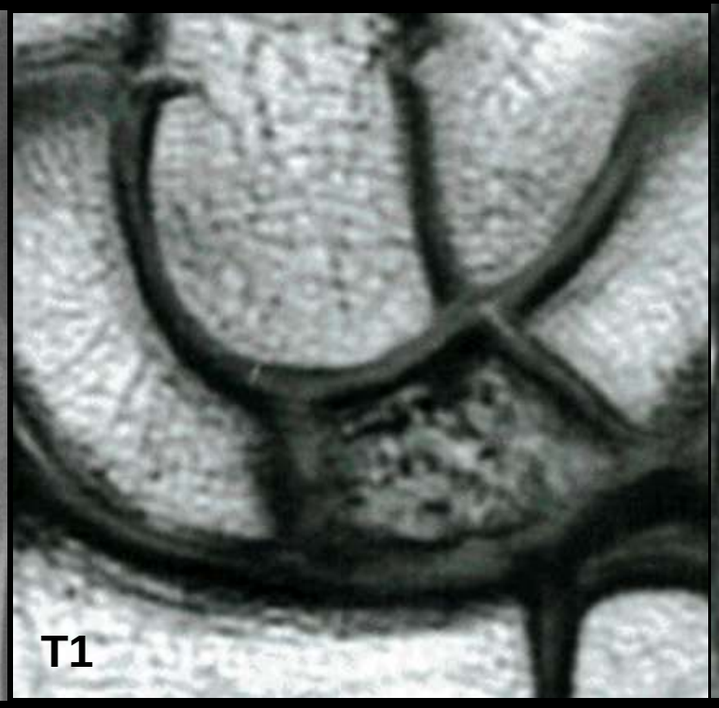
Normal

+/-

Subtle patchy sclerosis

+/-

Subtle fracture lines



Patchy low T1 signal and hyperintense stir signal

+/-

May see fracture lines

Kienbock's Disease

Lichtman's Four Stages of Osteonecrosis of the Lunate Bone

Stage 2

Sclerosis with a normal shape

+/-

Early collapse of the radial aspect of the lunate

Diffuse low T1 signal and hyperintense stir signal

+/-

Fracture lines may be present

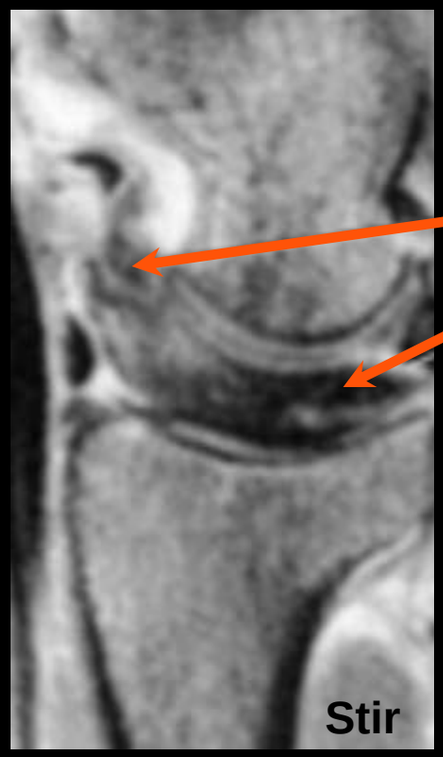
Kienbock's Disease

Lichtman's Four Stages of Osteonecrosis of the Lunate Bone

Stage 3

Lunate collapse

Lunate collapse



Kienbock's Disease

Lichtman's Four Stages of Osteonecrosis of the Lunate Bone

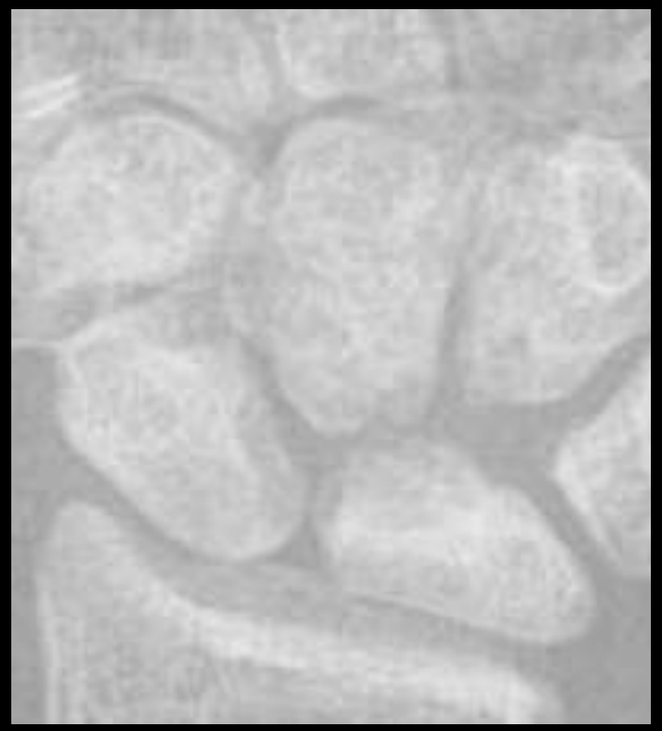
Stage 3 – 3A and 3B

Lunate collapse

3A:

Lunate collapse

Normal Scaphoid



3B:

Lunate collapse

Scaphoid rotation

Disruption of the scapholunate ligament

Proximal migration of the capitate

Kienbock's Disease

Lichtman's Four Stages of Osteonecrosis of the Lunate Bone

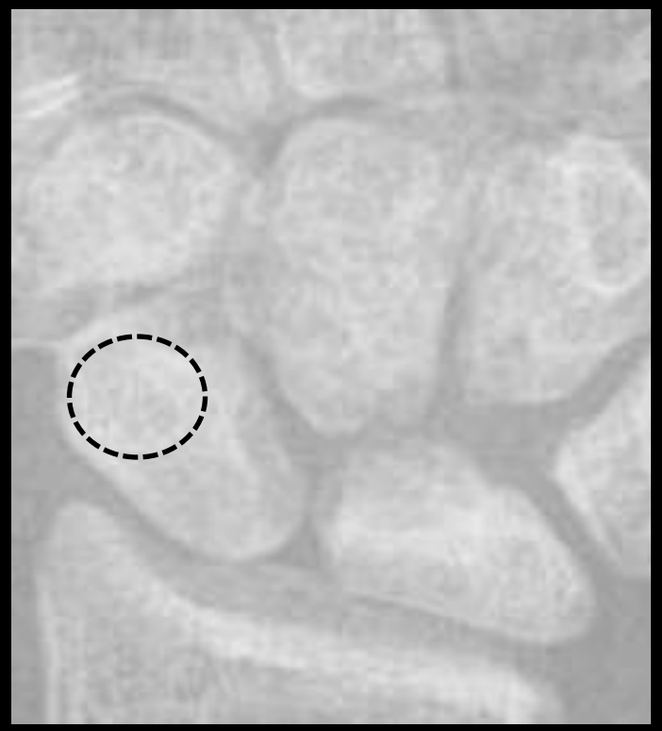
Stage 3 – 3A and 3B

Lunate collapse

3A:

Lunate collapse

Normal Scaphoid



3B:

Lunate collapse

Scaphoid rotation

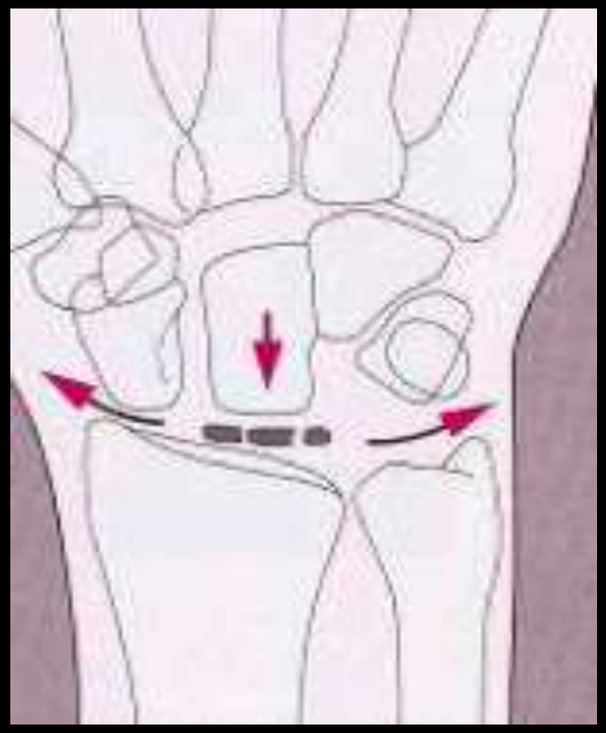
Disruption of the scapholunate ligament

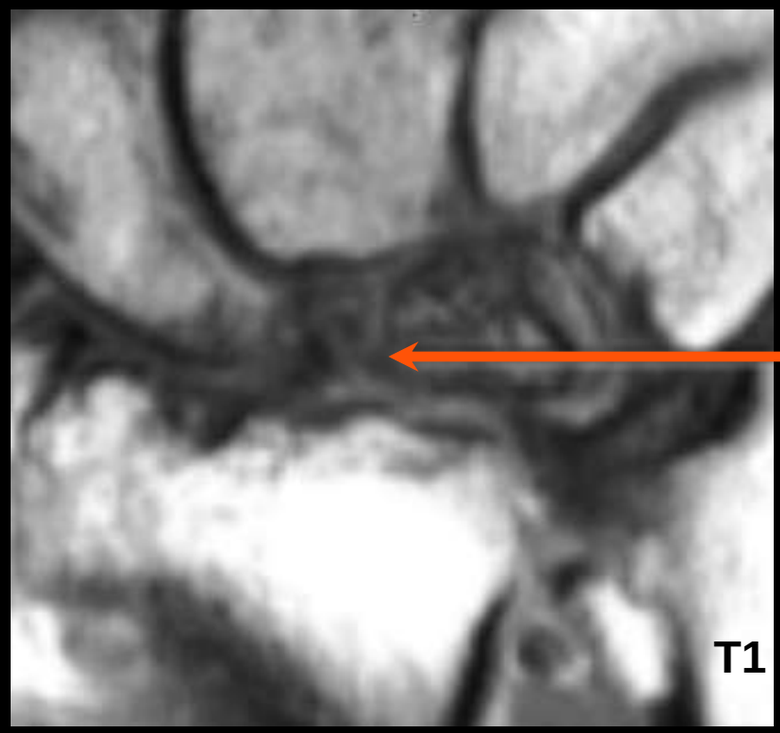
Proximal migration of the capitate

Kienbock's Disease

Lichtman's Four Stages of Osteonecrosis of the Lunate Bone

Stage 4

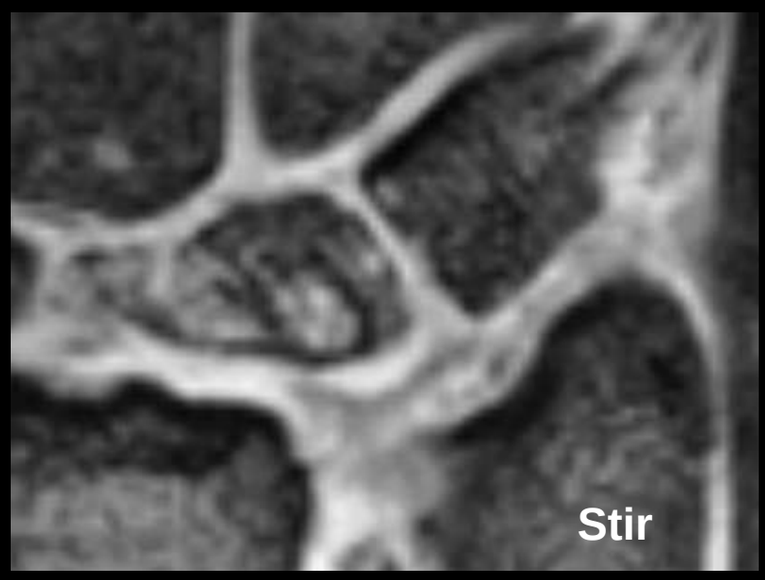




Lunate collapse

Lunate collapse

Radiocarpal and midcarpal osteoarthrosis

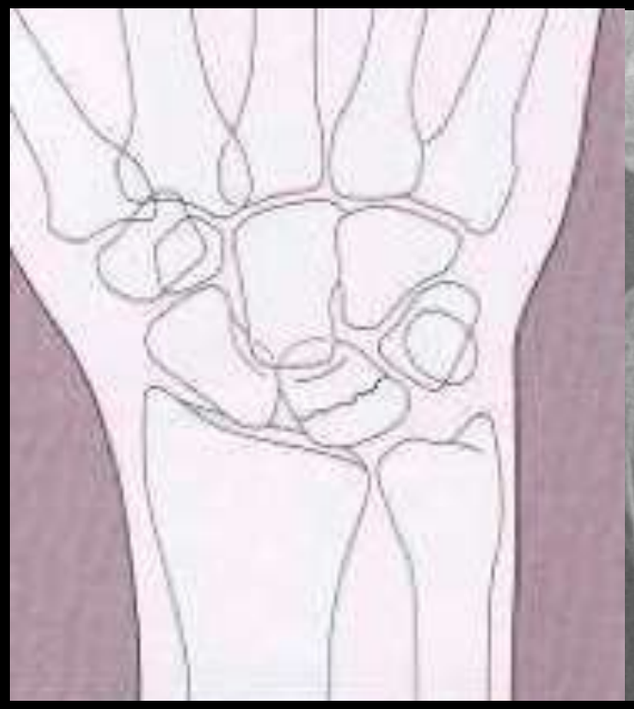


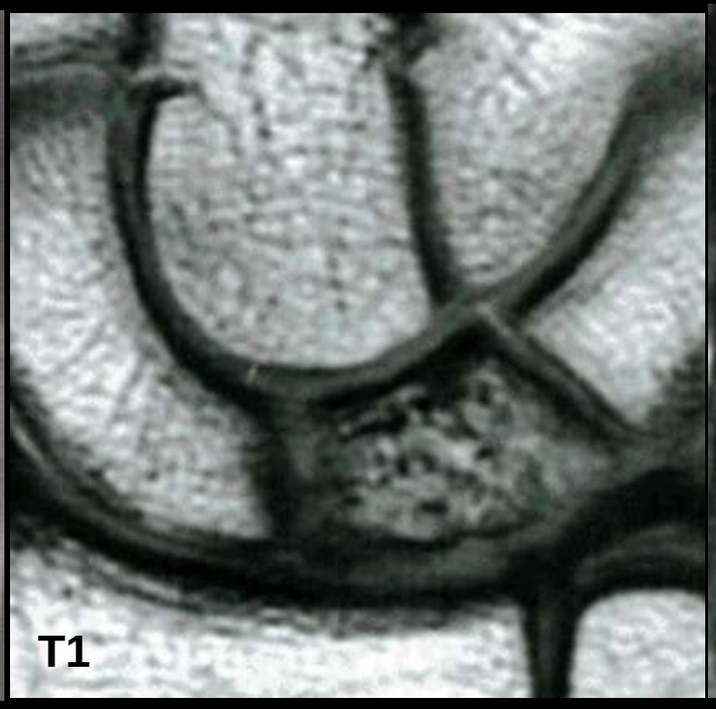
Radiocarpal and midcarpal osteoarthrosis

Kienbock's Disease

Treatment

Stage 1





Cast Immobilization for 3 months

Amadio PC et al: Fractures of the Carpal Bones. *In* DP Green et al. Green's Operative Hand Surgery. 5th ED. 2005, p 756

Uroskie JA et al: Vascular Disorders of the Hand and Upper Extremity. *In* Beredjiklian et al. Review of Hand Surgery. 1st ED. 2004, p 74-77

Kienbock's Disease

Treatment

Stage 2 and 3A

Stage 2

Joint leveling procedures

Unloading procedures

Vascularization procedures

Stage 3A

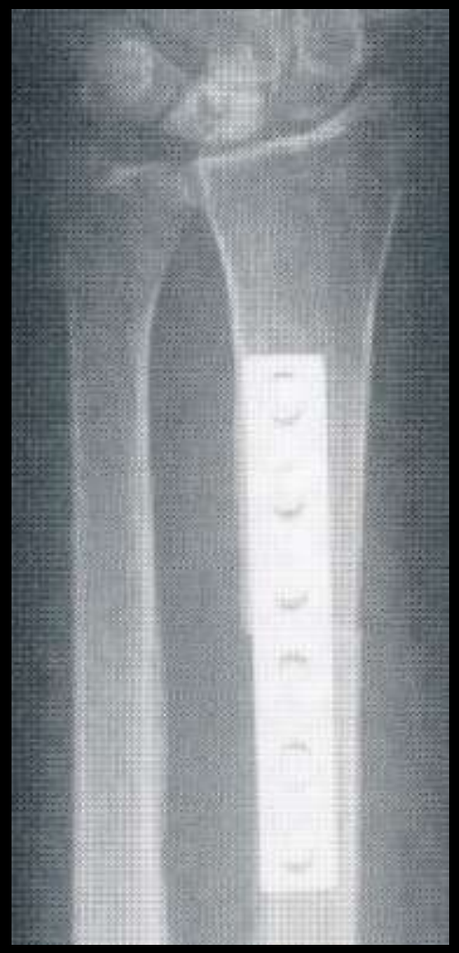
Amadio PC et al: Fractures of the Carpal Bones. *In* DP Green et al. Green's Operative Hand Surgery. 5th ED. 2005, p 756

Uroskie JA et al: Vascular Disorders of the Hand and Upper Extremity. *In* Beredjiklian et al. Review of Hand Surgery. 1st ED. 2004, p 74-77

Kienbock's Disease

Treatment

Stage 2 and 3A: Joint leveling procedures



If ulnar – variance:

Radial shortening or ulnar lengthening

If ulnar + variance:

Capitate shortening osteotomy

Amadio PC et al: Fractures of the Carpal Bones. *In* DP Green et al. Green's Operative Hand Surgery. 5th ED. 2005, p 756

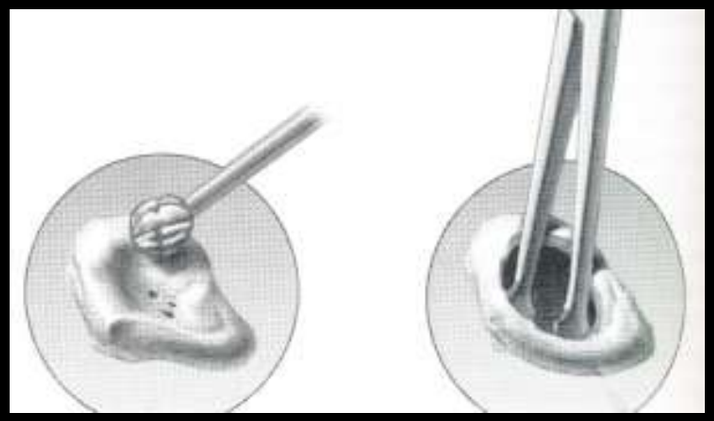
Uroskie JA et al: Vascular Disorders of the Hand and Upper Extremity. *In* Beredjiklian et al. Review of Hand Surgery. 1st ED. 2004, p 74-77

Kienbock's Disease

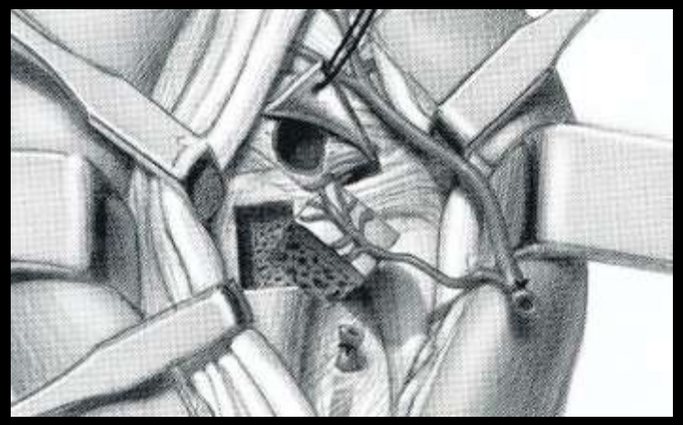
Treatment

Stage 2 and 3A

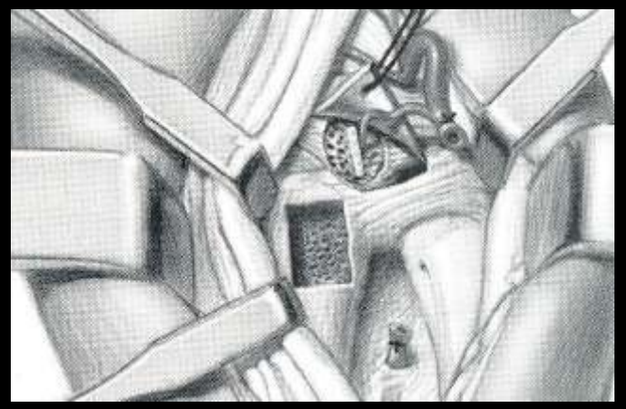
Vascularized bone graft



Debridement of necrotic bone
from the lunate bone



Vascularized bone graft
harvested from the distal radius



Bone graft inserted into lunate

Amadio PC et al: Fractures of the Carpal Bones. *In* DP Green et al. Green's Operative Hand Surgery. 5th ED. 2005, p 756

Uroskie JA et al: Vascular Disorders of the Hand and Upper Extremity. *In* Beredjiklian et al. Review of Hand Surgery. 1st ED. 2004, p 74-77

Kienbock's Disease

Treatment

Stage 3B

Scaphotrapeziotrapezoid (STT) Fusion

Proximal Row Carpectomy

Excision of the scaphoid, lunate, and triquetrum

Amadio PC et al: Fractures of the Carpal Bones. *In* DP Green et al. Green's Operative Hand Surgery. 5th ED. 2005, p 756

Uroskie JA et al: Vascular Disorders of the Hand and Upper Extremity. *In* Beredjiklian et al. Review of Hand Surgery. 1st ED. 2004, p 74-77

Kienbock's Disease

Treatment

Stage 4

Proximal Row Carpectomy

Radiocapitate-metacarpal wrist arthrodesis +/- lunate excision

Amadio PC et al: Fractures of the Carpal Bones. *In* DP Green et al. Green's Operative Hand Surgery. 5th ED. 2005, p 756

Uroskie JA et al: Vascular Disorders of the Hand and Upper Extremity. *In* Beredjiklian et al. Review of Hand Surgery. 1st ED. 2004, p 74-77

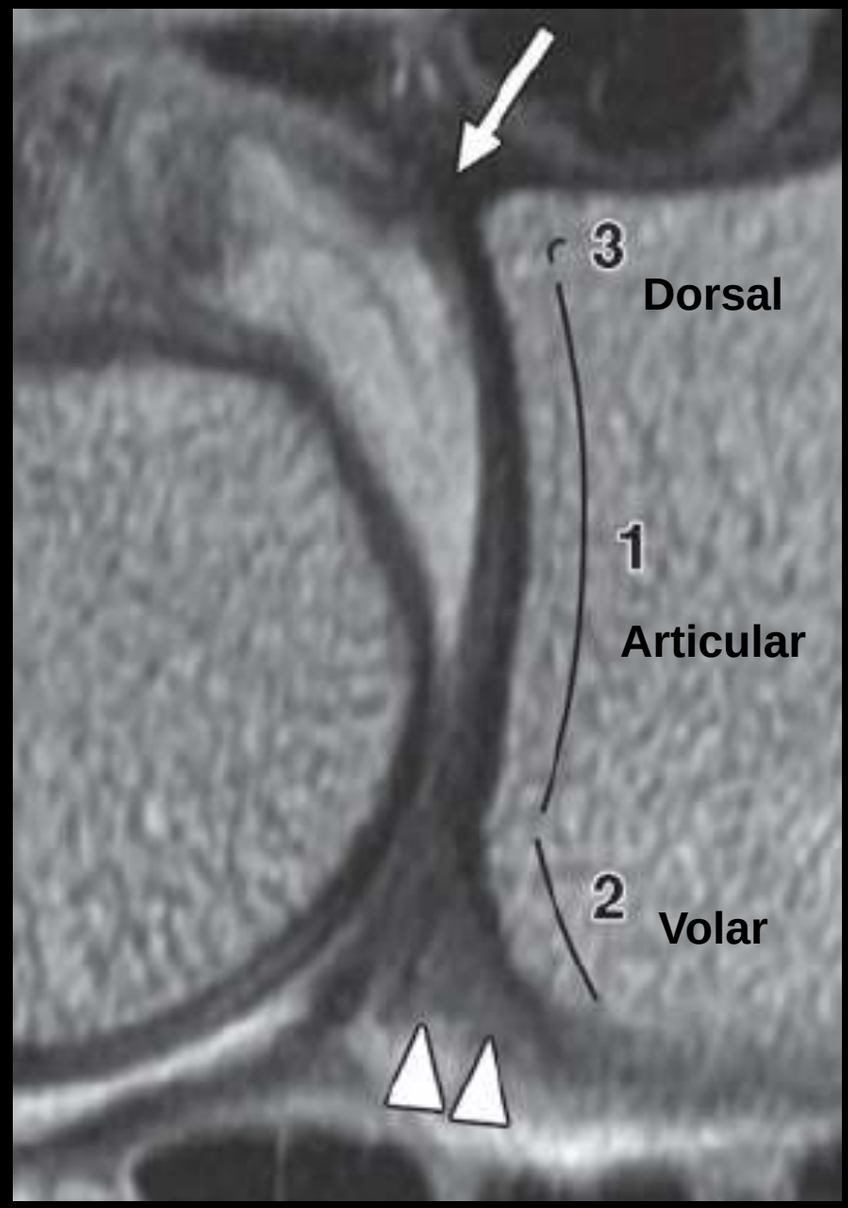
Distal Radioulnar Joint (DRUJ)

Anatomy

Osseous Facets of Distal Radius

- Three facets:
  1) Articular facet
     - ✓covered with hyaline cartilage
     - ✓thickness decreases from center to periphery
  2) Facet of the footprint of the volar distal radioulnar ligament
     - ✓larger than dorsal footprint
     - ✓devoid of cartilage
  3) Facet of the footprint of the dorsal distal radioulnar ligament
     - ✓devoid of cartilage

Attachment of dorsal radioulnar ligament



Broad attachment of volar radioulnar ligament

Buck FM, Nico MAC, Gheno R, Haghighi P, Trudell DJ, Resnick D. AJR; 2010: 202-207

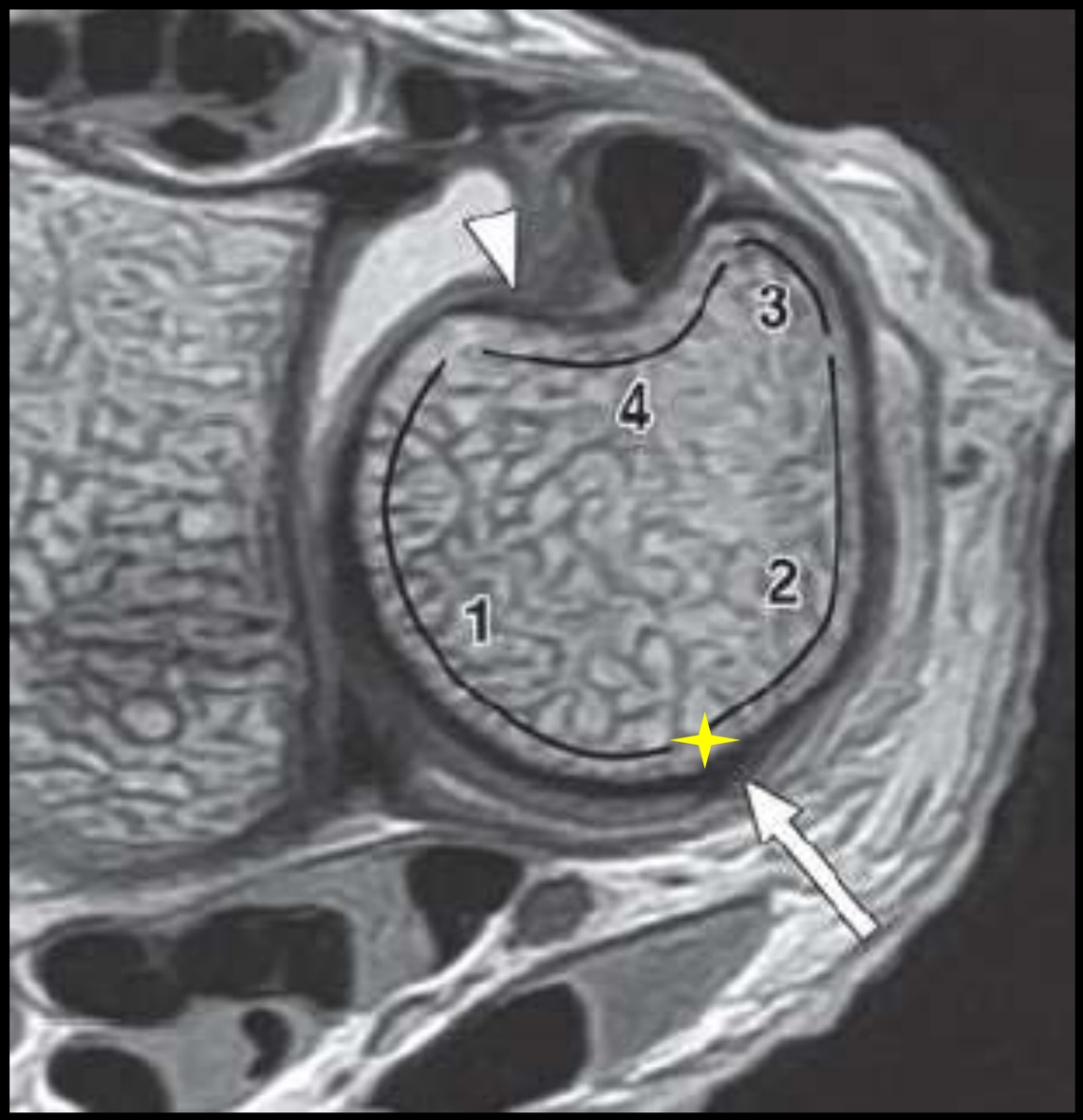
Distal Radioulnar Joint (DRUJ)

Anatomy

Osseous Facets of Ulnar Head

- Four facets:
  1) Articular
     - ✓covered with hyaline cartilage
     - ✓constant thickness (2 mm)
  2) Volar
     - ✓adjacent to bare area which is devoid of cartilage✦
  3) Styloid
     - ✓continuous with styloid process of the ulna
  4) ECU
     - ✓only concave facet

White Arrowhead = Dorsal attachment of joint capsule



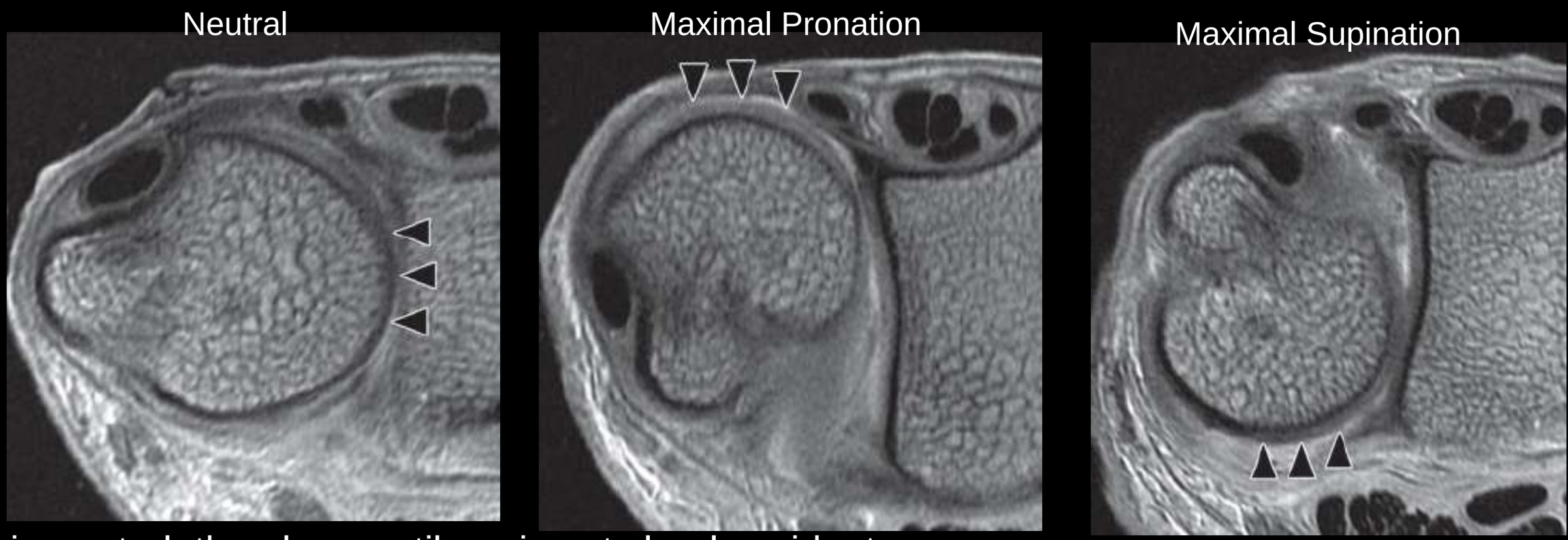
White Arrow = Volar attachment of joint capsule

Buck FM, Nico MAC, Gheno R, Haghighi P, Trudell DJ, Resnick D. AJR; 2010: 202-207

Distal Radioulnar Joint (DRUJ)

Anatomy

Osseous Facets of Ulnar Head

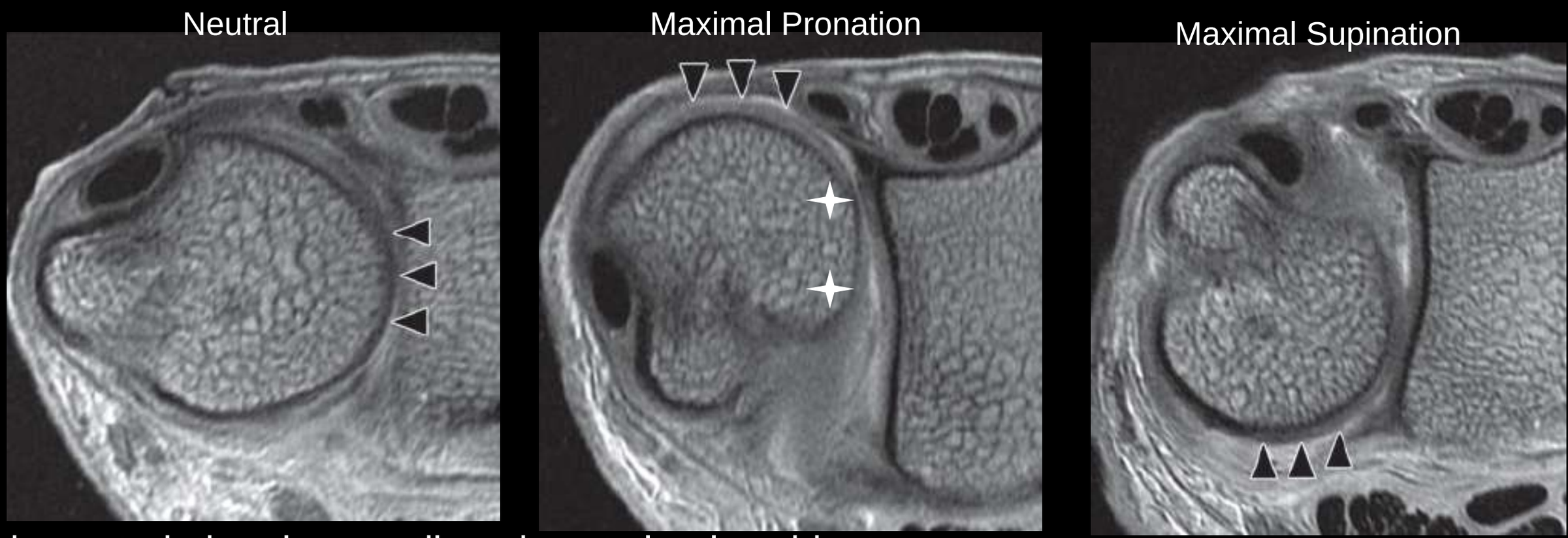


- in neutral, the ulnar cartilage is not clearly evident
- cartilage becomes apparent upon supination and pronation
- for optimal assessment of radial and ulnar cartilages, imaging in at least two of the three positions is needed

Distal Radioulnar Joint (DRUJ)

Anatomy

Osseous Facets of Ulnar Head



- in neutral, the ulnar cartilage is not clearly evident
- cartilage becomes apparent upon supination and pronation
- for optimal assessment of radial and ulnar cartilages, imaging in at least two of the three positions is needed
- In pronation, the volar facet and capsule rotate into joint✦does not represent cartilage loss

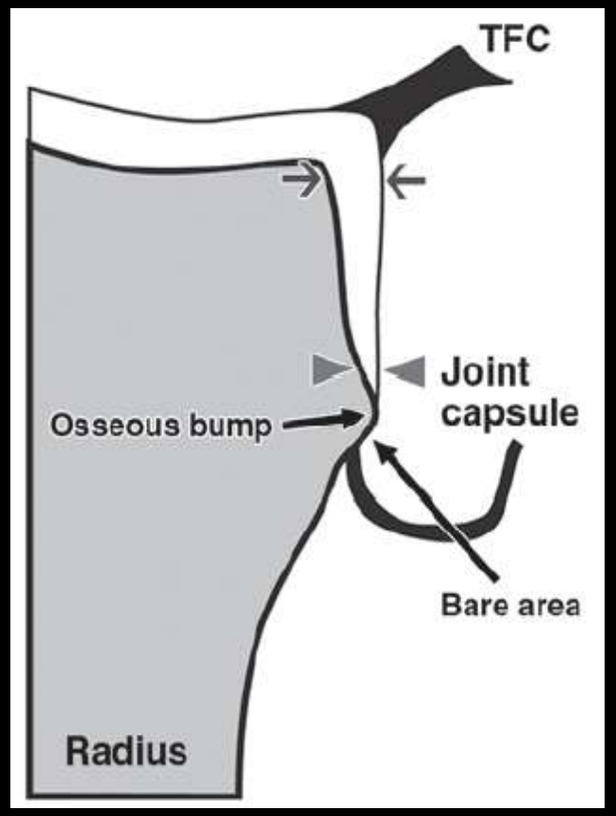
Buck FM, Nico MAC, Gheno R, Haghighi P, Trudell DJ, Resnick D. AJR; 2010: 202-207

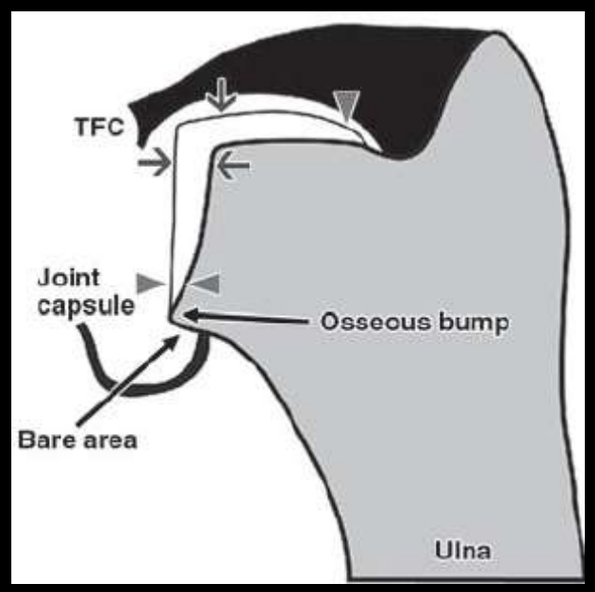
Distal Radioulnar Joint (DRUJ)

Anatomy

Radial and Ulnar Sides of DRUJ

- cartilage thickness is maximal distally
- osseous bump at proximal end of cartilages
  - ✓ site of cartilage loss and osteoarthrosis
- bare area present between termination of cartilages and insertion of joint capsule
  - ✓ area prone to erosion in inflammatory arthropathies



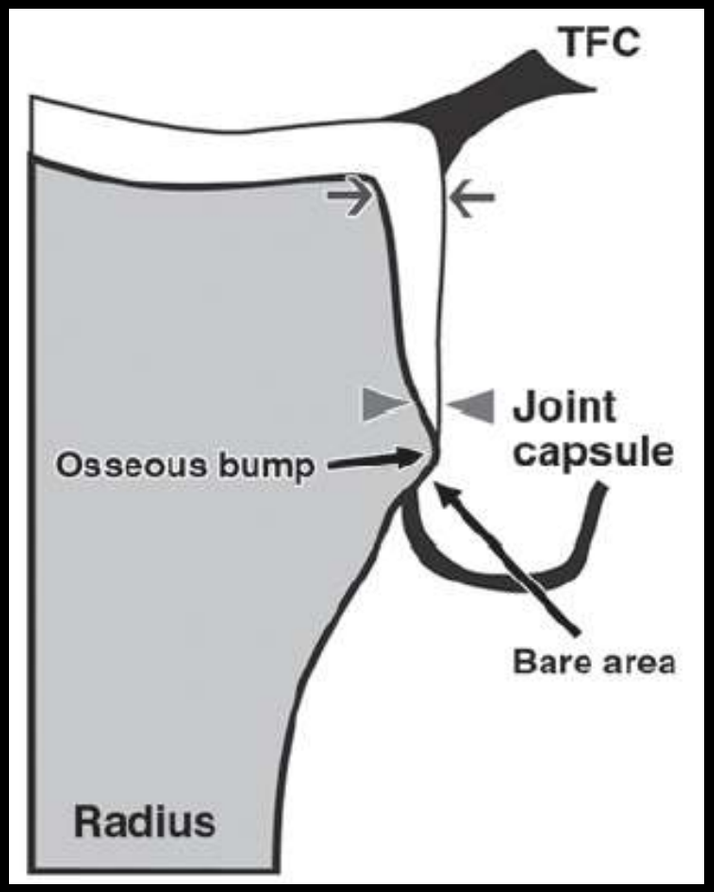


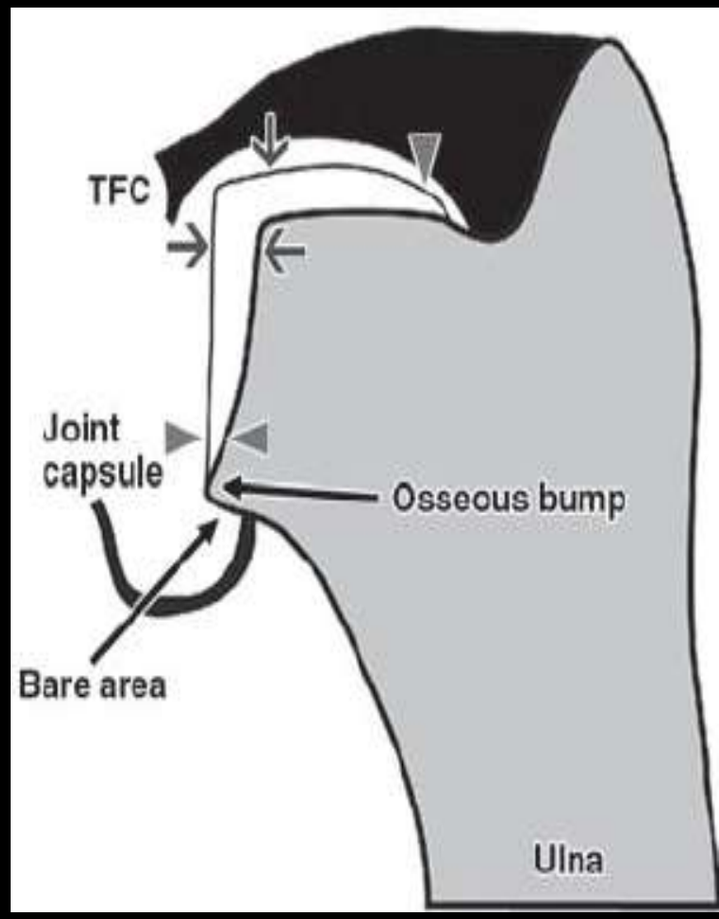
Buck FM, Nico MAC, Gheno R, Haghighi P, Trudell DJ, Resnick D. AJR; 2010: 202-207

Distal Radioulnar Joint (DRUJ)

Bare Area

Osteoarthrosis

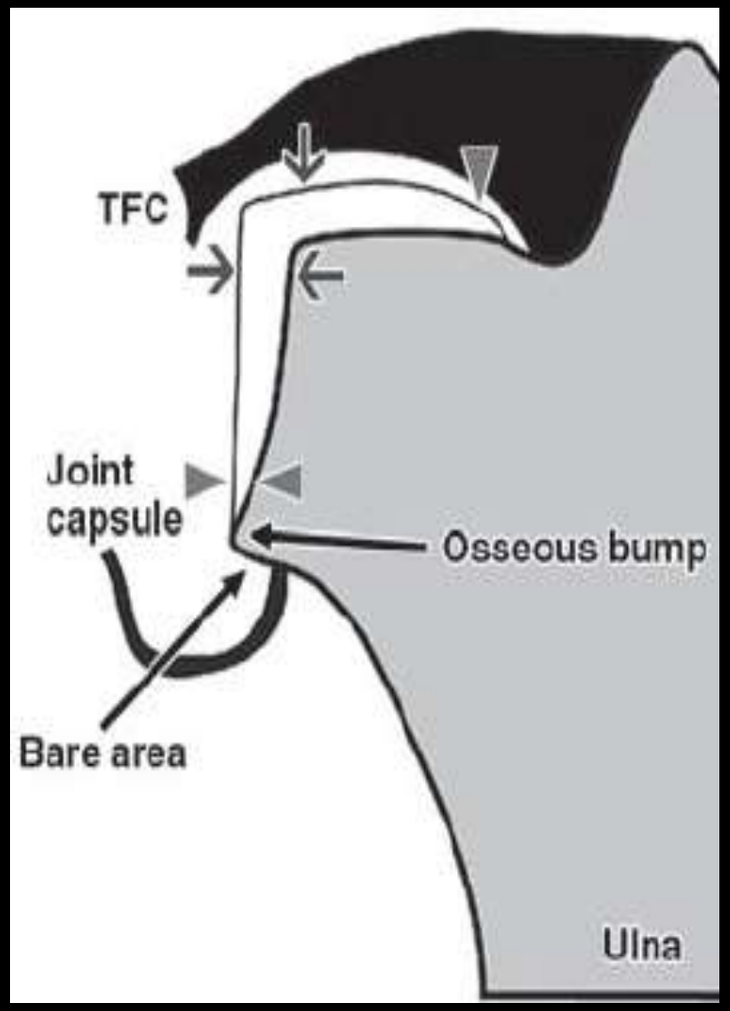




Distal Radioulnar Joint (DRUJ)

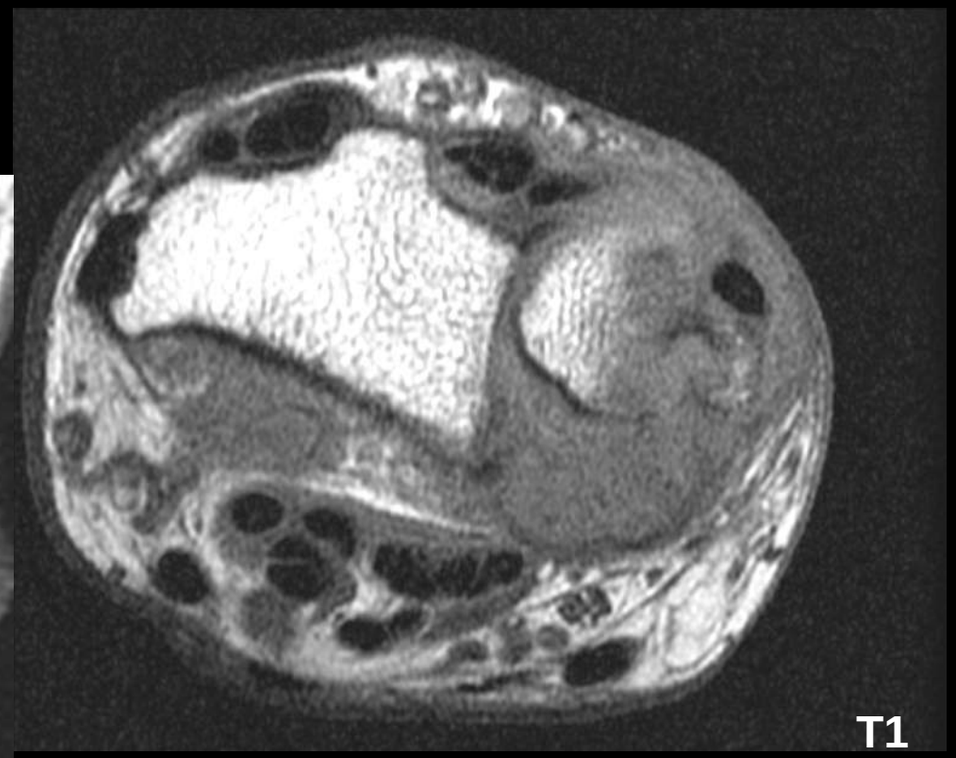
Bare Area

Rheumatoid Arthritis

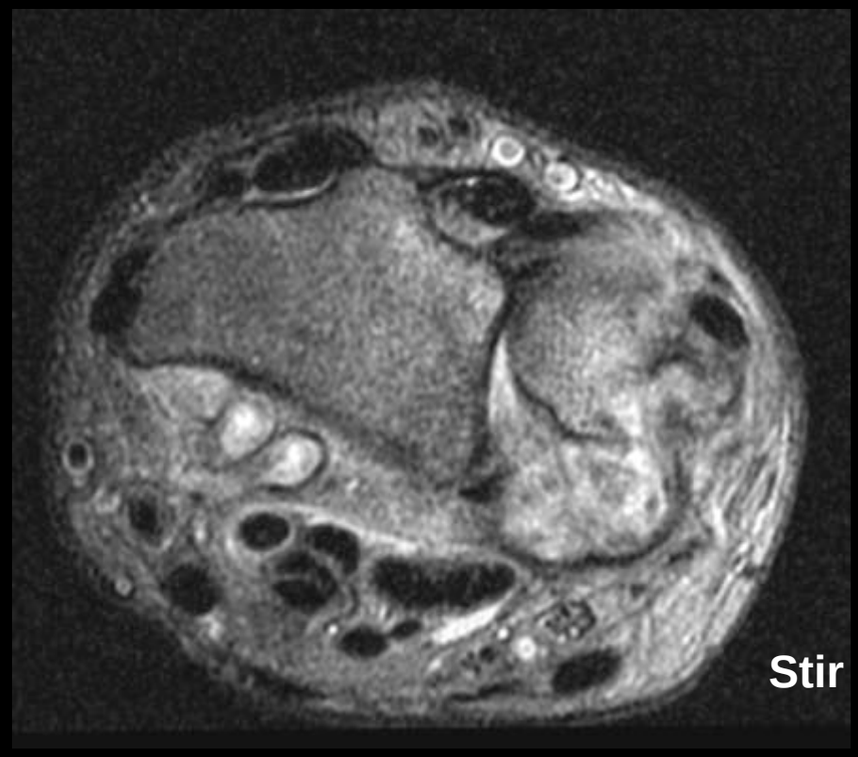


DRUJ synovitis

Ulnar styloid erosion



ECU tenosynovitis



Thank you Mini

Distal Radioulnar Joint (DRUJ)

Stability

- involved in pronation and supination of the forearm
- the radius moves with respect to a relatively fixed ulna
- despite this, by convention, instability of the DRUJ is described as ulnar subluxation or dislocation
- structures providing stability to this joint are not agreed upon

✓ triangular fibrocartilage
✓ dorsal and volar radioulnar ligaments
✓ meniscus homologue
✓ volar ulnocarpal ligaments (ulnolunate and ulnotriquetral)
✓ extensor carpi ulnaris tendon and sheath
✓ pronator quadratus and flexor carpi ulnaris muscles
✓ annular ligament of the elbow (coronal stability)
✓ interosseous membrane of the forearm (longitudinal stability)

Distal Radioulnar Joint (DRUJ)

Instability

- Dorsal instability predominates

Causes:

- ✓ fractures (Galeazzi, Essex-Lopresti, base of ulnar styloid process)
- ✓ tendinous and ligamentous injury
- ✓ inflammatory arthropathies (rheumatoid)
- ✓ osteoarthrosis

Clinical Manifestations:

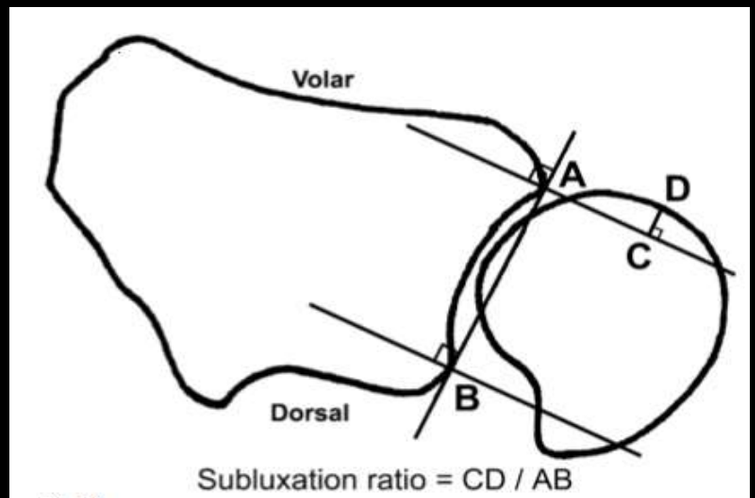
- ✓ pain, weakness, loss of forearm rotation, and snapping
- ✓ dorsal prominence of the ulnar head
- ✓ diagnosis of DRUJ instability can be a subjective and inaccurate finding on clinical exam

Distal Radioulnar Joint (DRUJ)

Instability

Computed Tomography

- imaging of the wrist in a custom-designed device with a handle grip bar
- ensures forearm position in is 70° of pronation and supination
- imaging technique can be applied to both wrists in order to identify DRUJ instability



Subluxation ratio = CD / AB

Fig. 2-B

The subluxation ratio method. Two lines perpendicular to a line connecting the volar and dorsal margins of the sigmoid notch are drawn from the volar and dorsal margins of the sigmoid notch. The ratio of the length of CD to that of AB is calculated.

- Subluxation ratio:
  - ✓ found to be the simplest technique
  - ✓ best inter-observer reliability for measuring translation of the distal radioulnar joint

Park MJ and Kim JP. JBJS. 2008; 90:145-153

Distal Radioulnar Joint (DRUJ)

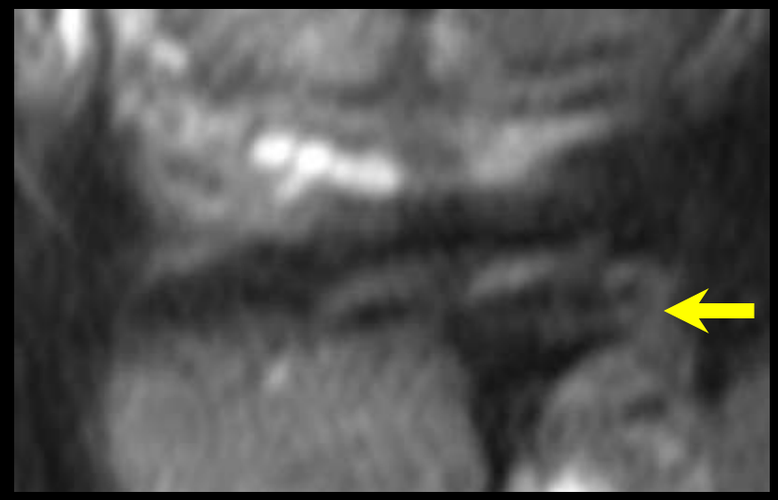
Instability

- for subluxation/ dislocation of the DRUJ:

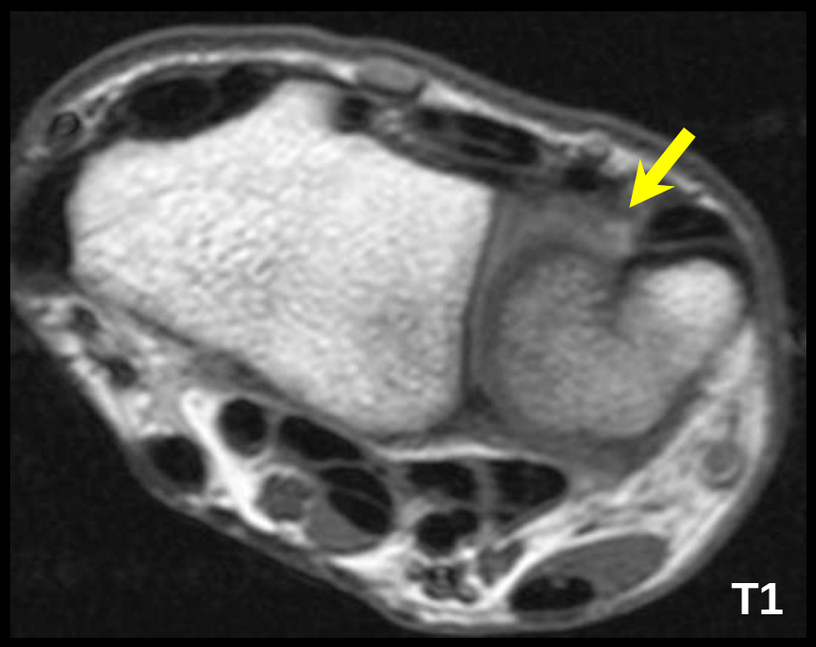
  ✓ volar and dorsal radioulnar ligament injury is usually required

T1

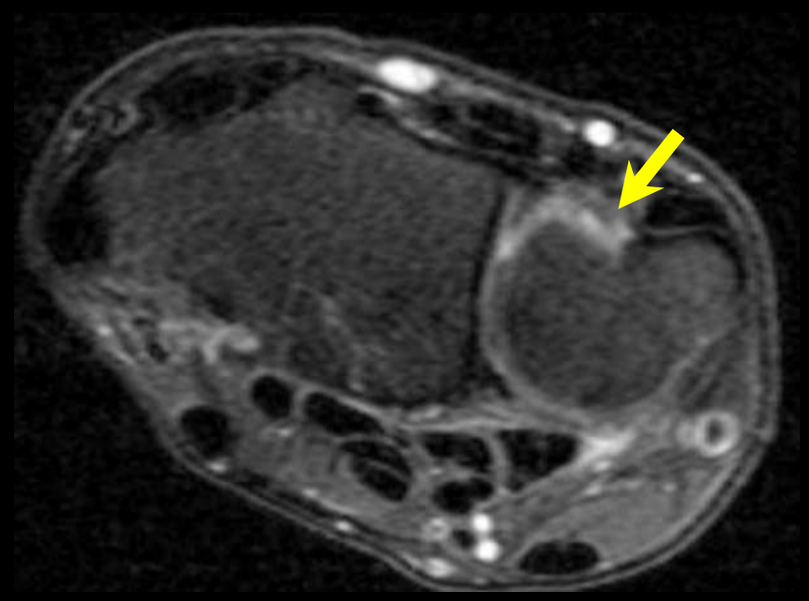
Injury of the dorsal radioulnar ligament



Stir



T1



Stir

Matthew Sharp 2010
Thank you

Distal Radioulnar Joint (DRUJ)

Instability

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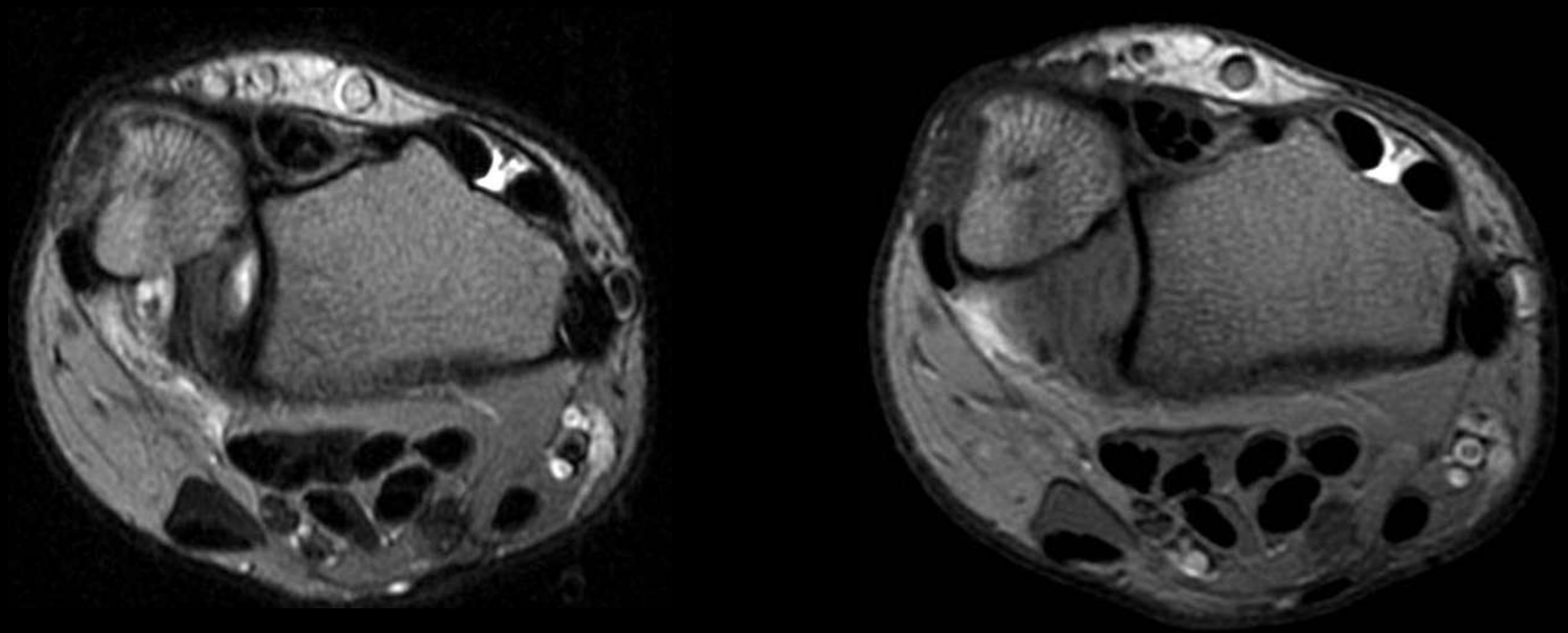


Thank you Mini

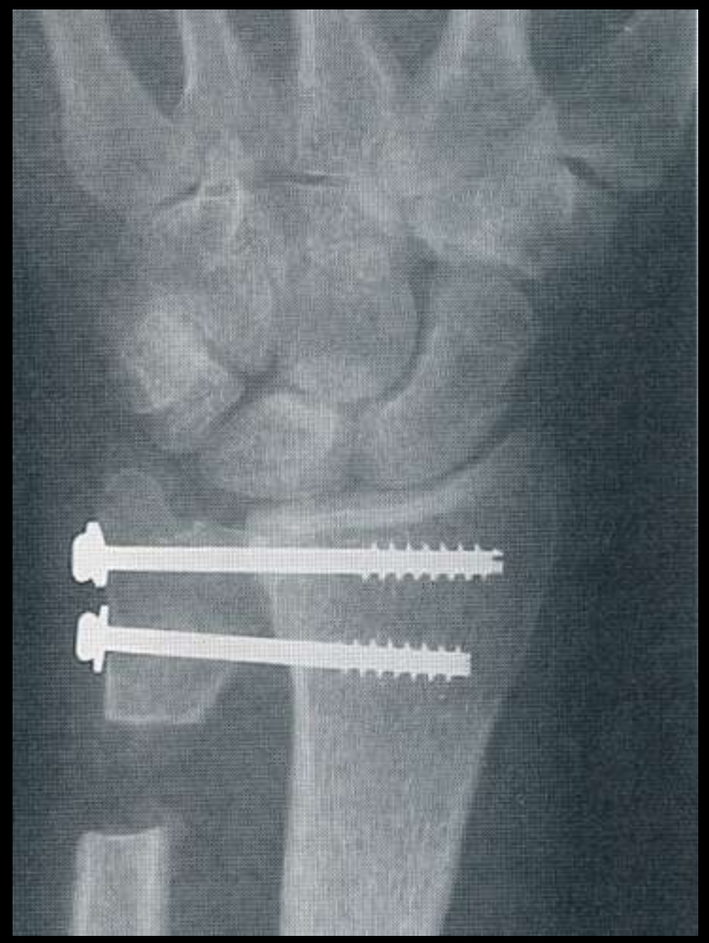
Distal Radioulnar Joint (DRUJ)

Instability

Treatment

- DRUJ pinning
- TFC and ligamentous repair
- pinning of base of ulnar styloid fractures, if present
- chronic instability is met with a salvage procedure such as the Sauvé-Kapandji

Sauvé-Kapandji Procedure



Fusion of the DRUJ

Distal resection of the ulna to preserve forearm rotation

Blazar PE: Dislocations/Instability. *In* Beredjiklian PK and Bozentka DJ (Eds): Review of Hand Surgery. Philadelphia, WB Saunders, 2004, p 149-150.

Pisotriquetral Joint (PTJ)

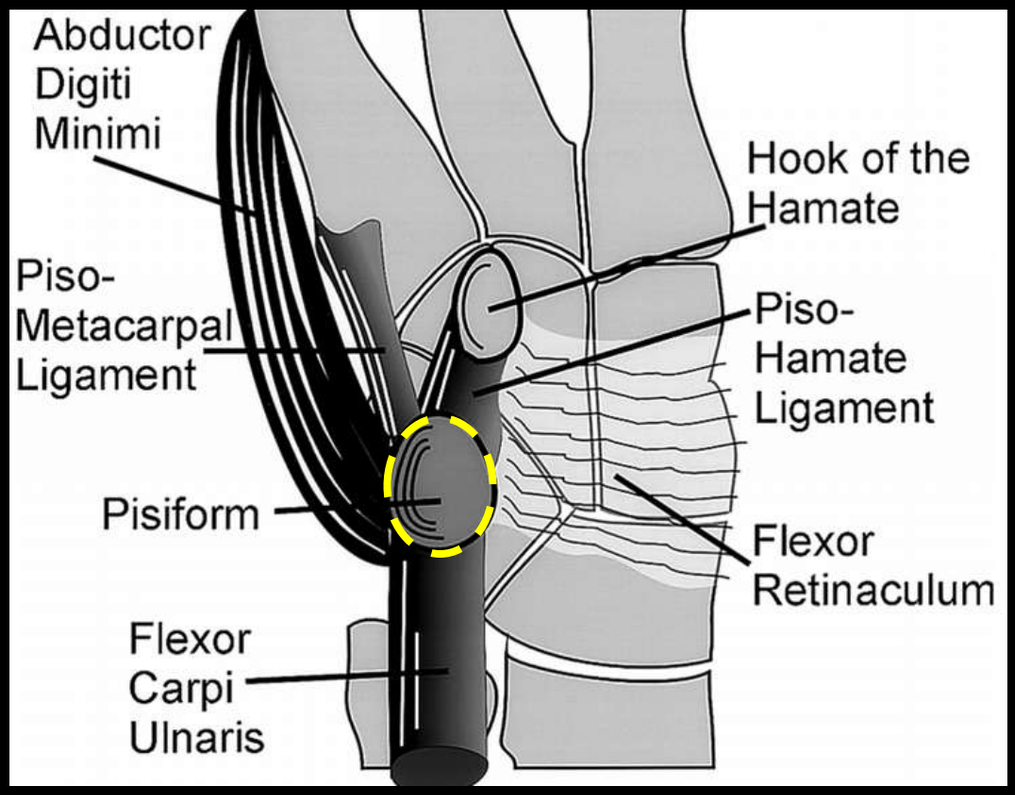
Anatomy

- synovial joint that normally communicates with the radiocarpal compartment (12-18%)

- pisiform bone has been likened to a lever (much like the patella), increasing the force of wrist flexion

- stability of PTJ is dependent on two groups of opposing forces:
  - ✓ Ulnar side:
    - flexor carpi ulnaris (FCU)
    - pisometacarpal ligament
    - abductor digiti minimi
  - ✓ Radial side:
    - flexor retinaculum
    - pisohamate ligament

- FCU, pisohamate ligament, pisometacarpal ligament are the main stabilizers of the PTJ



Theumann NH, Pfirmann CWA, Chung CB, Antonio GE, Trudell DJ, Resnick D. Radiology. 2002; 222(3):763-70

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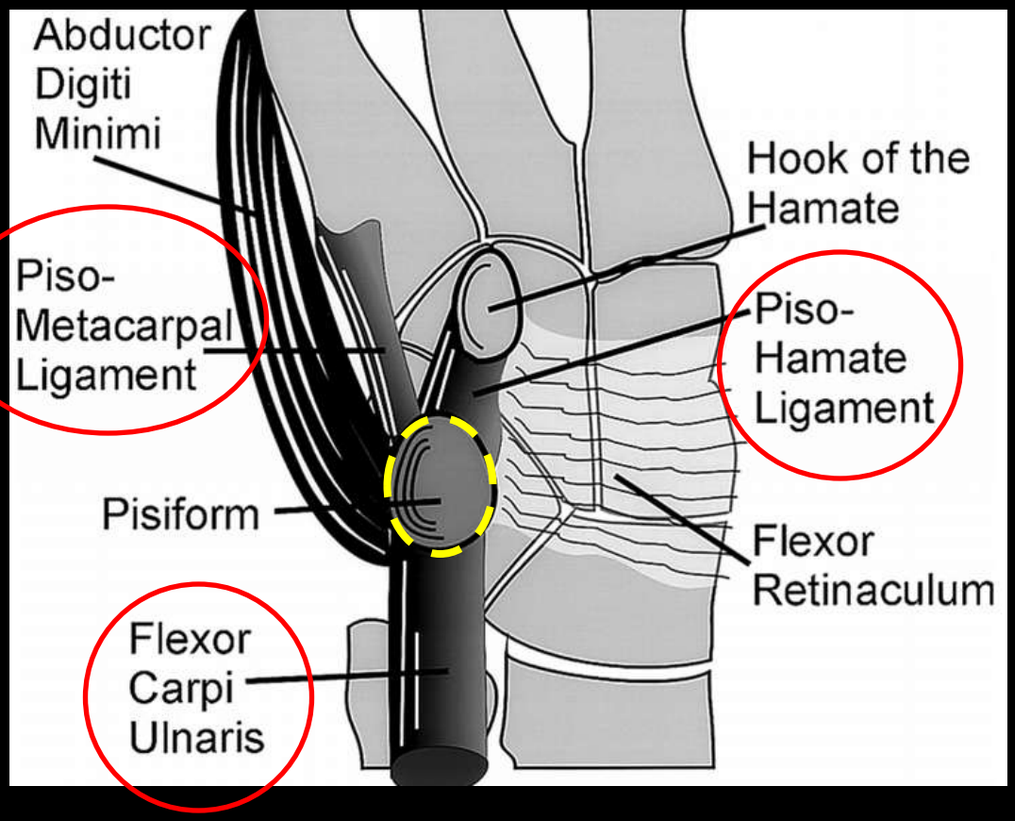
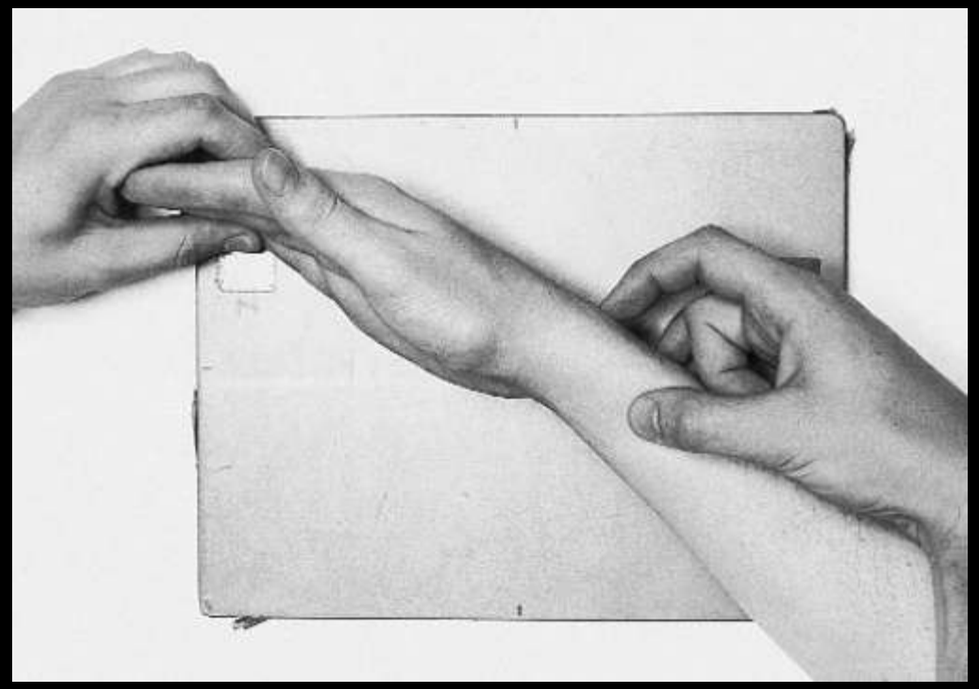


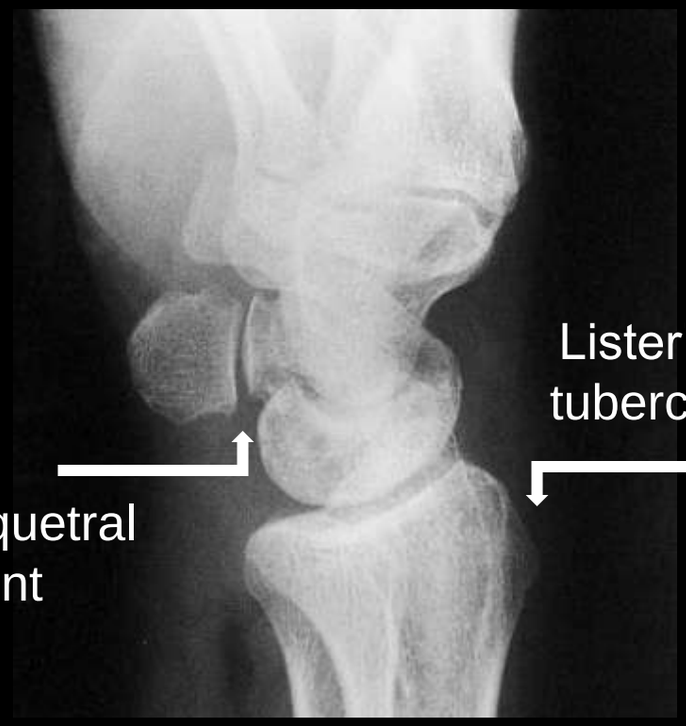
Theumann NH, Pfirmann CWA, Chung CB, Antonio GE, Trudell DJ, Resnick D. Radiology. 2002; 222(3):763-70

Pisotriquetral Joint (PTJ)

Radiographic Anatomy



Lateral x-ray of wrist in neutral position with forearm supinated by 30°



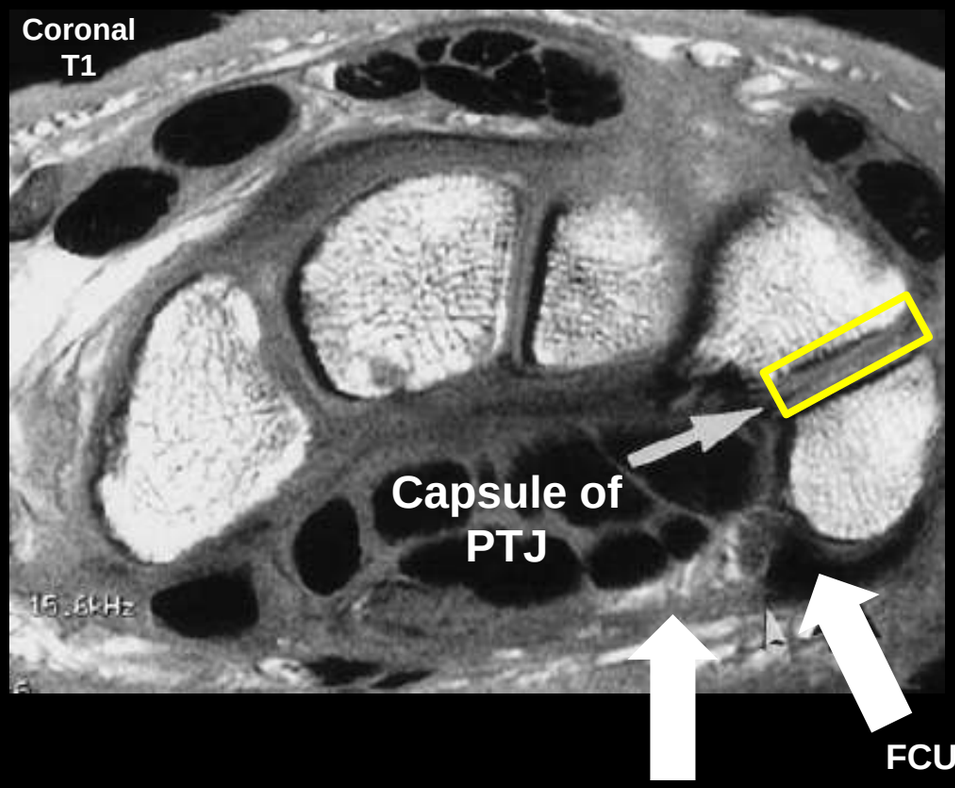
Gardner-Thorpe D et al. J Hand Surg Br; 1999: 24:252

Pisotriquetral Joint (PTJ)

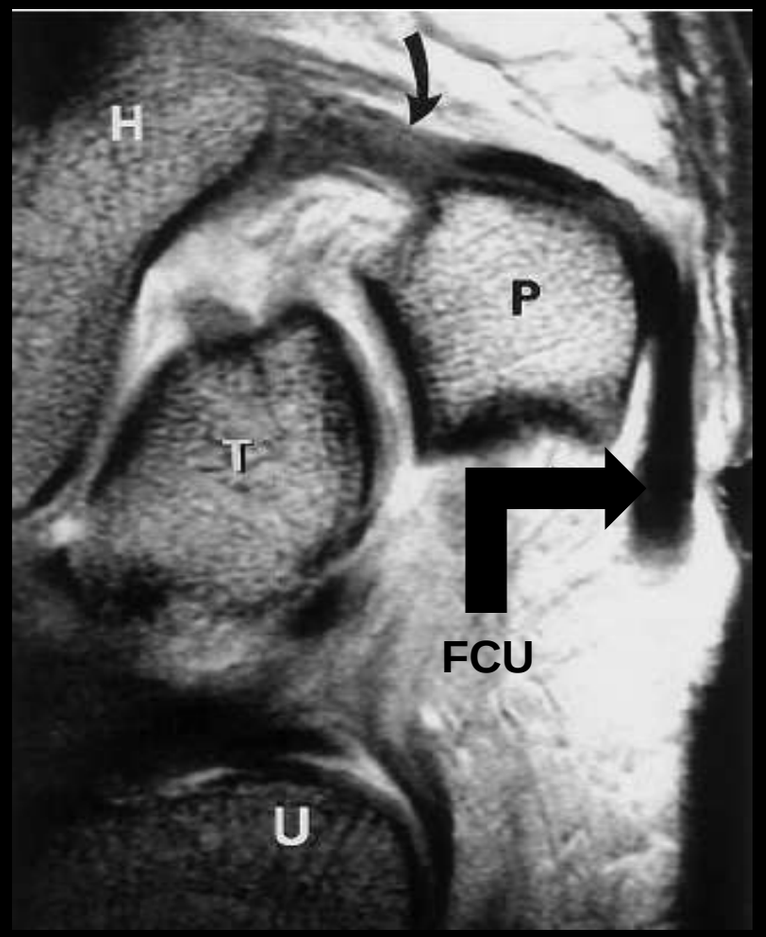
MRI Anatomy

Radial Stabilizers

- ✓flexor retinaculum
- ✓pisohamate ligament



FCU fibers and pisohamate ligament



Sagittal
T1

Theumann NH, Pfirmann CWA, Chung CB, Antonio GE, Trudell DJ, Resnick D. Radiology. 2002; 222(3):763-70

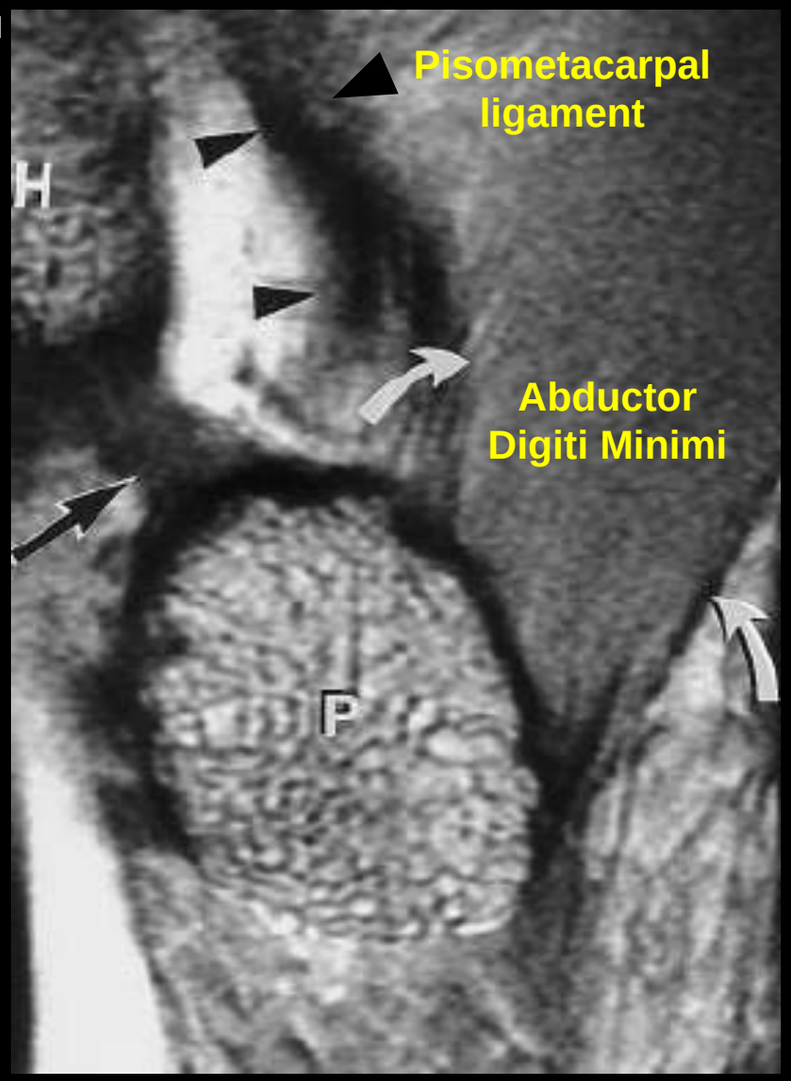
Pisotriquetral Joint (PTJ)

MRI Anatomy

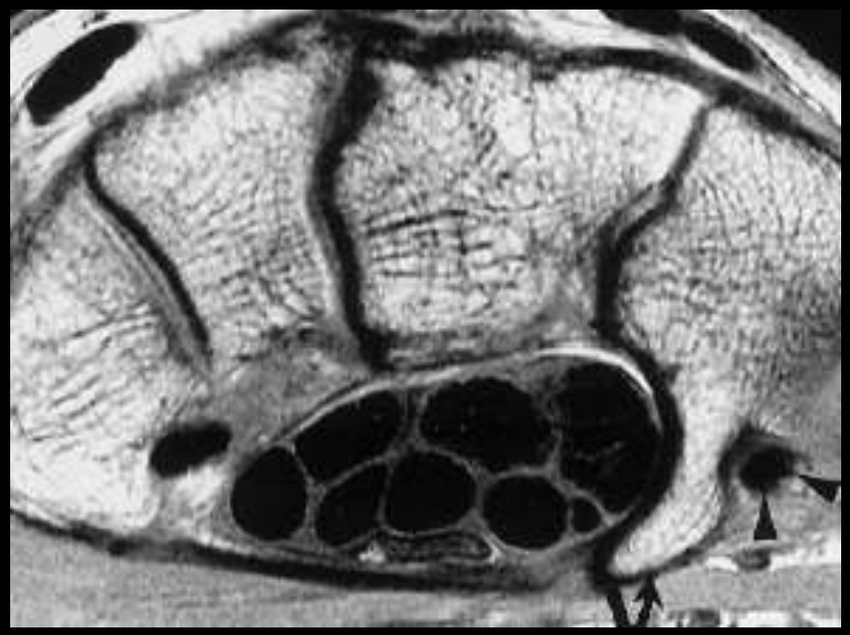
Ulnar Stabilizers

- ✓FCU
- ✓abductor digiti minimi
- ✓pisometacarpal ligament

Coronal T1



Axial T1



Theumann NH, Pfirmann CWA, Chung CB, Antonio GE, Trudell DJ, Resnick D. Radiology. 2002; 222(3):763-70

Pisotriquetral Joint (PTJ)

Instability

- soft tissue failure of stabilizing structures leading to chronic ulnar sided wrist pain

Cause:
- ✓ acute trauma (fractures)
- ✓ repetitive microtrauma (racquet sports)

Complications:
- ✓ distal pisiform dislocation, instability of the PTJ
- ✓ ulnar nerve irritation in Guyon's canal
- ✓ cartilage loss and osteoarthrosis

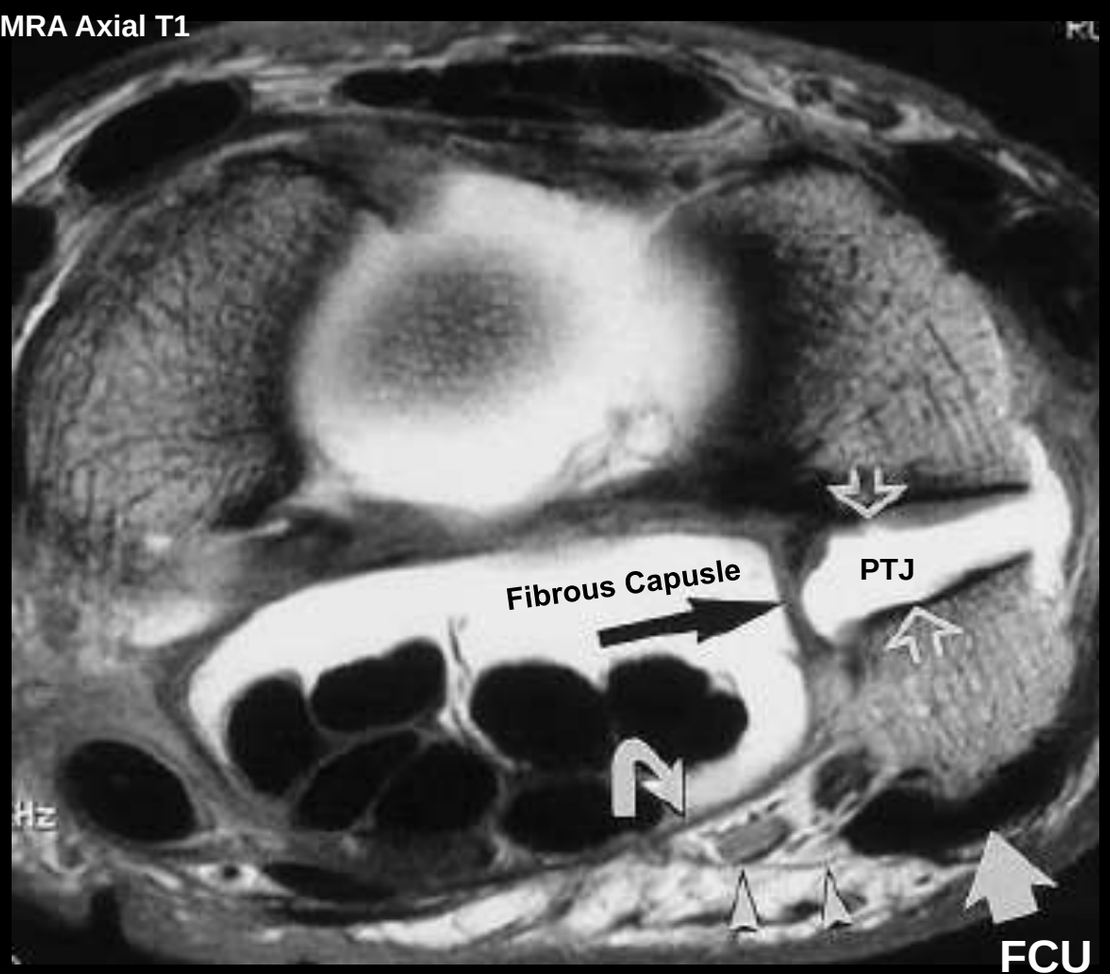
Clinical:
- ✓ tenderness over pisiform on clinical exam
- ✓ paresthesias about ulnar nerve distribution

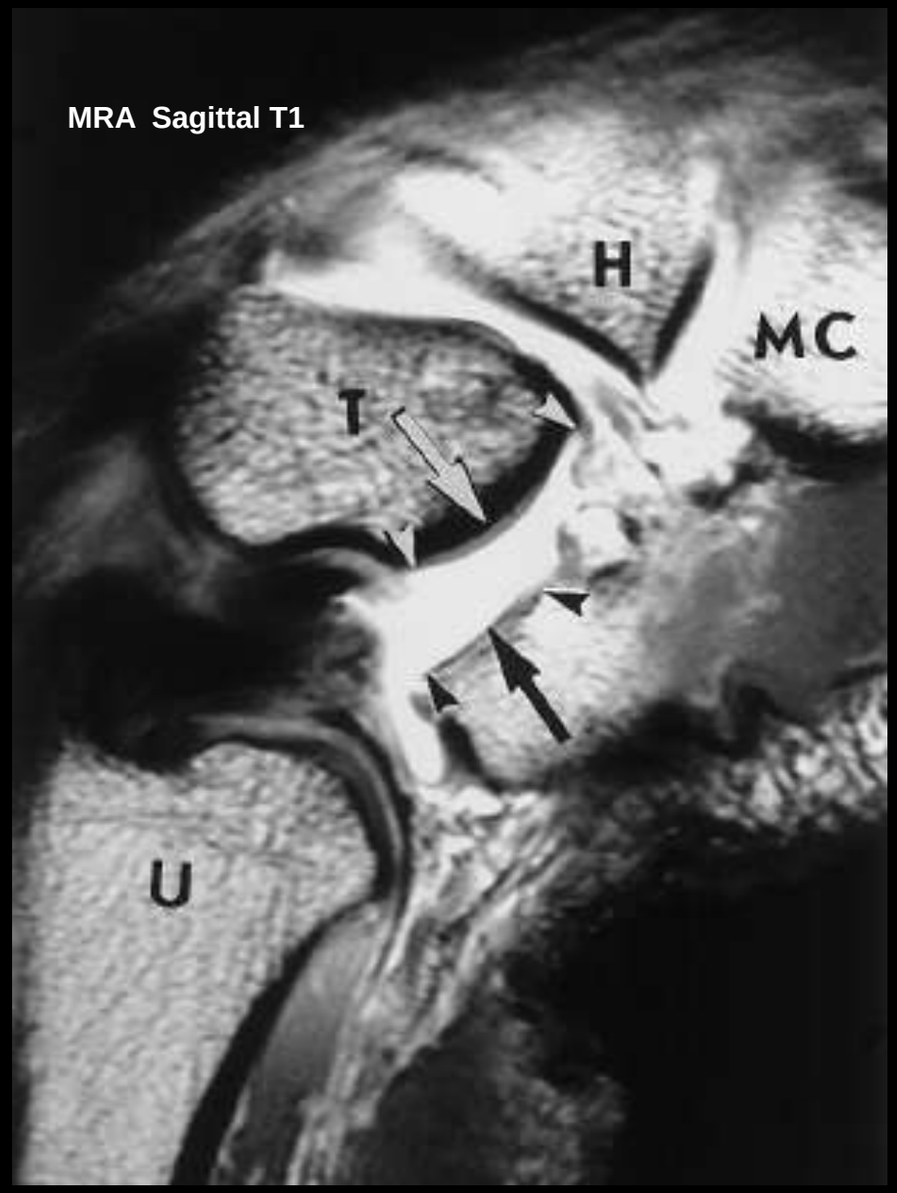
Treatment :
- ✓ conservative with immobilization and intra-articular steroid injections
- ✓ pisiformectomy via a longitudinal split in the FCU for refractory symptoms

Theumann NH, Pfirmann CWA, Chung CB, Antonio GE, Trudell DJ, Resnick D. Radiology. 2002; 222(3):763-70

Pisotriquetral Joint (PTJ)

Focal triquetral and diffuse pisiform full thickness cartilage loss



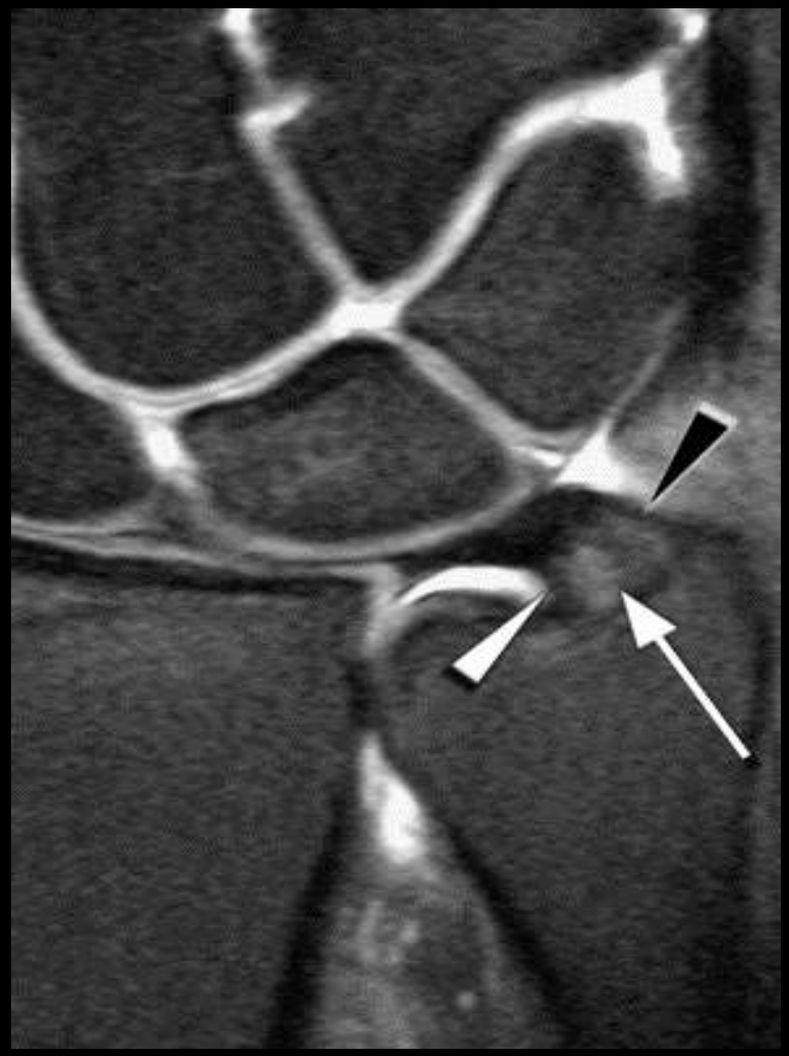


Theumann NH, Pfirmann CWA, Chung CB, Antonio GE, Trudell DJ, Resnick D. Radiology. 2002; 222(3):763-70

Triangular Fibrocartilage Complex (TFCC)

Anatomy

- fibrocartilage-ligament complex
- transmits axial load between the carpus and the ulna
- stabilizes the ulnar aspect of the carpus
- plays a role in stabilizing the DRUJ



Components:

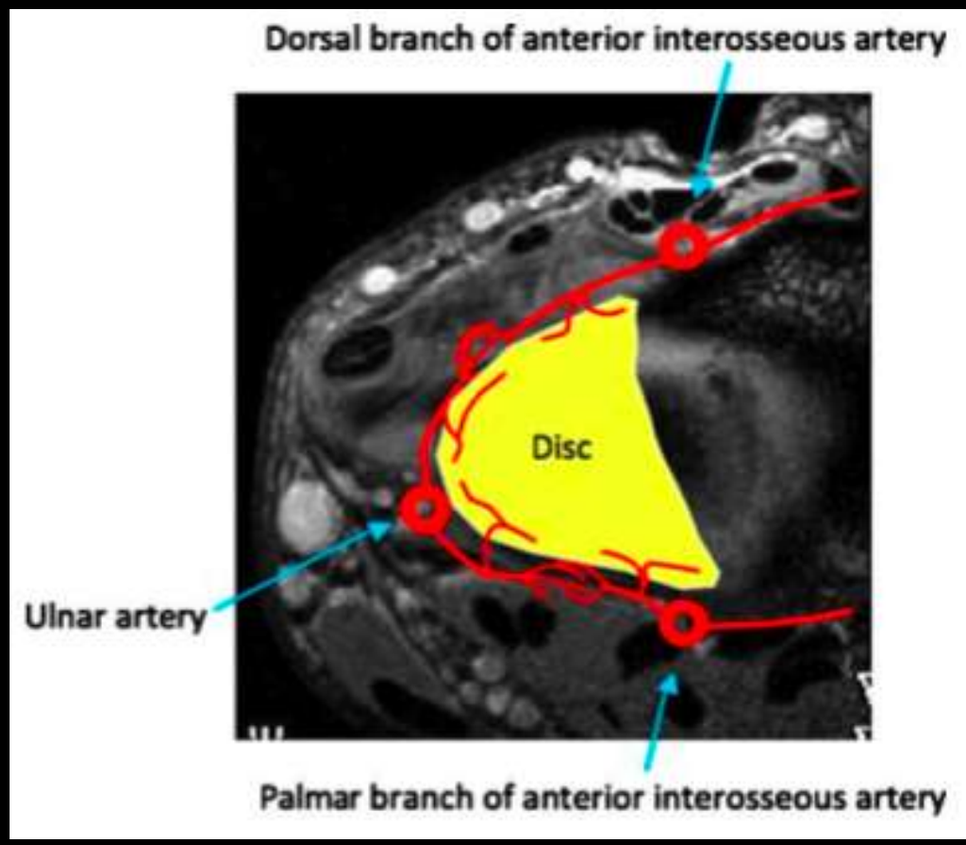
- ✓ bow tie shaped articular disc (TFC)
- ✓ meniscus homologue
- ✓ volar ulnolunate and ulnotriquetral ligaments
- ✓ volar and dorsal radioulnar ligaments
- ✓ (+/-) ulnar collateral ligament

Triangular Fibrocartilage Complex (TFCC)

Anatomy

Vascular Supply :

- three main arterial branches:
  - ✓ ulnar artery
  - ✓ palmar branch of the anterior interosseous artery
  - ✓ dorsal branch of the anterior interosseous artery
- supply blood to the periphery of the TFC
- central disc is avascular



Triangular Fibrocartilage Complex (TFCC)

Components:

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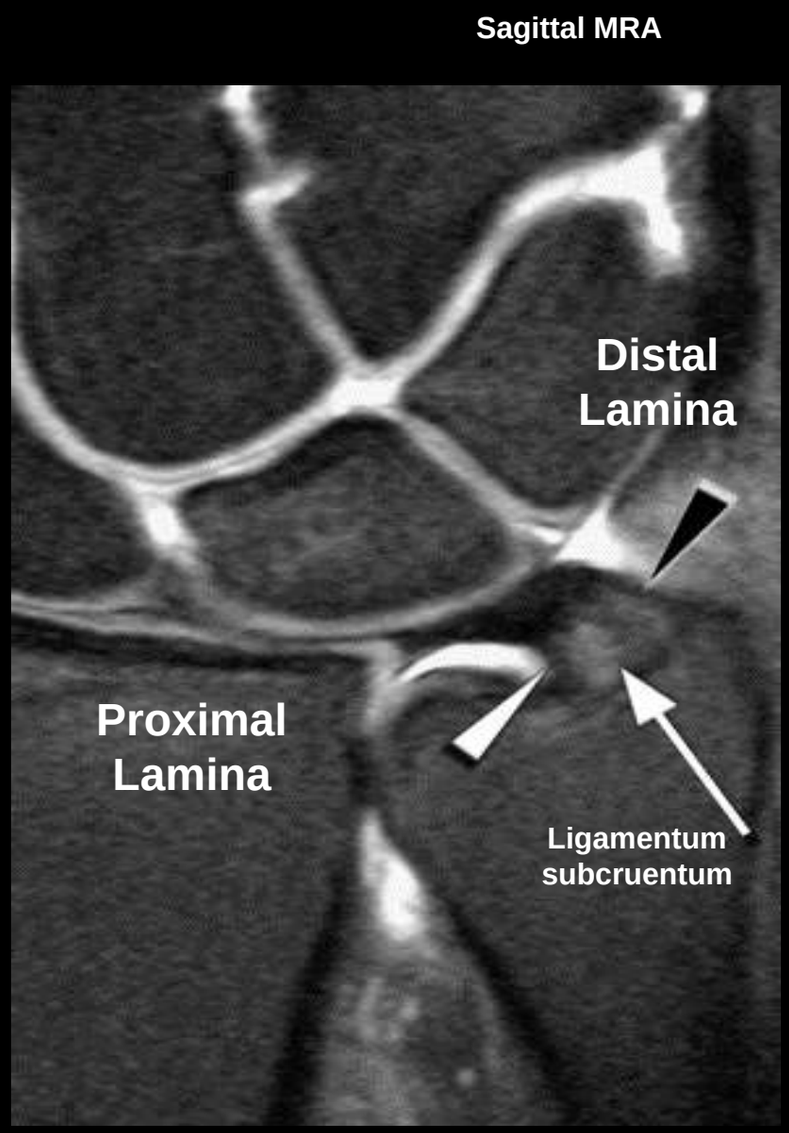


Triangular Fibrocartilage Complex (TFCC)

Anatomy

Ulnar Variance and TFC Morphology

Positive Variance

TFC thinned

Stretched distally

Arc-shaped between the distal ulna and carpus

Triangular Fibrocartilage Complex (TFCC)

Anatomy

Ulnar Variance and TFC Morphology

Positive Variance

TFC thinned

Stretched distally

Arc-shaped between the distal ulna and carpus

Neutral Variance

TFC minimally tilted

Follows the cartilage of the lunate fossa

Triangular Fibrocartilage Complex (TFCC)

Anatomy

Ulnar Variance and TFC Morphology

Positive Variance

TFC thinned

Stretched distally

Arc-shaped between the distal ulna and carpus

Neutral Variance

TFC minimally tilted

Follows the cartilage of the lunate fossa

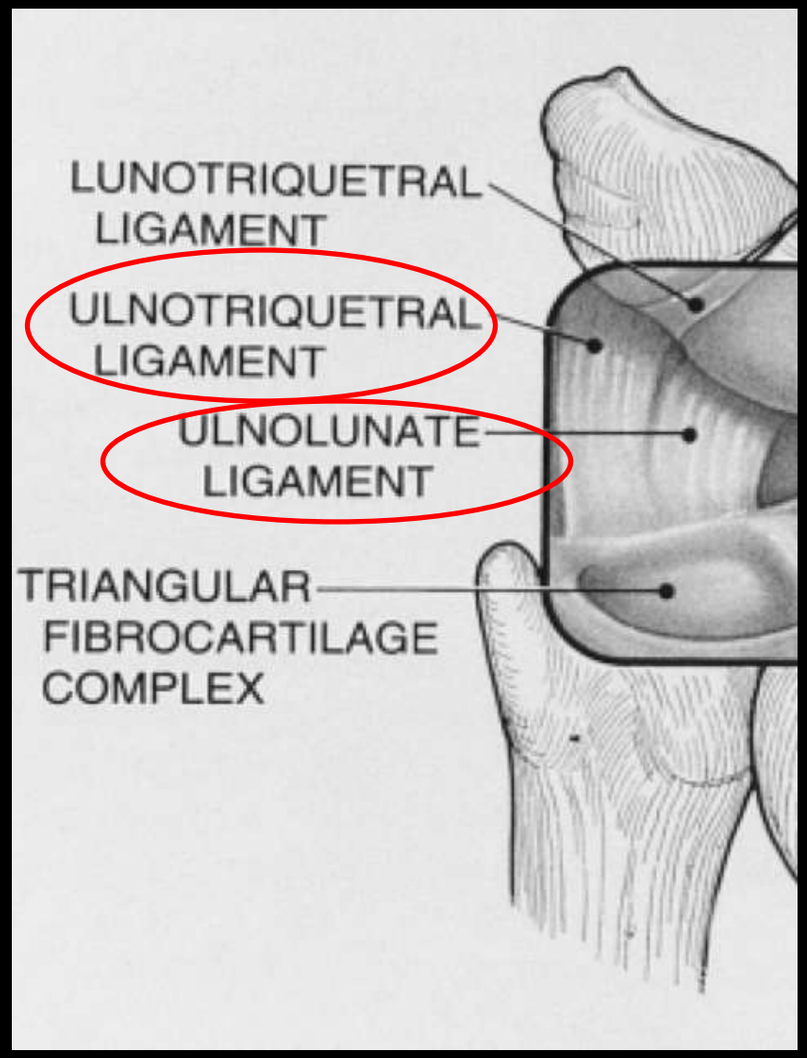
Negative Variance

TFC thicker, shorter, and more horizontal

Triangular Fibrocartilage Complex (TFCC)

Components:

- ✓bow tie shaped articular disc (TFC disc proper)
- ✓meniscus Homologue
- ✓volar ulnolunate and ulnotriquetral ligaments
- ✓volar and dorsal radioulnar ligaments
- ✓(+/-) ulnar collateral ligament



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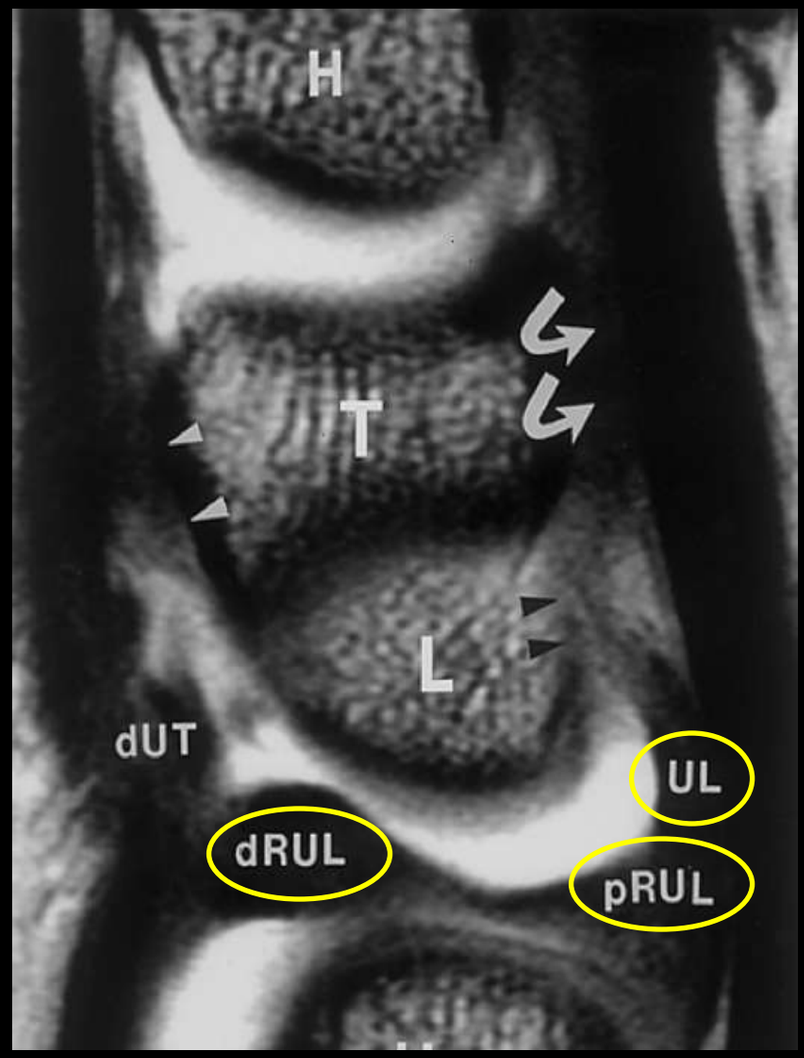
- ✓(+/-) ulnar collateral ligament

Sagittal T1 MRA



Theumann Nh, Pfirrmann CWA, Antonio GE, Chung CB, Gilula LA, Trudell DJ, Resnick D. Radiology; 2003: 226:171-179

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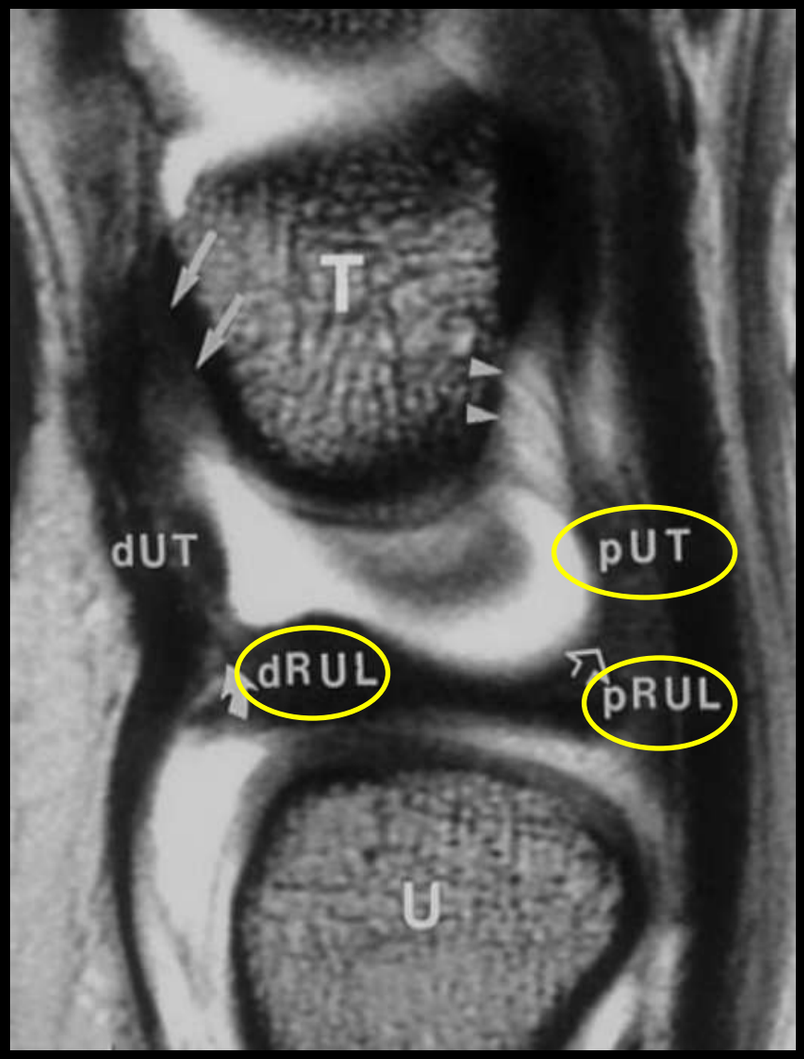


Theumann Nh, Pfirrmann CWA, Antonio GE, Chung CB, Gilula LA, Trudell DJ, Resnick D. Radiology; 2003: 226:171-179

Triangular Fibrocartilage Complex (TFCC)

Anatomy

Ulnomeniscal Homologue (UMH) Components

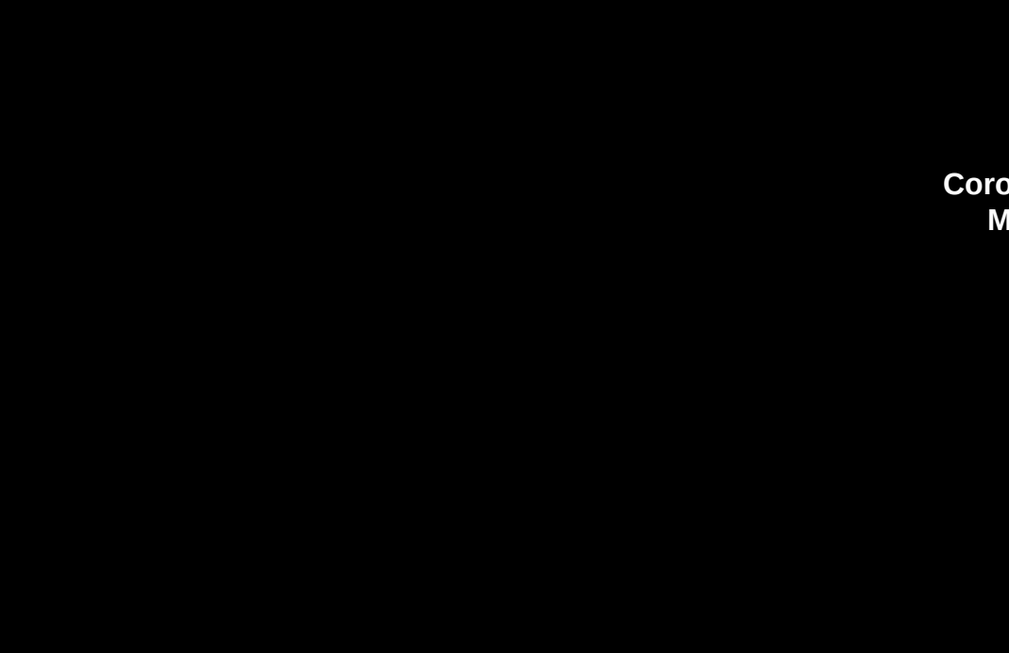
- Four components:

1) Styloid component
   - ✓ between the entrance to the prestyloid recess and the ECU tendon
   - ✓ divided into fibrous and vascular parts
   - ✓ attaches to the ulnar styloid process

2) Radioulnar component

3) Collateral component

4) Distal insertion



Buck FM, Gheno R, Nico MAC, Haghighi P, Trudell DJ, Resnick D. Radiology; 2009: Vol 253 (3) 771-779

Triangular Fibrocartilage Complex (TFCC)

Anatomy

Ulnomeniscal Homologue (UMH) Components

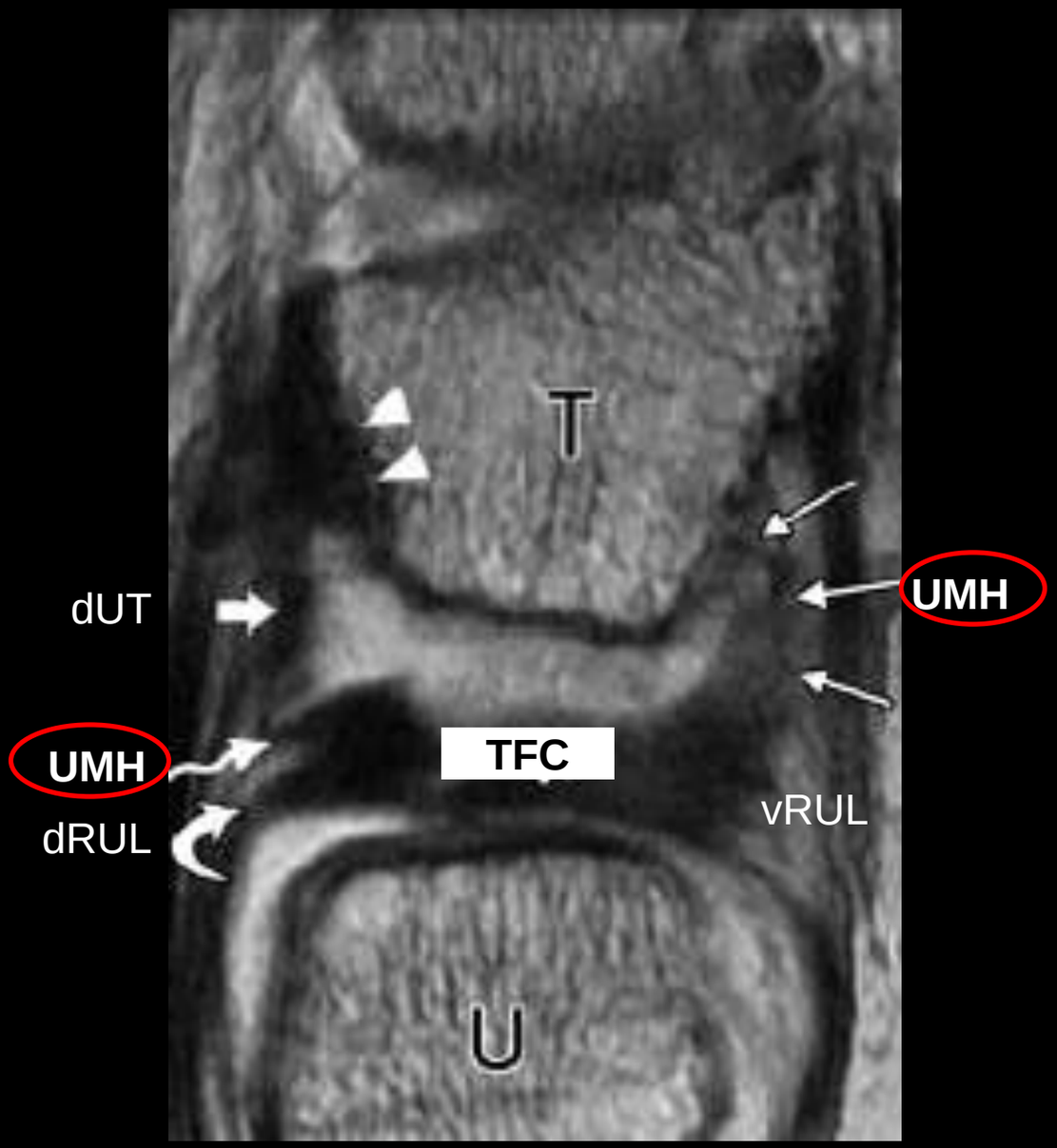
- Four components:

  1) Styloid component

  2) Radioulnar component
     - ✓ merges with the styloid component dorsally and the pre-styloid recess volarly and distally
     - ✓ intimate with the radioulnar ligaments

  3) Collateral component

  4) Distal insertion



Buck FM, Gheno R, Nico MAC, Haghighi P, Trudell DJ, Resnick D. Radiology; 2009: Vol 253 (3) 771-779

Triangular Fibrocartilage Complex (TFCC)

Anatomy

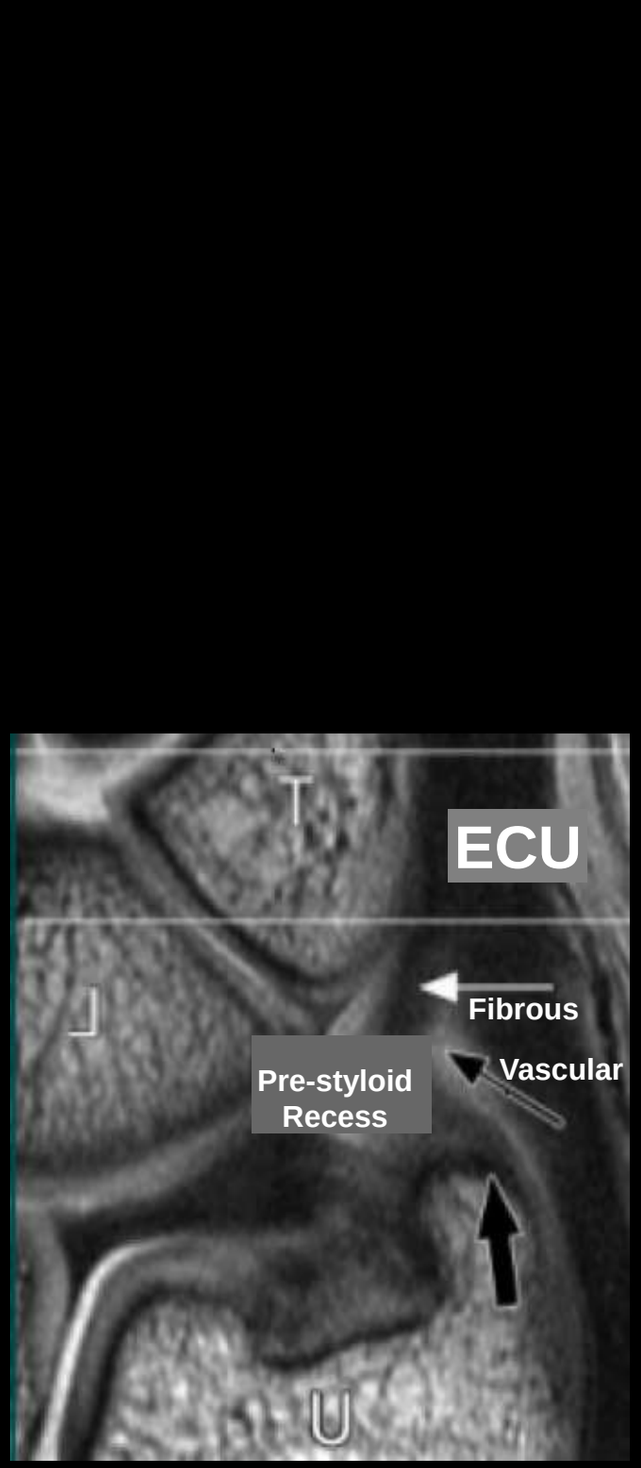
Ulnomeniscal Homologue (UMH) Components
• Four components:

1) Styloid component

2) Radioulnar component

3) Collateral component
- ✓ intimate with the triquetrum
- ✓ fuses with the ulnar collateral ligament ventrally and the ECU tendon sheath dorsally
- ✓ Ulnar collateral ligament complex:
  - collateral portion of the MH
  - ECU tendon sheath
  - ulnar collateral ligament

4) Distal insertion



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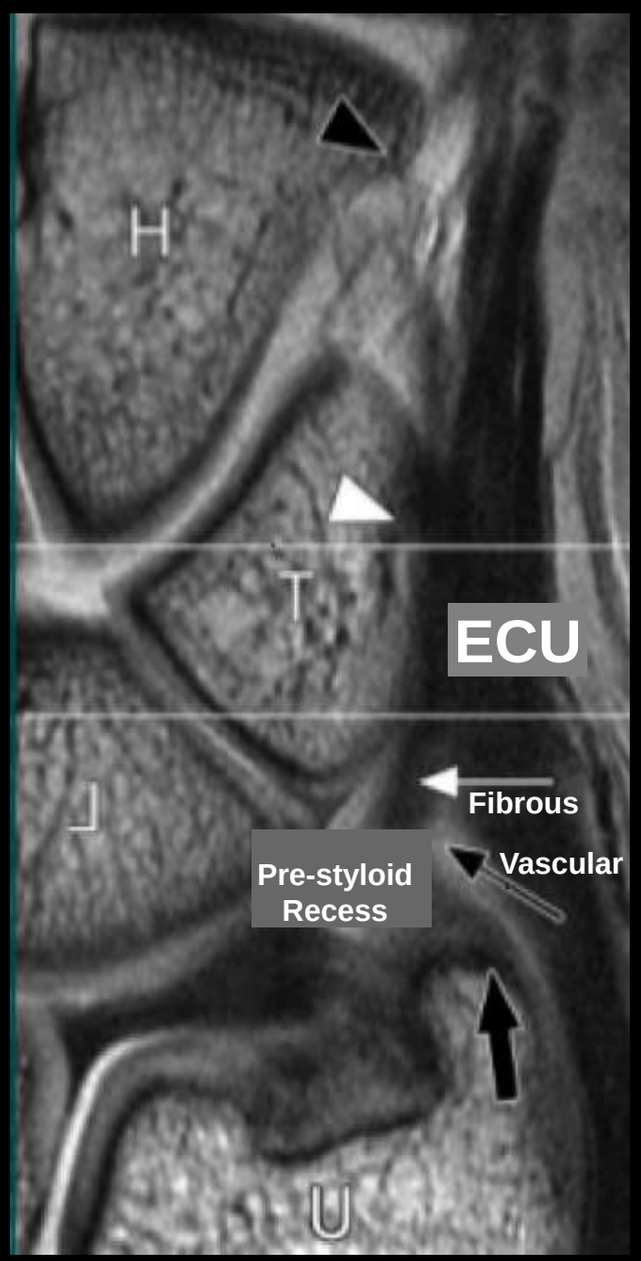
- Four components:
  - 1) Styloid component
  - 2) Radioulnar component
  - 3) Collateral component
  - 4) Distal insertion
    - attaches to the triquetrum, hamate and fifth MC bones



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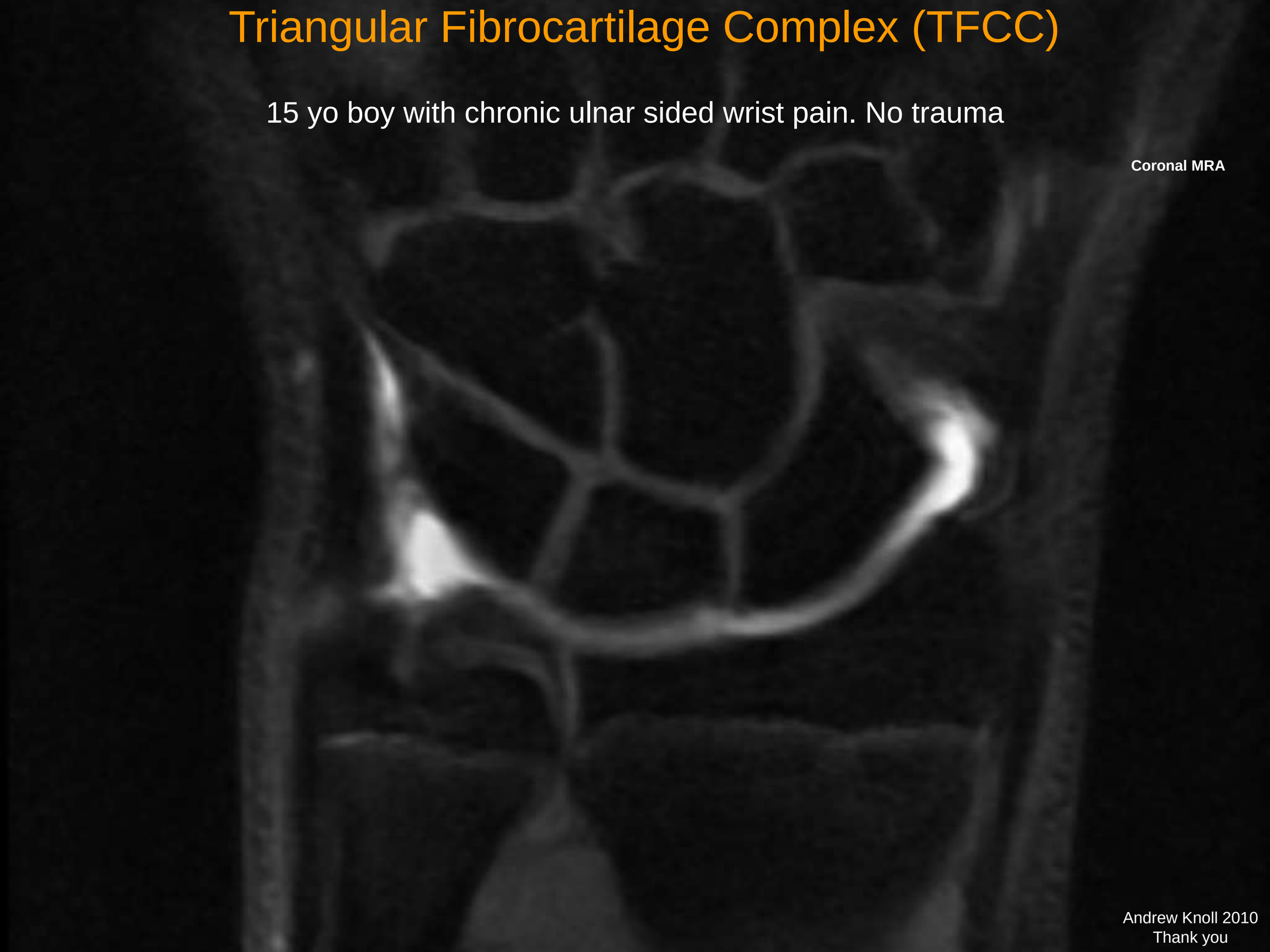
Triangular Fibrocartilage Complex (TFCC)

15 yo boy with chronic ulnar sided wrist pain. No trauma

Coronal MRA



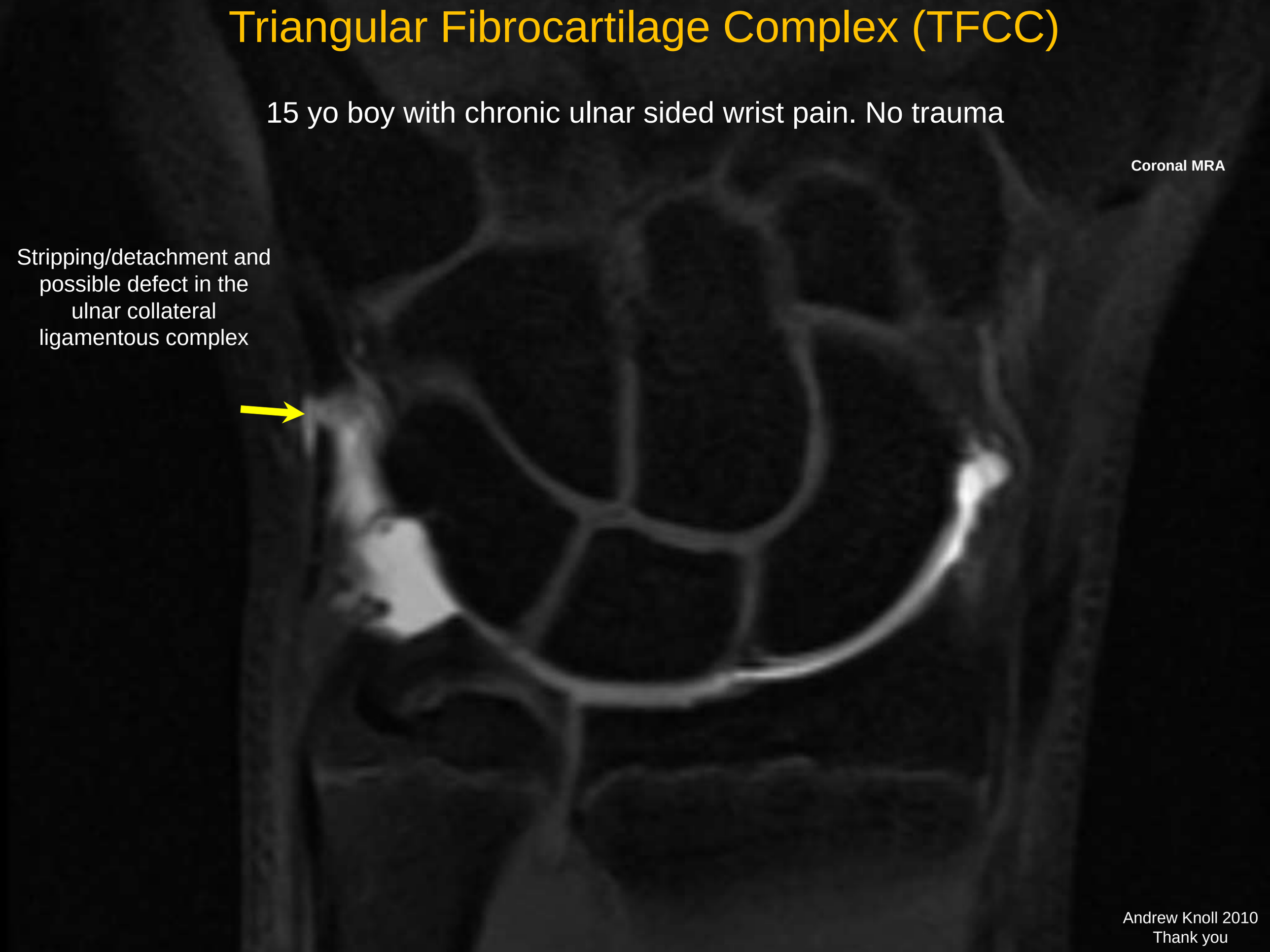
Andrew Knoll 2010
Thank you

Triangular Fibrocartilage Complex (TFCC)

15 yo boy with chronic ulnar sided wrist pain. No trauma

Coronal MRA

Stripping/detachment and possible defect in the ulnar collateral ligamentous complex



Andrew Knoll 2010
Thank you

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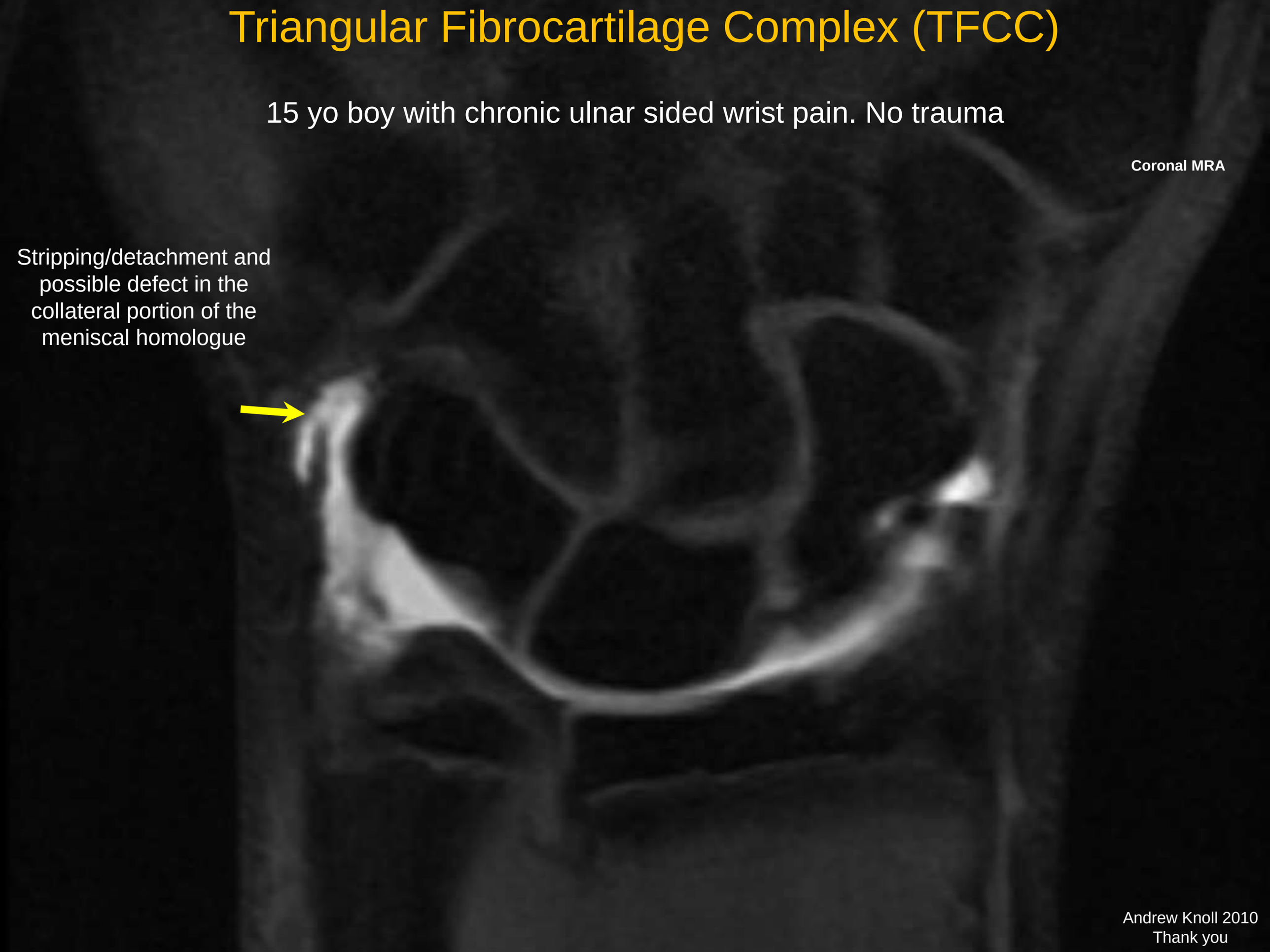
Stripping/detachment and possible defect in the collateral portion of the meniscal homologue



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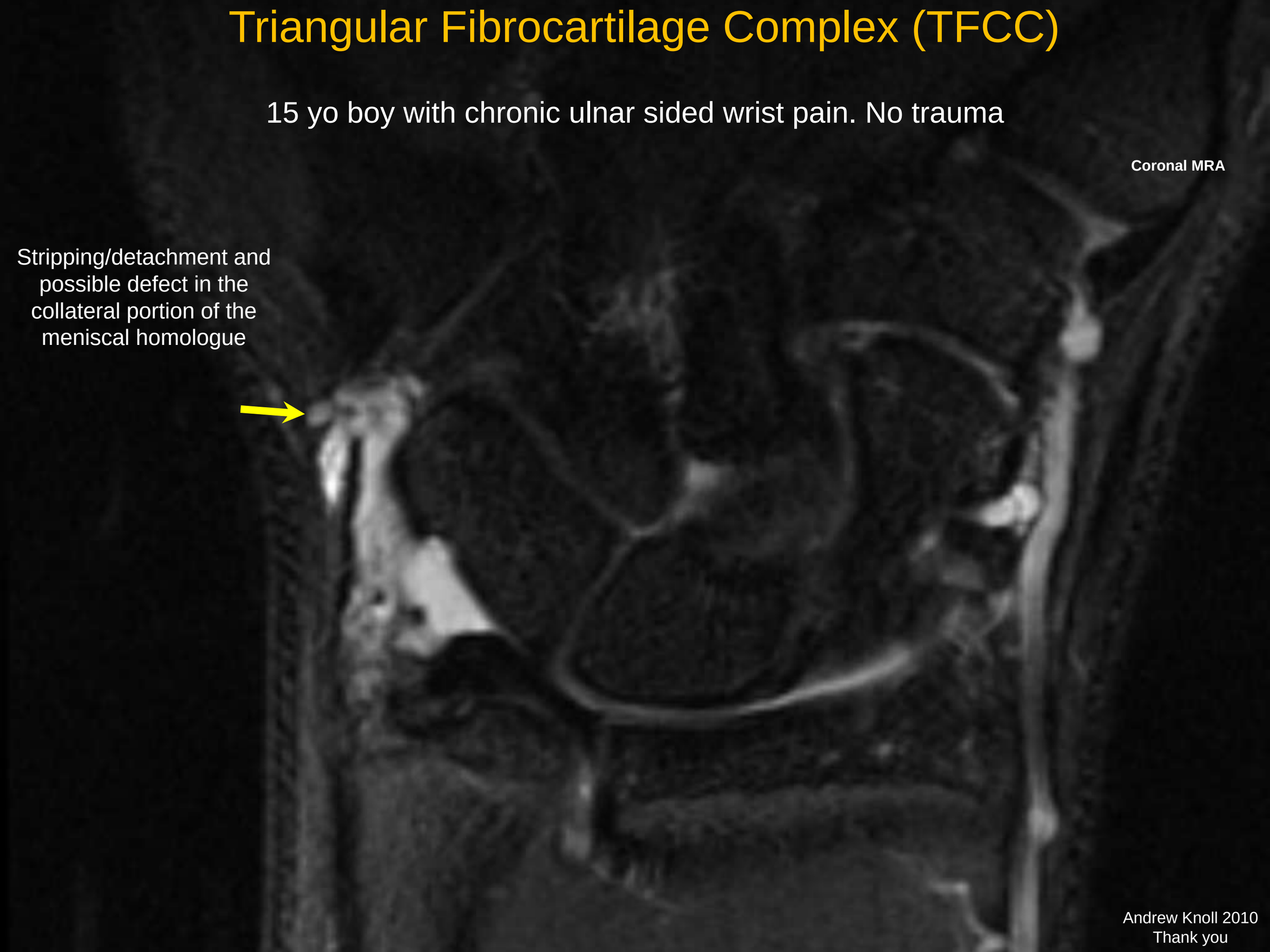

Andrew Knoll 2010
Thank you

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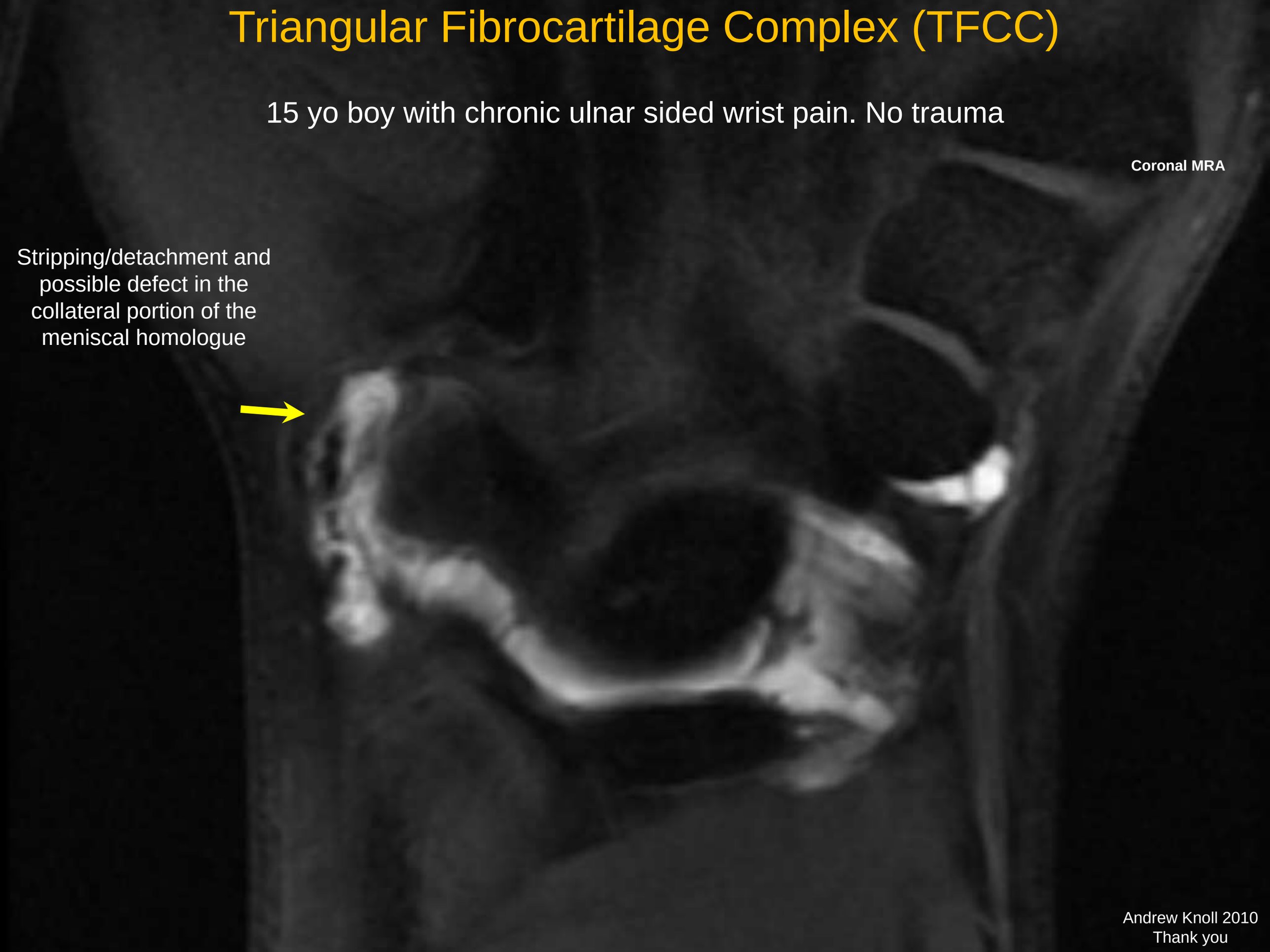
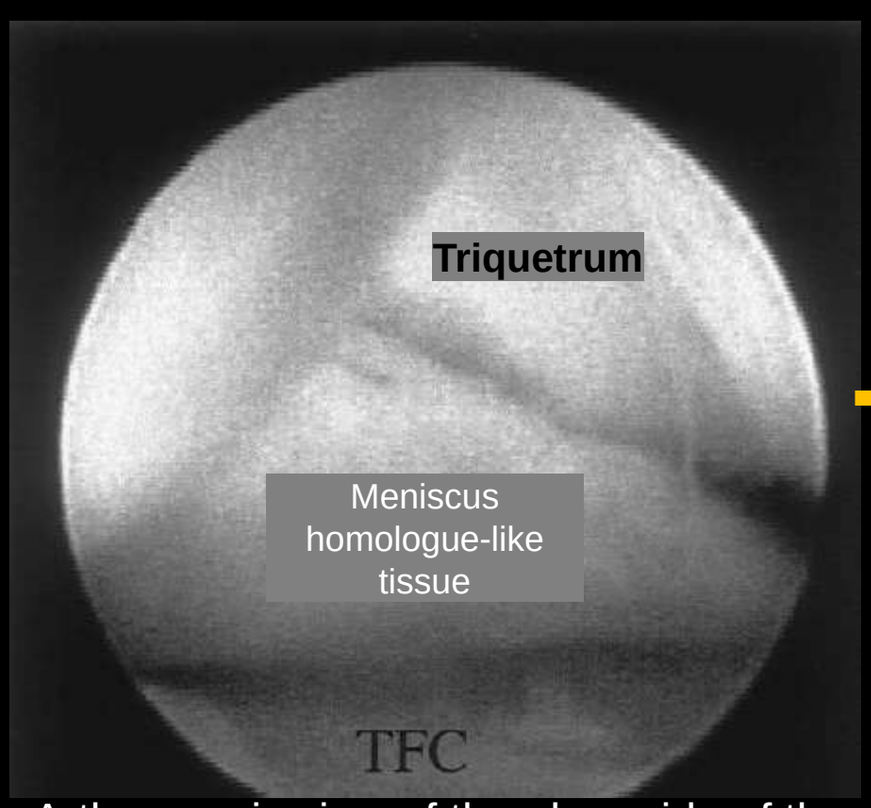


Andrew Knoll 2010
Thank you

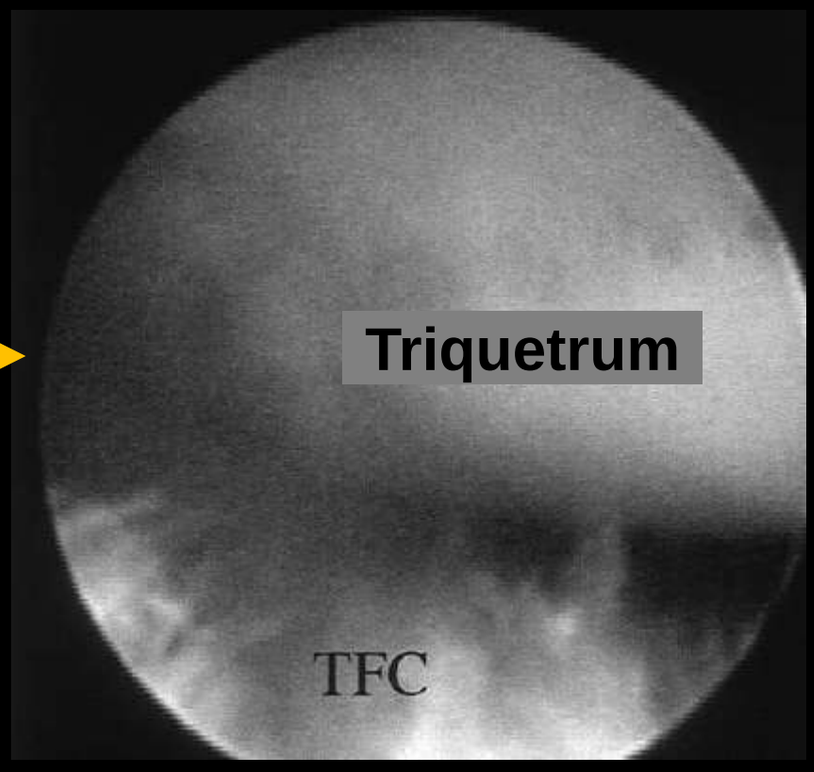
Triangular Fibrocartilage Complex (TFCC)

Ulnomeniscal Homologue (UMH) Injury

- clinical significance largely unknown
- arthroscopic reports of detached “meniscus homologue-like tissue” in cases of normal TFCC and chronic ulnar sided wrist pain
- resection of this tissue led to disappearance of symptoms



Arthroscopic view of the ulnar side of the wrist



Post resection

Nishikawa S et al. Journal of Hand Surgery; 2002: 27B: 1:86-89

Triangular Fibrocartilage Complex (TFCC)

MR Imaging - TFCC injuries

Cause:

- ✓ acute trauma (FOOSH)
- ✓ chronic repetitive microtrauma and elongated ulna
- ✓ degenerative

- MRI is very accurate for diagnosing TFCC injuries

- surface coil increases accuracy for injury to finer components of TFCC

- MR arthrography allows identification of communicating vs. noncommunicating defects

- presence of contrast within the DRUJ after radiocarpal injection indicates a communicating defect

- radial sided communicating defects are commonly bilateral and asymptomatic

- noncommunicating defects are ulnar sided and more often symptomatic

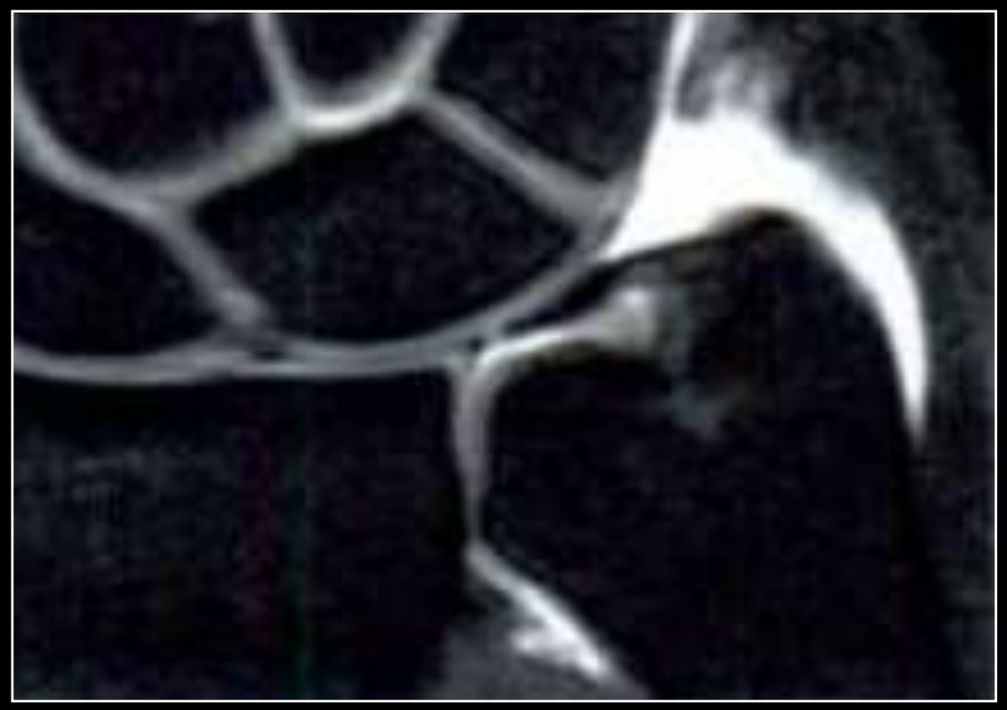
Palmer Classification of TFCC Lesions

I. Traumatic injury
   A. Central perforation
   B. Ulnar avulsion
   C. Distal avulsion
   D. Radial avulsion

II. Degenerative injury
   A. TFC wear
   B. TFC wear and chondromalacia
   C. TFC perforation and chondromalacia
   D. TFC perforation, chondromalacia, and luno-triquetral ligament perforation
   E. TFC perforation, chondromalacia, lunotri-quetral ligament perforation, and ulnocar-pal/radioulnar arthritis

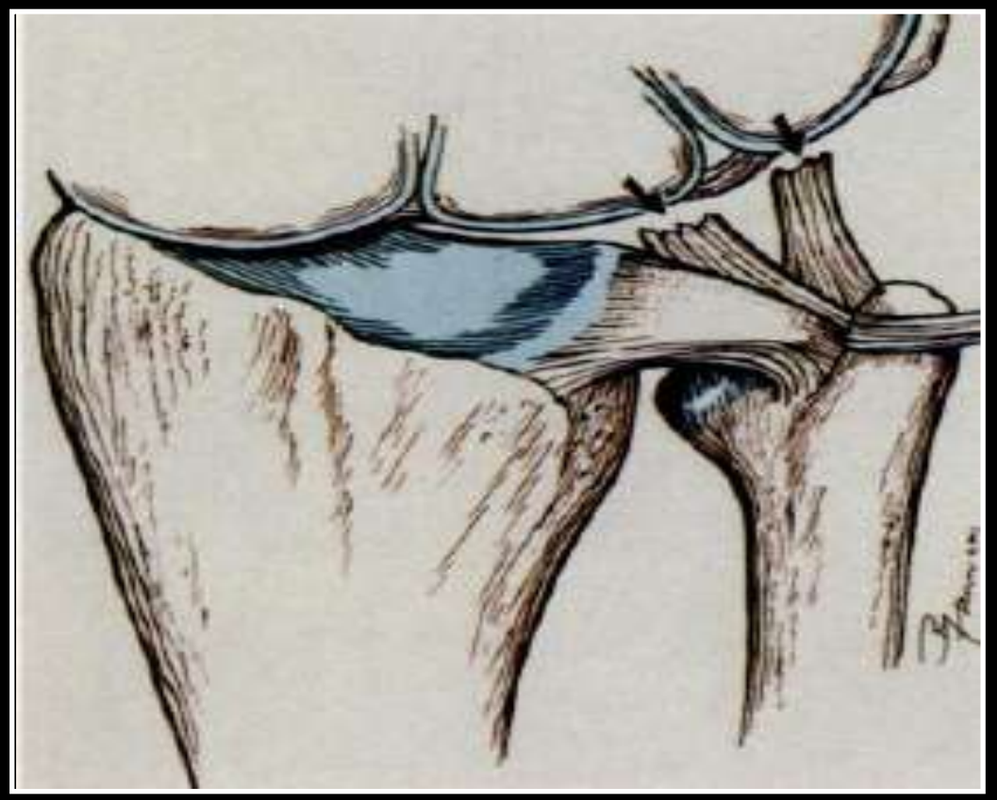
Triangular Fibrocartilage Complex (TFCC)

MR Imaging – Palmer Classification of Traumatic TFCC Injuries

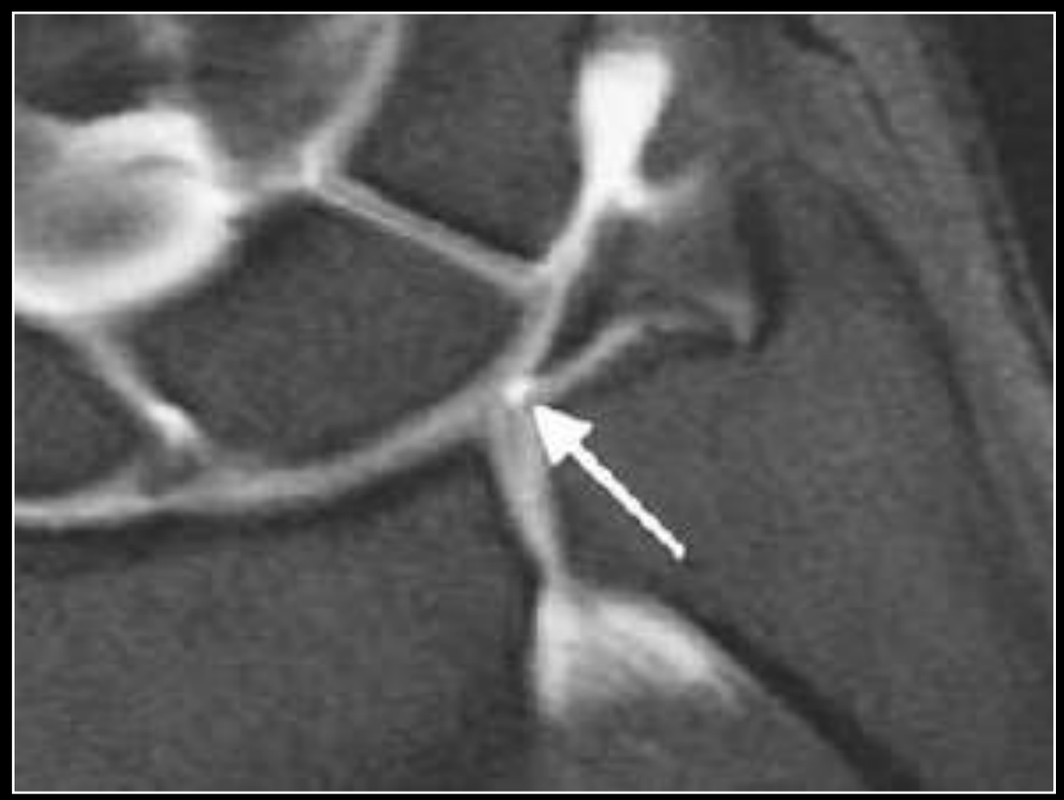


1A – Arthroscopic debridement

1B - Suture repair



1C - Suture repair



1D - Arthroscopic re-attachment

Triangular Fibrocartilage Complex (TFCC)

MR Imaging

Degenerative injuries (Class 2):

- ✓ progressive wear of the TFC
- ✓ lunotriquetral (LT) ligament tears
- ✓ ulnocarpal/radioulnar cartilage loss

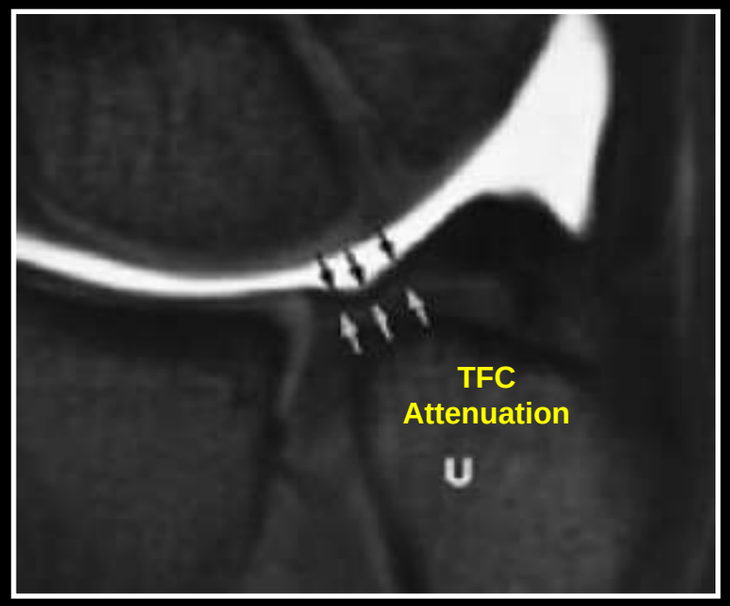
Risk factors:

- ✓ chronic repetitive microtrauma
- ✓ increased prevalence in those 35 yo and older
- ✓ often secondary to ulnar impaction syndrome from an elongated ulna

II. Degenerative injury
- A. TFC wear
- B. TFC wear and chondromalacia
- C. TFC perforation and chondromalacia
- D. TFC perforation, chondromalacia, and lunotriquetral ligament perforation
- E. TFC perforation, chondromalacia, lunotriquetral ligament perforation, and ulnocarpal/radioulnar arthritis

Triangular Fibrocartilage Complex (TFCC)

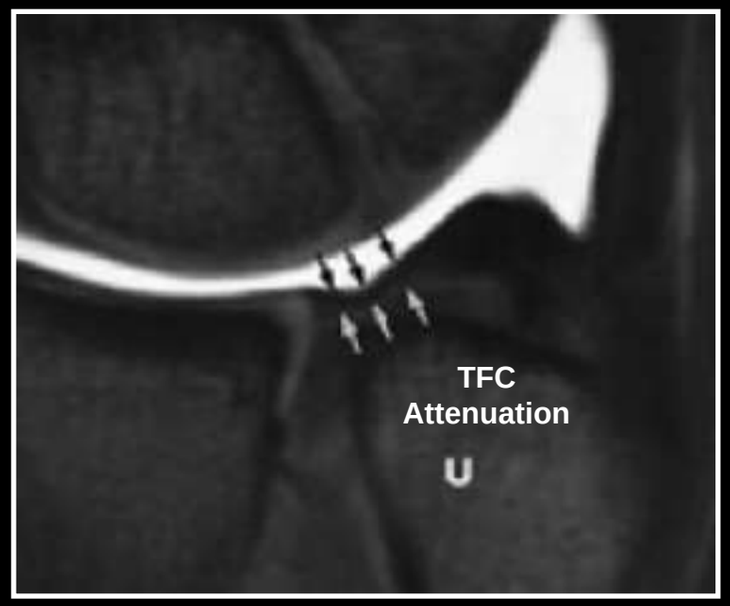
MR Imaging – Palmer Classification of Degenerative TFCC Injuries



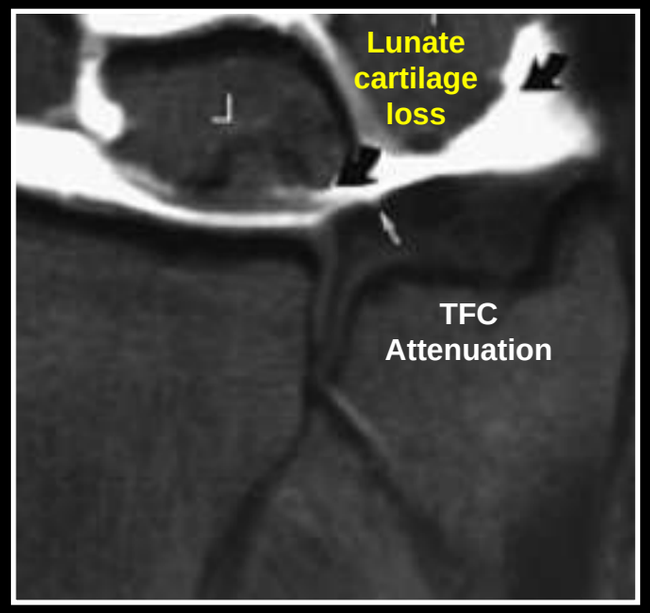
2A

Triangular Fibrocartilage Complex (TFCC)

MR Imaging – Palmer Classification of Degenerative TFCC Injuries



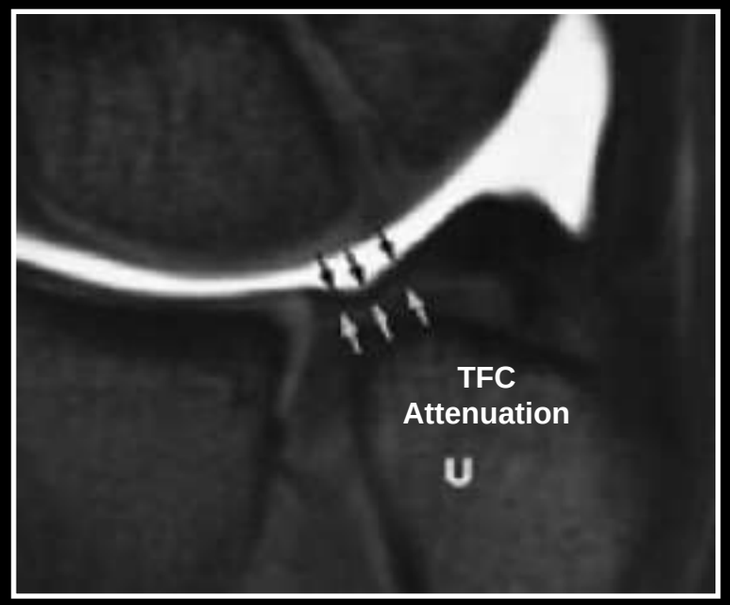
2A



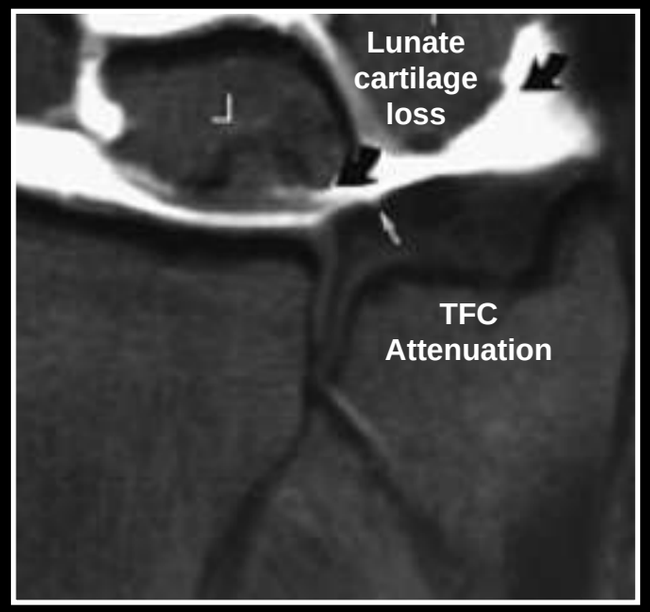
2B

Triangular Fibrocartilage Complex (TFCC)

MR Imaging – Palmer Classification of Degenerative TFCC Injuries



2A



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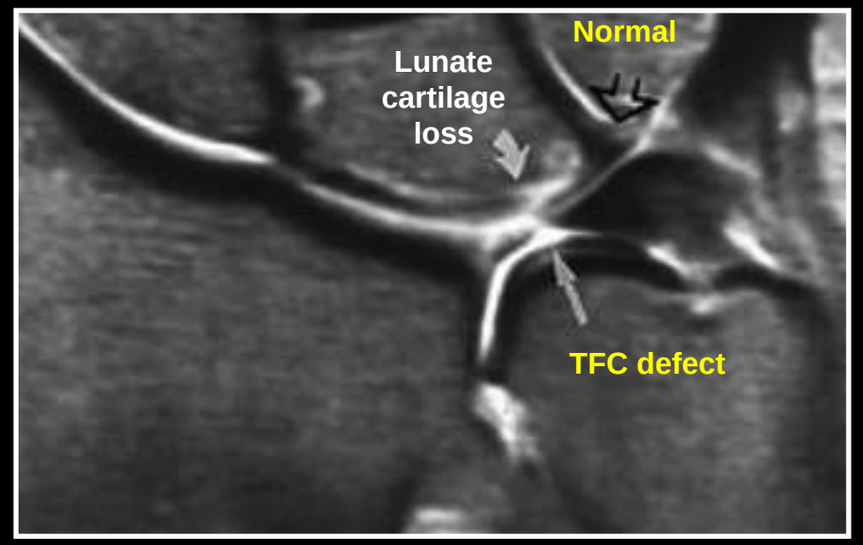
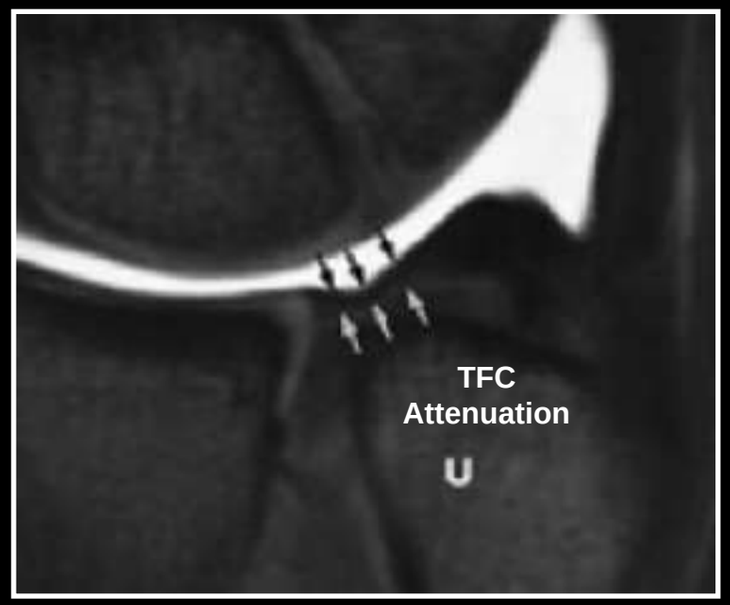


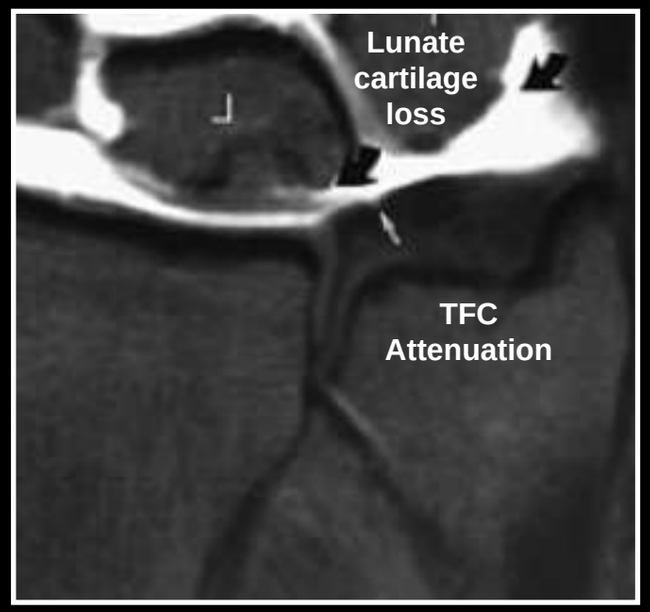
2C

Triangular Fibrocartilage Complex (TFCC)

MR Imaging – Palmer Classification of Degenerative TFCC Injuries



2A



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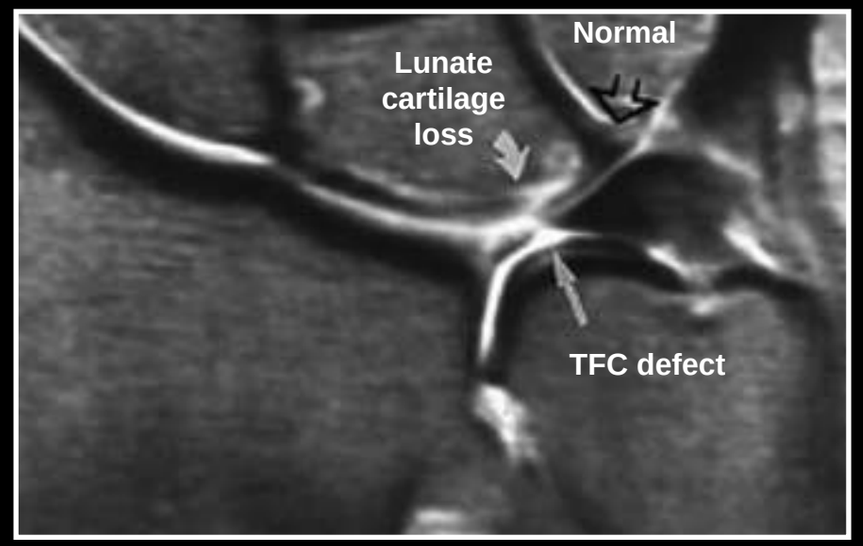

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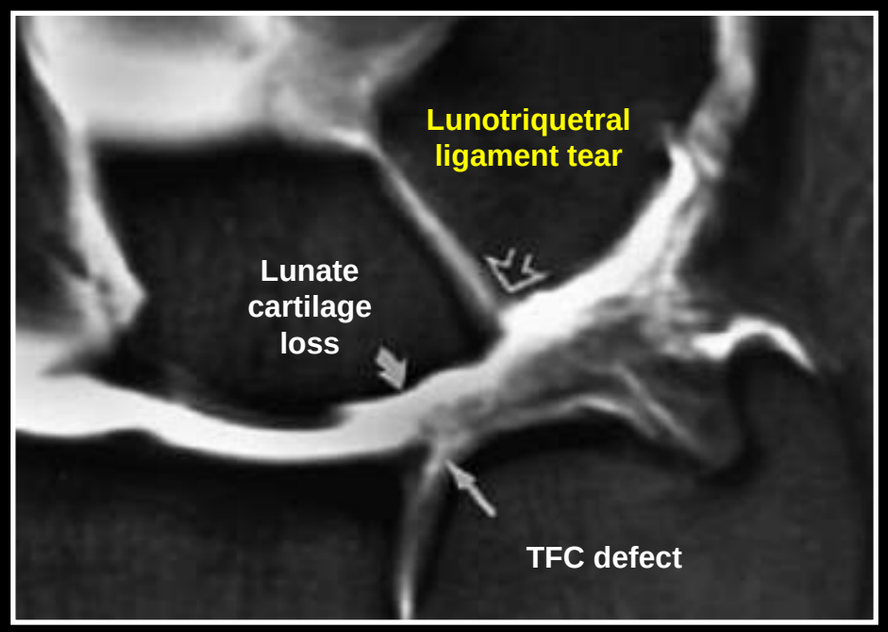
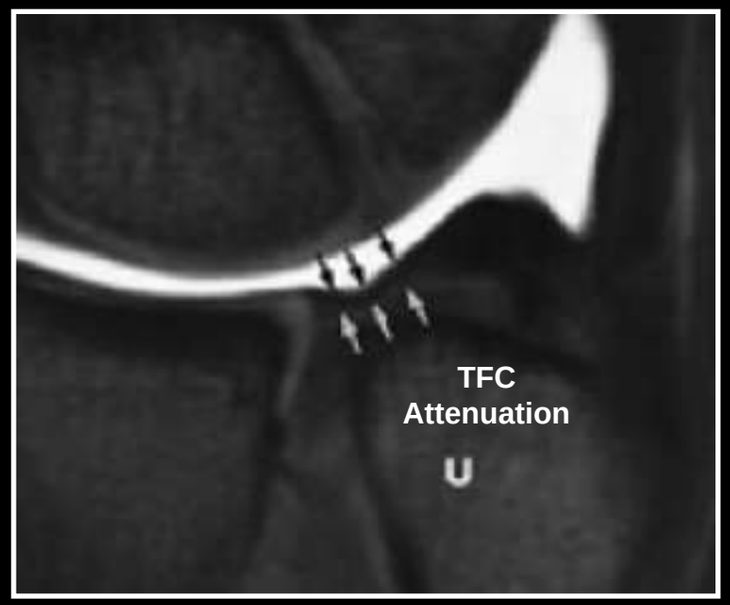


2D

Triangular Fibrocartilage Complex (TFCC)

MR Imaging – Palmer Classification of Degenerative TFCC Injuries



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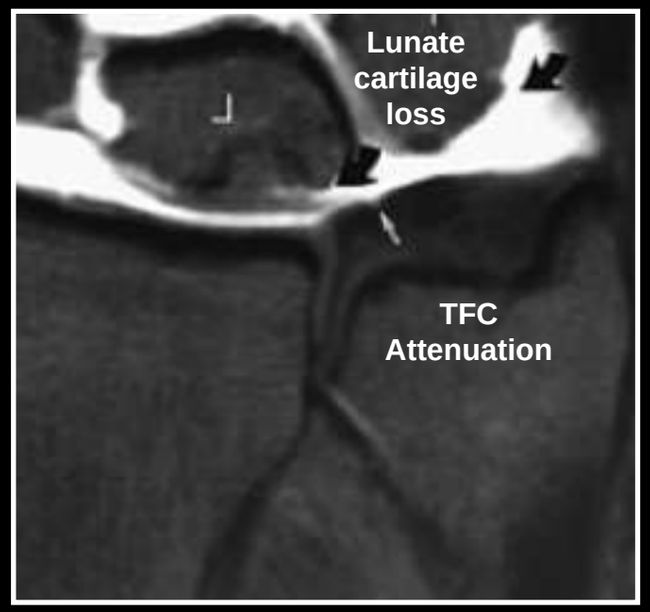
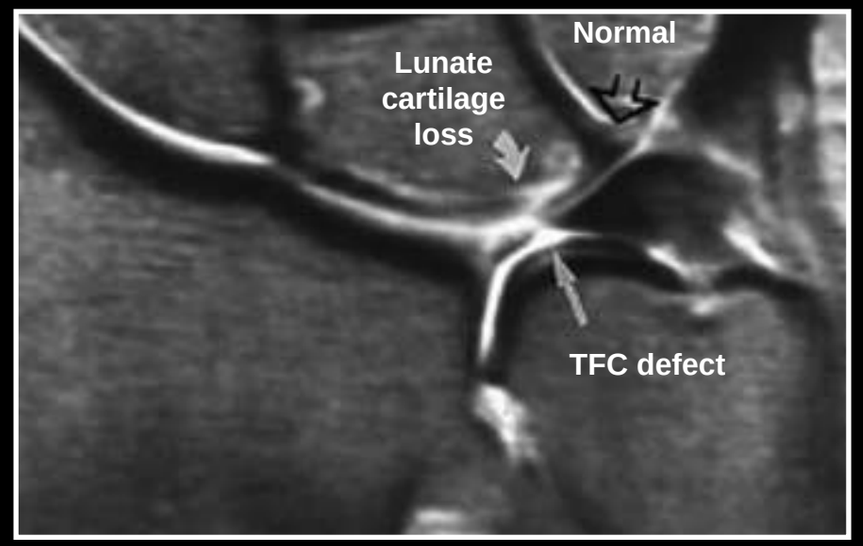
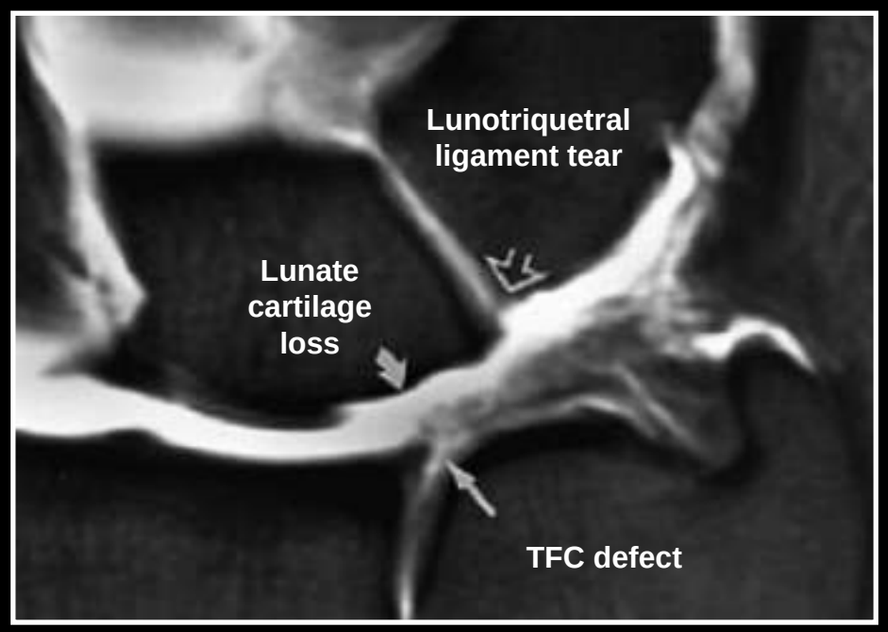


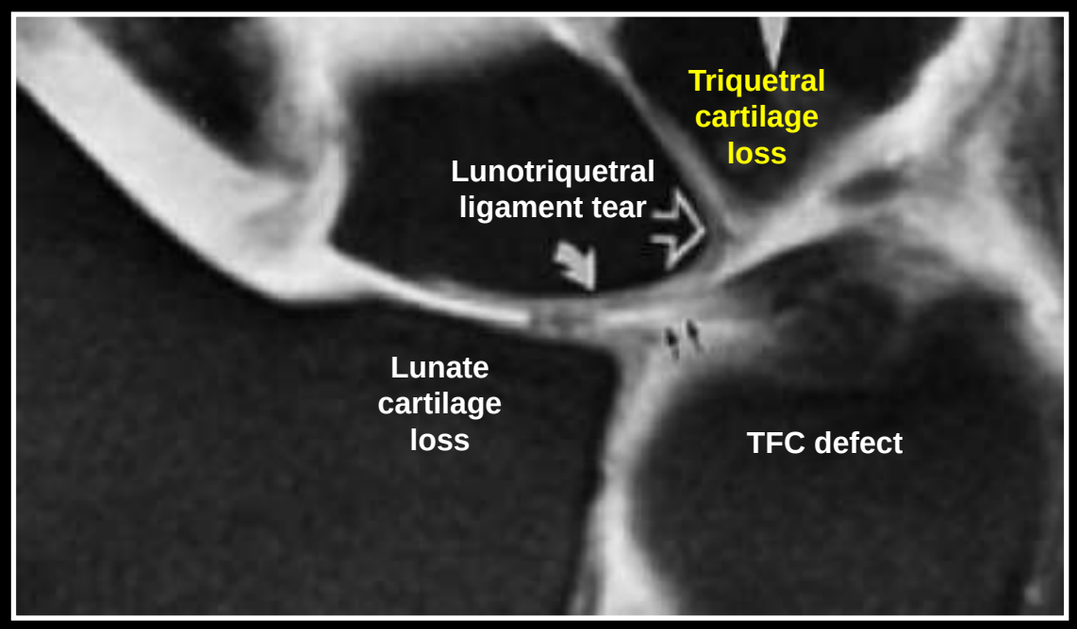
2B



2C



2D



2E

Triangular Fibrocartilage Complex (TFCC)

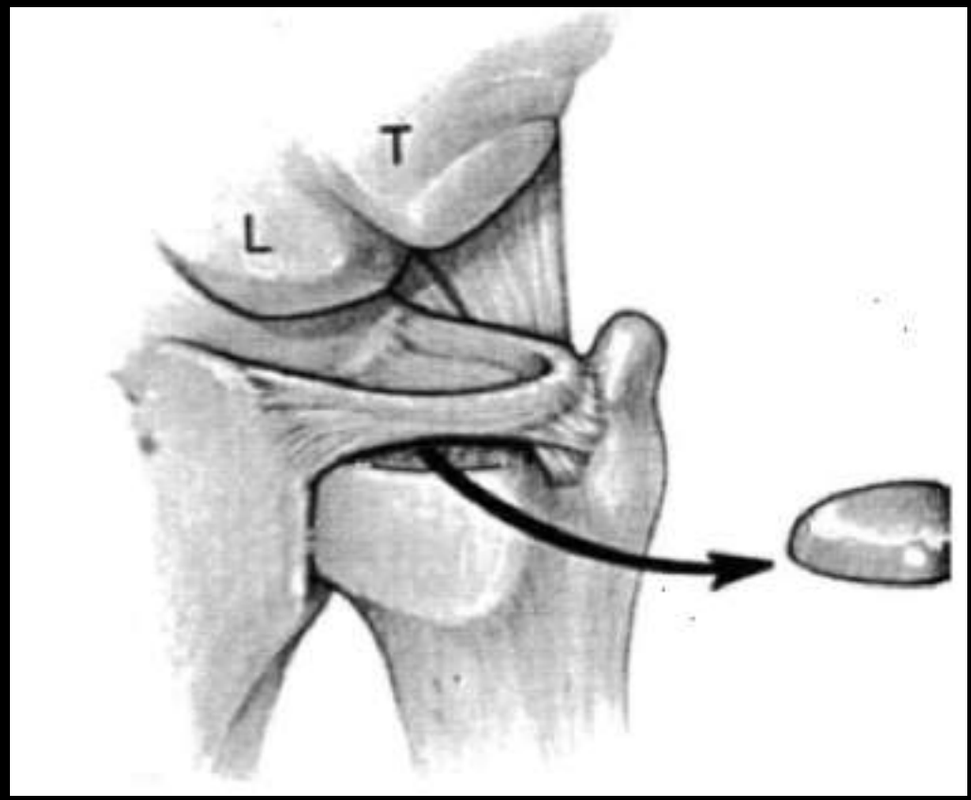
Arthroscopic Intra-articular

Wafer Resection

Degenerative injuries (Class 2)

Treatment

- ✓ 2A-D lesions are debrided
- ✓ 2E lesions undergo resection of the distal ulna (Wafer procedure)
- ✓ end-stage 2E lesions undergo salvage procedures:
  - Bowers
  - Darrach
  - Sauvé-Kapandji

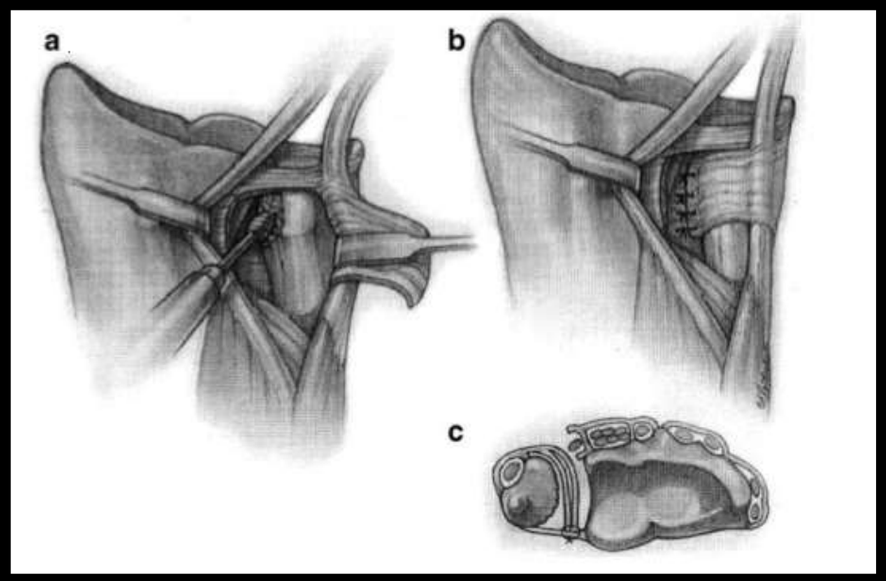


Triangular Fibrocartilage Complex (TFCC)

MR Imaging

End stage degenerative class 2E injuries – Salvage procedures

Bowers



Resection of the radial aspect of the ulna

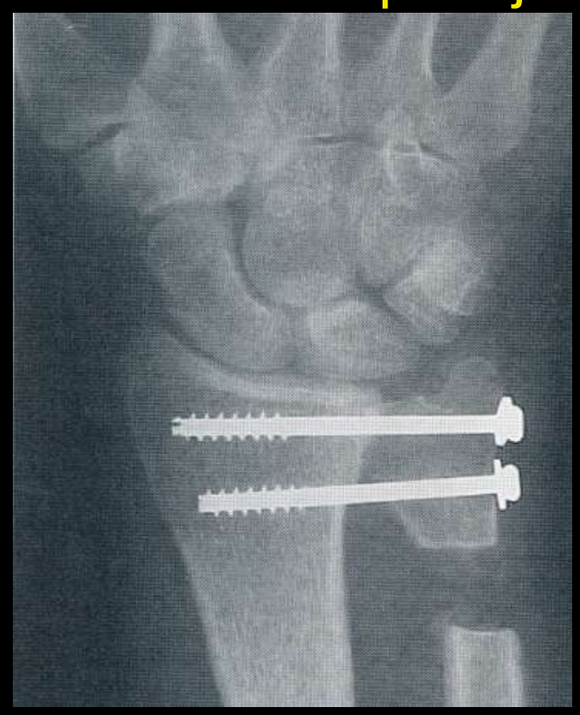
Flap created from the dorsal portions of the extensor retinaculum and DRUJ capsule

Flap sutured to volar DRUJ capsule

Darrach

Resection of the distal ulna

Sauvé-Kapandji



Fusion of the DRUJ

Distal ulnar resection to preserve forearm rotation

Ulnar Variance

Anatomy

Positive Variance

- larger biomechanical forces imparted onto the TFCC

- TFC is thinner in appearance

- associated with:
  - ✓ ulnar abutment/impaction syndrome
  - ✓ degenerative tears of the TFCC and lunotriquetral ligament

Cerezal L et al. Radiographics 2002; 22: 105-121

Ulnar Impaction Syndromes

A) Ulnocarpal Abutment/Ulnar Impaction Syndrome

- results from chronic impaction of the ulnar head against the TFCC and the ulnar sided carpal bones

Clinical findings:

- ✓ swelling and ulnar sided wrist pain
- ✓ limitation of wrist ROM

Causes:

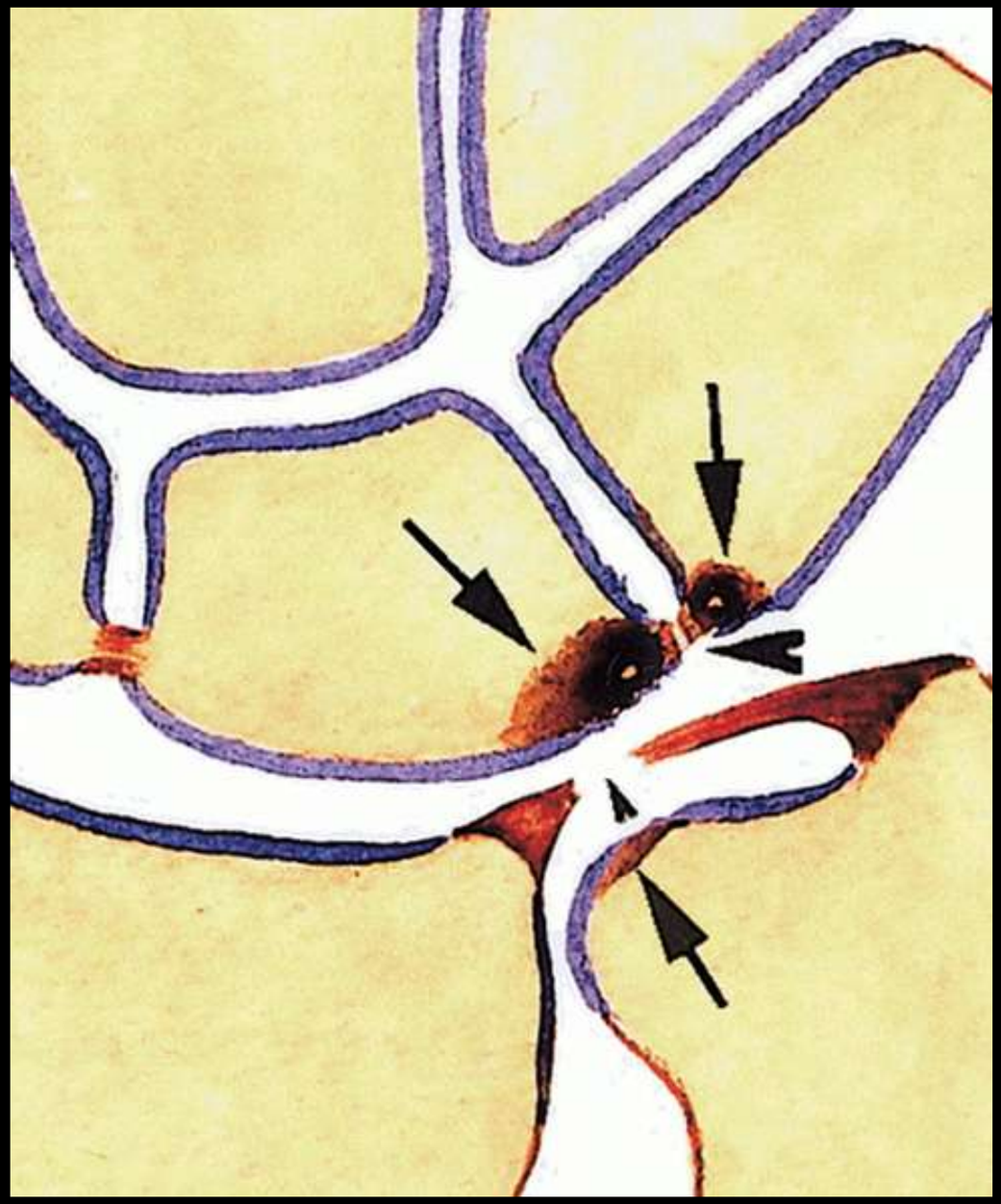
- ✓ positive > neutral and negative ulnar variance
- ✓ shortened radius from a prior fracture/surgery
- ✓ premature physeal arrest of the distal radius

Radiographic findings:

- ✓ sclerosis, cystic change, and osteophytosis of the ulnar aspect of the lunate, radial side of the triquetrum, and ulna

MRI findings:

- ✓ detected earlier than radiographic findings
- ✓ cartilage degeneration, marrow edema, and subchondral cysts
- ✓ Injuries of the TFCC and lunotriquetral (LT) ligament



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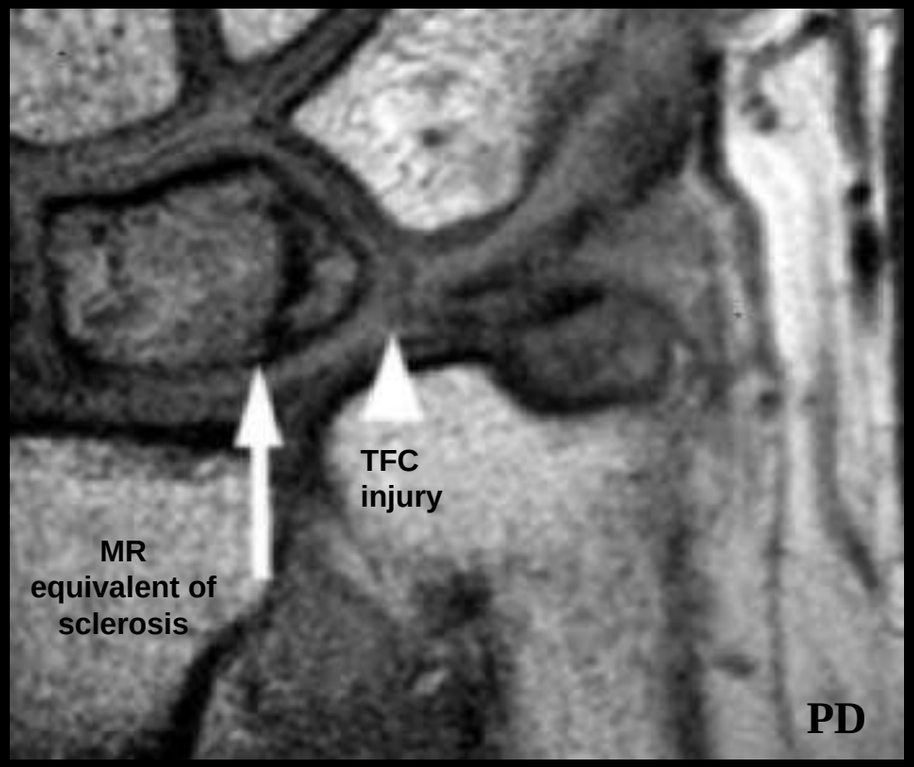
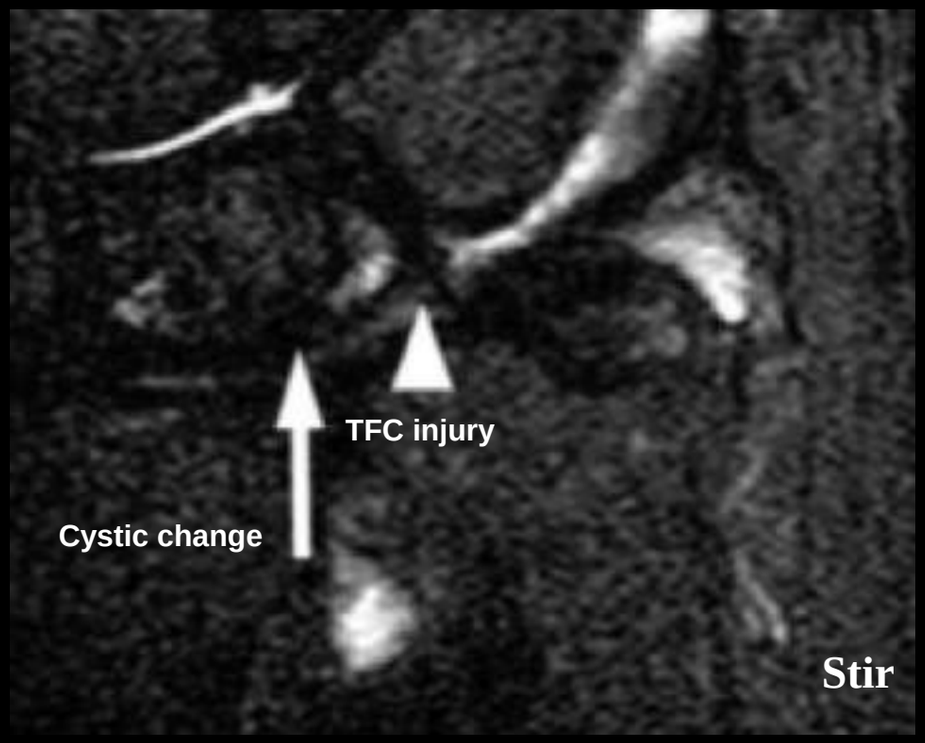
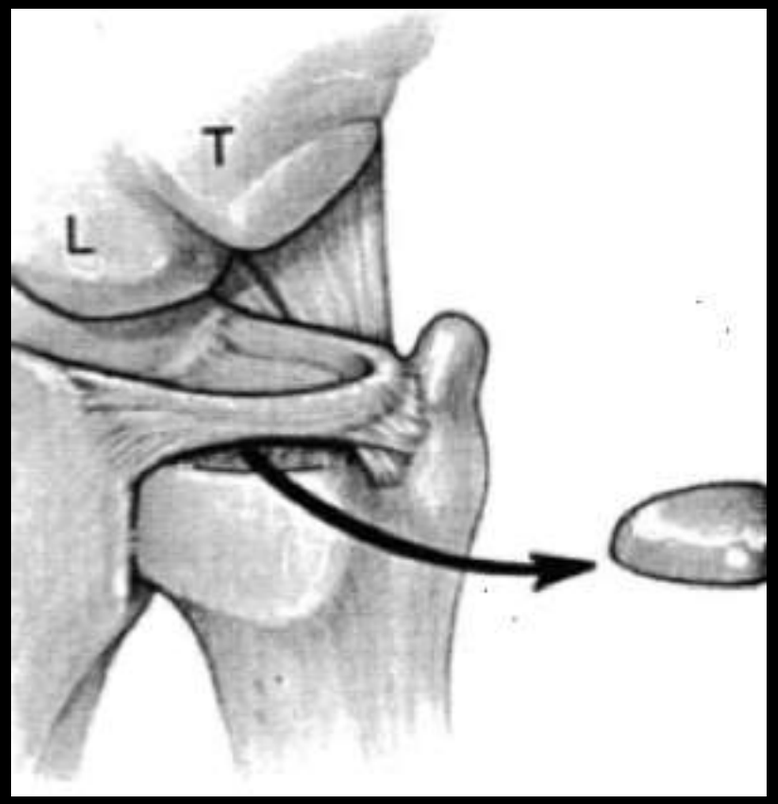




Ulnar Impaction Syndromes

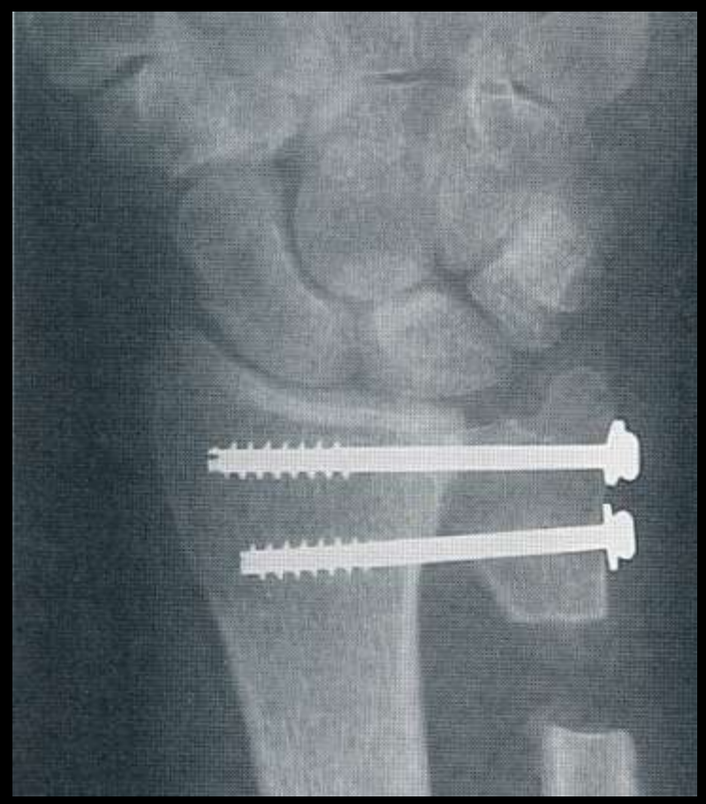
A) Ulnocarpal Abutment/Ulnar Impaction Syndrome

Treatment – Ulnar shorteneing and salvage procedures



Wafer Procedure

Darrach Procedure



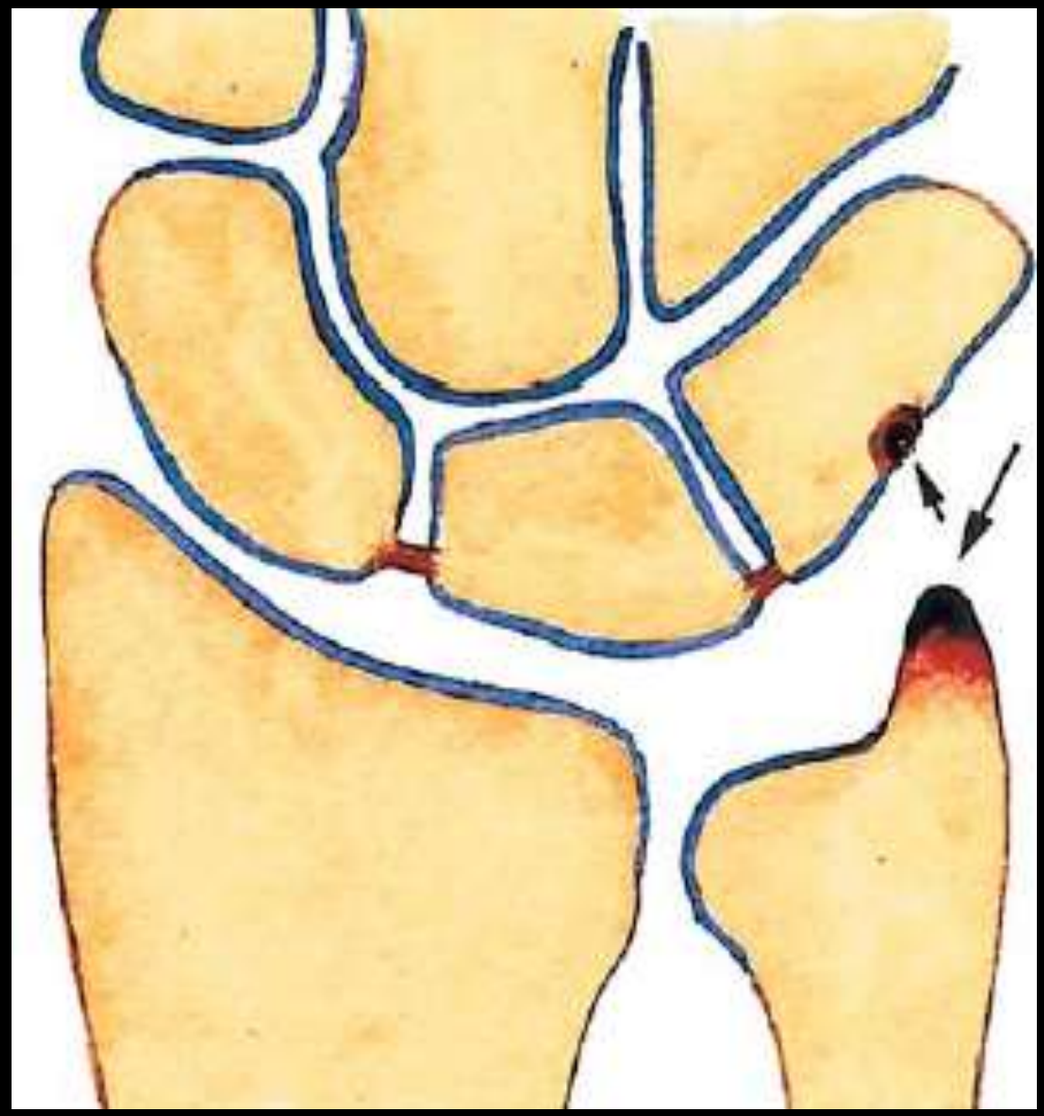
Sauvé-Kapandji Procedure

Ulnar Impaction Syndromes

B) Ulnar Styloid Impaction Syndrome

- results from chronic impaction of the ulnar styloid against the triquetrum

- more common in negative ulnar variance wrists with prominent styloid processes



Causes:

- ✓ trauma (fracture of the dorsal triquetrum)
- ✓ repetitive microtrauma

Radiographic Findings:

- ✓ long ulnar styloid process (> 6 mm)
- ✓ sclerosis, cystic change, and osteophytosis of the triquetrum, and ulnar styloid

MRI findings:

- ✓ detected earlier than radiographic findings
- ✓ synovitis, cartilage degeneration, marrow edema, and subchondral cysts of triquetrum and ulnar styloid
- ✓ LT ligament and TFC injuries

Cerezal L et al. Radiographics 2002; 22: 105-121

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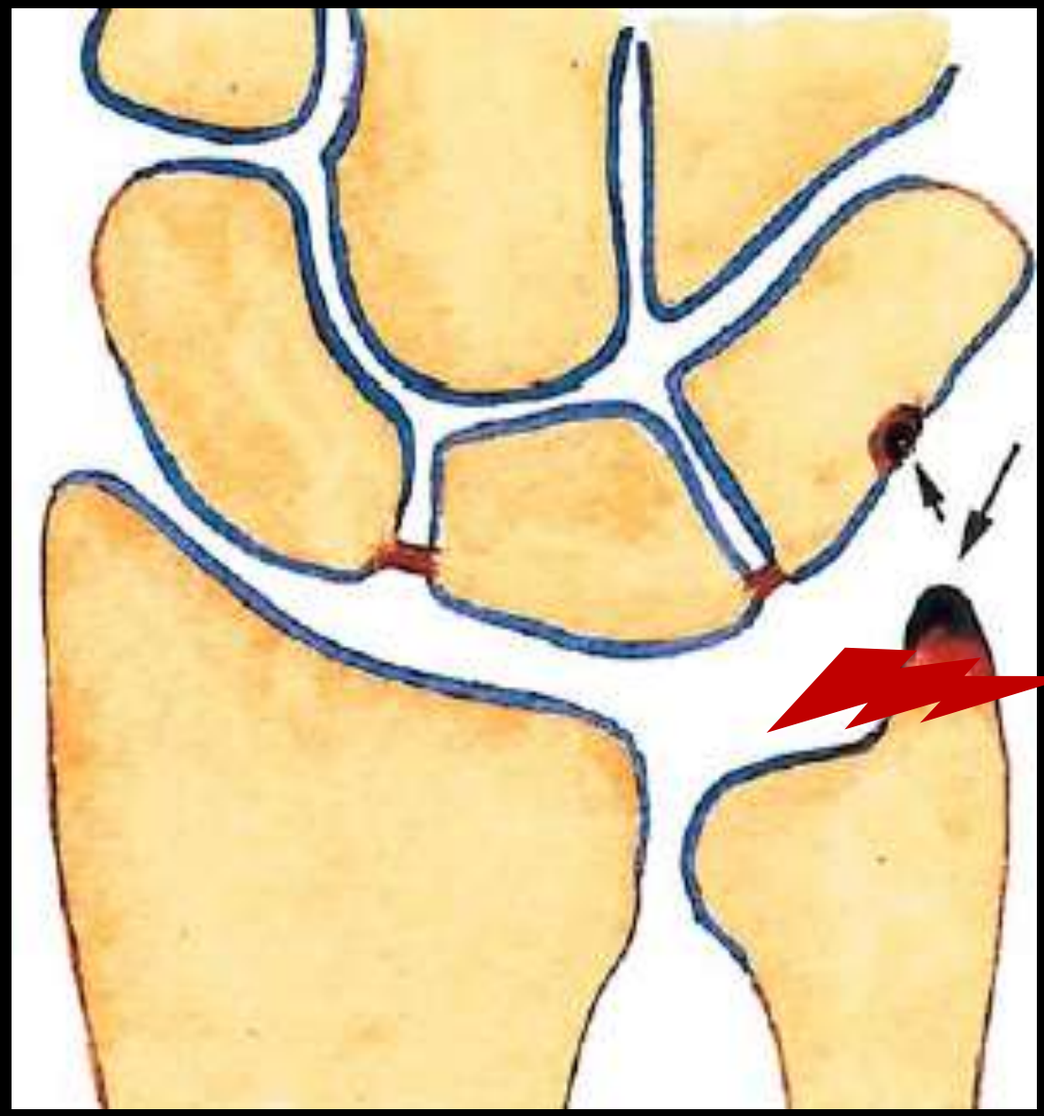


Treatment

Styloid resection

Spare the two most proximal mm so as not to interfere with the TFC laminae

Cerezal L et al. Radiographics 2002; 22: 105-121

Ulnar Impaction Syndromes

B) Ulnar Styloid Impaction Syndrome

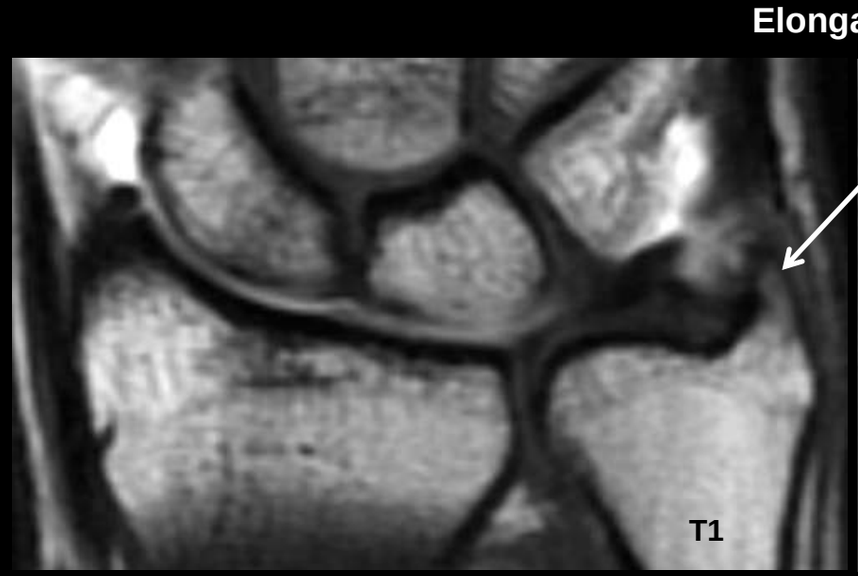
Boxer with ulnar sided wrist pain

Elongation and irregularity of the ulnar styloid process

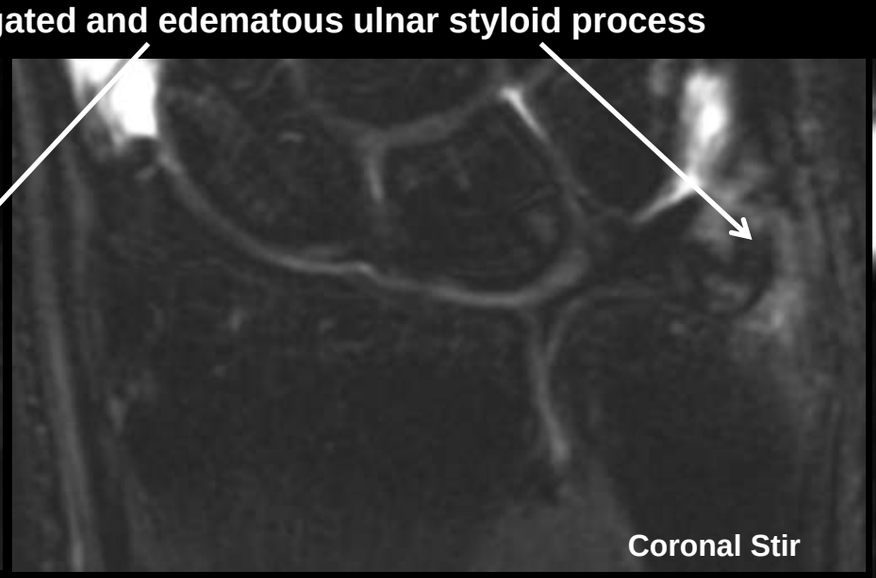
Ulnar Impaction Syndromes

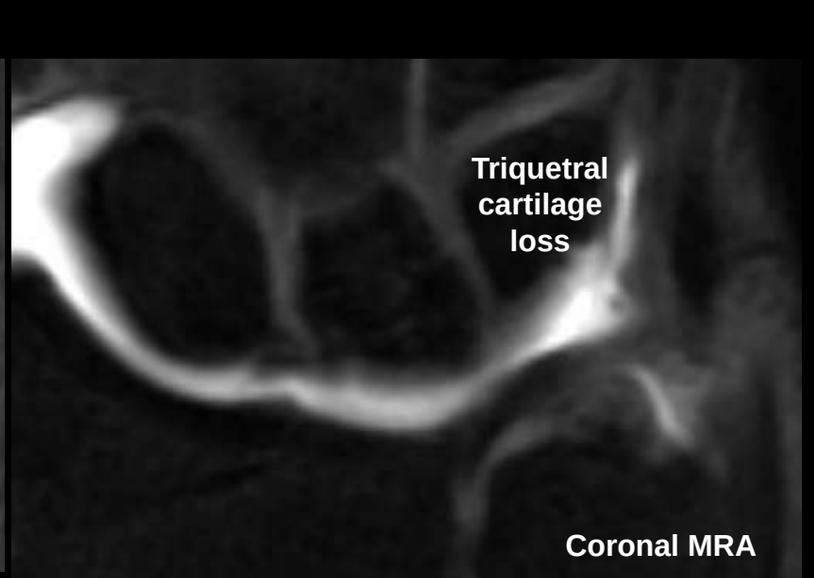
B) Ulnar Styloid Impaction Syndrome

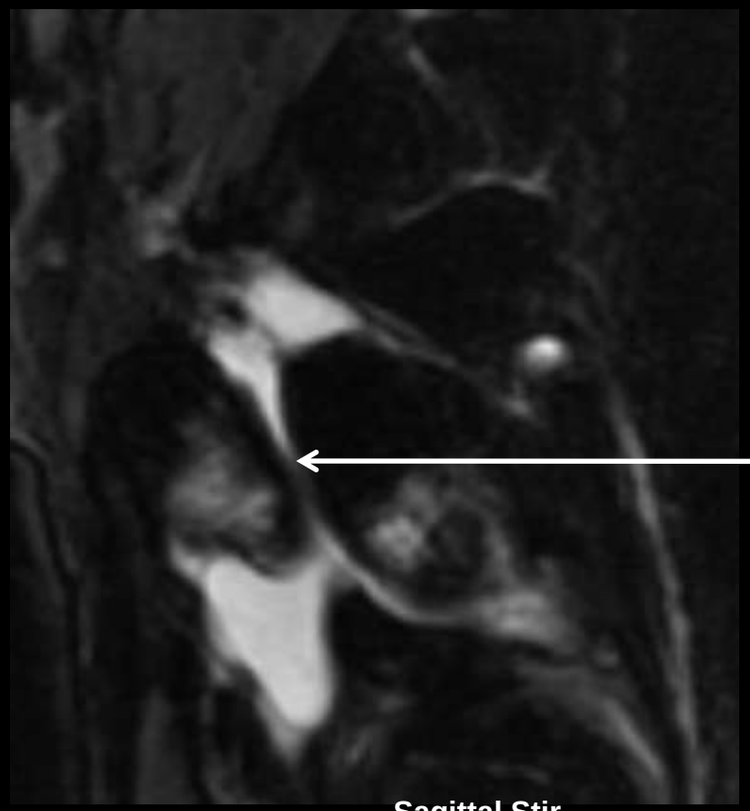
Boxer with ulnar sided wrist pain



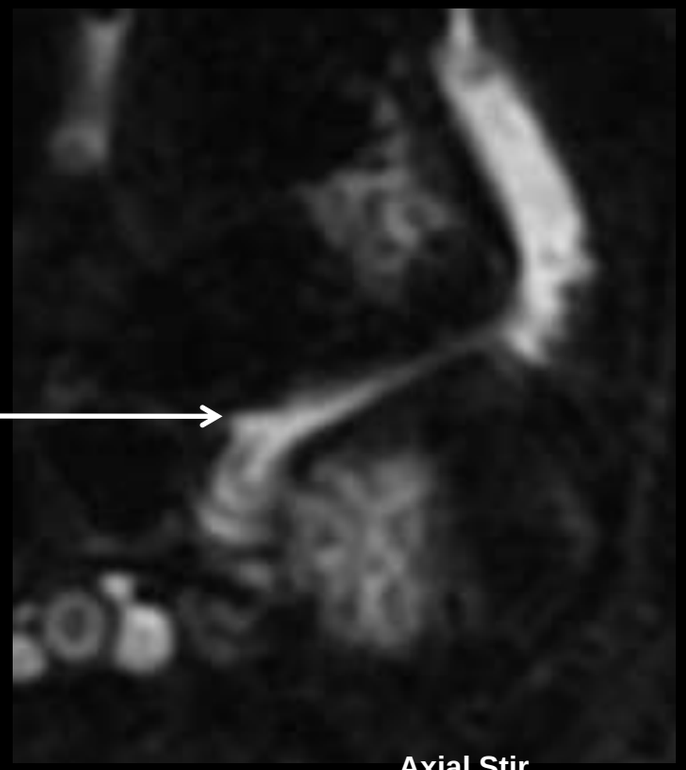
Elongated and edematous ulnar styloid process







Pisotriquetral joint osteoarthrosis



Jim Buratto 2010
Thank you

Ulnar Impaction Syndromes

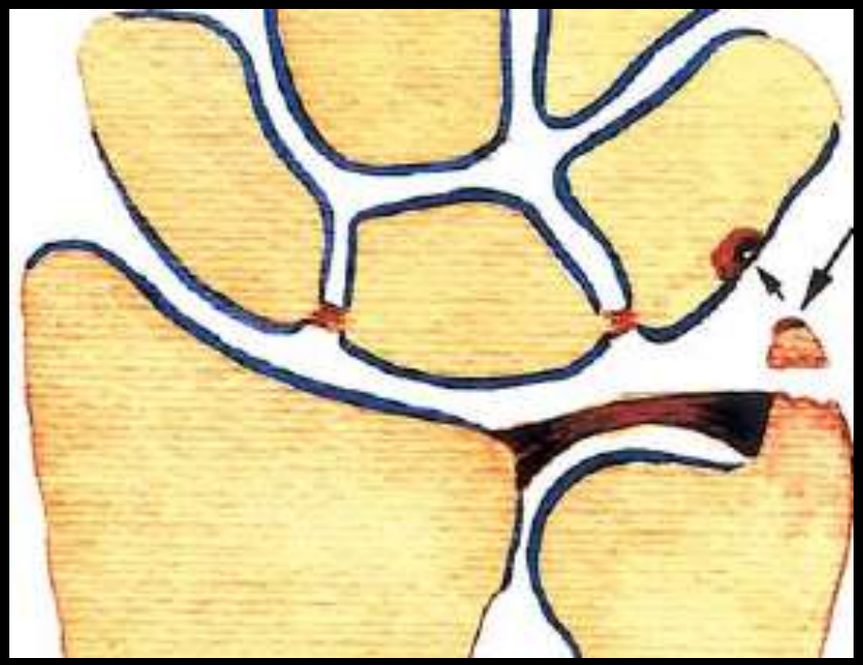
C) Ulnar Impaction Secondary to Ulnar Styloid Nonunion

Cause:

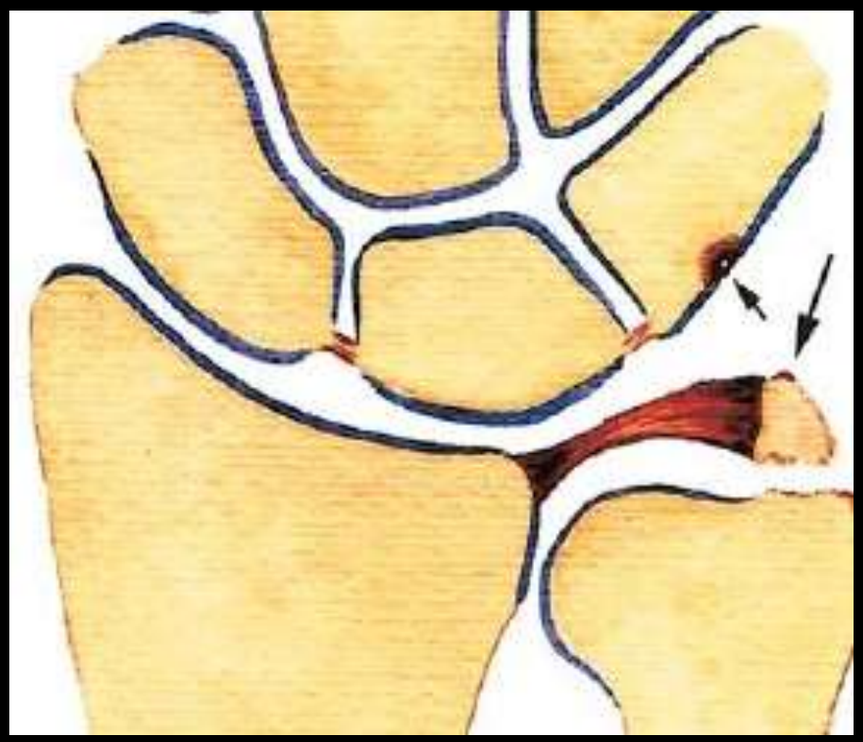
- ✓ nonunion of ulnar styloid process fracture
- ✓ fragment abuts the ulnar carpus and irritates the ECU
- ✓ tears of the TFC contribute to symptoms

Subdivided into Types 1 and 2

- ✓ Type 1:
  - nonunion of the tip of the ulnar styloid process
  - intact TFCC and DRUJ
- ✓ Type 2:
  - nonunion of the base of the ulnar styloid process
  - avulsion of the ulnar attachment of the TFCC and unstable DRUJ



Type 1



Type 2

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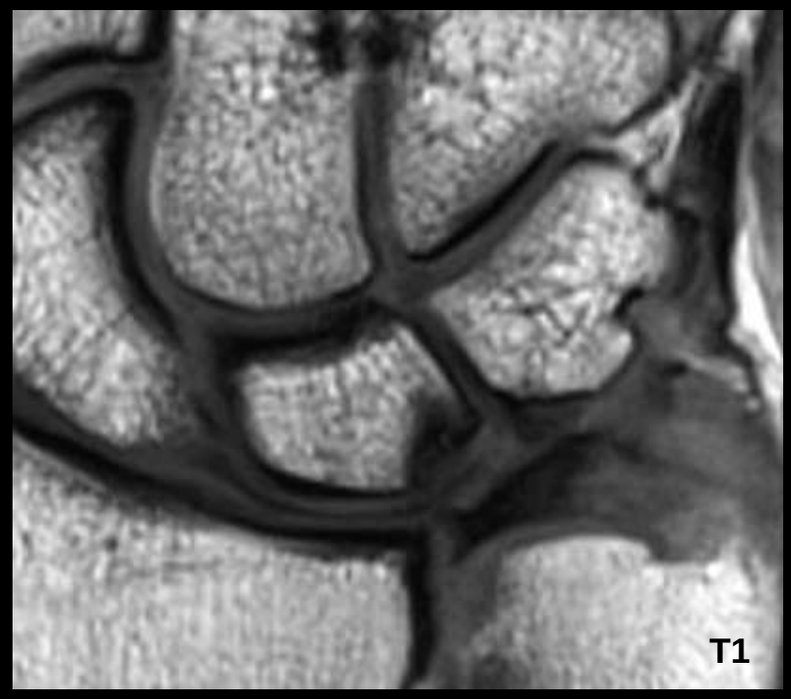
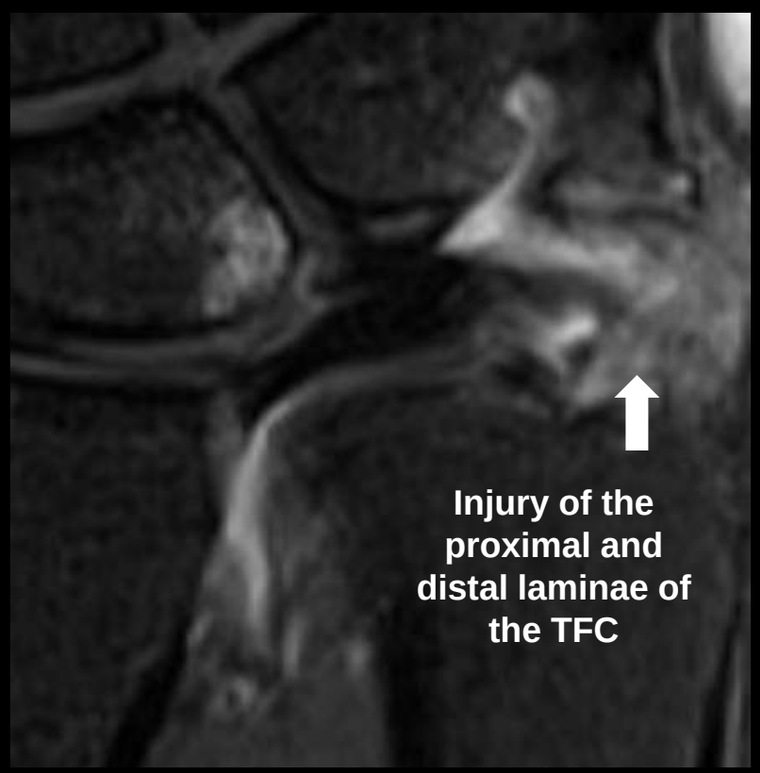
Ulnar Impaction Syndromes

C) Ulnar Impaction Secondary to Ulnar Styloid Nonunion

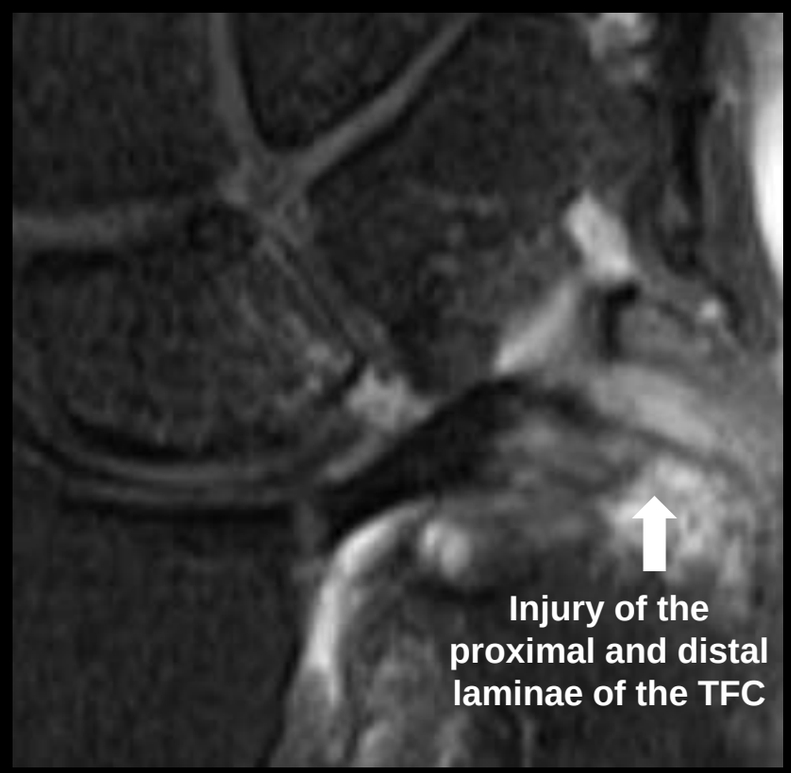
Navy recruit with ulnar sided wrist pain after fall





Stir

Stir



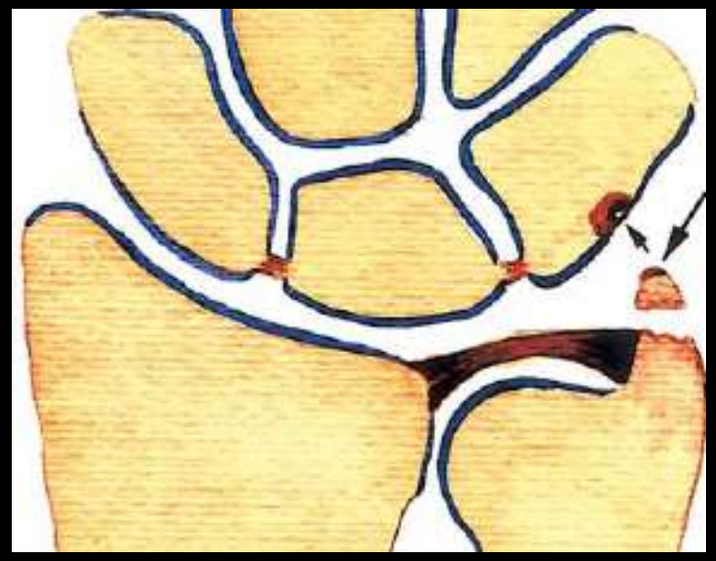
Stir

Ulnar Impaction Syndromes

C) Ulnar Impaction Secondary to Ulnar Styloid Nonunion

Treatment:

- if symptomatic, proceed to arthroscopy
- probe TFC for failure: looking for a “trampoline effect”

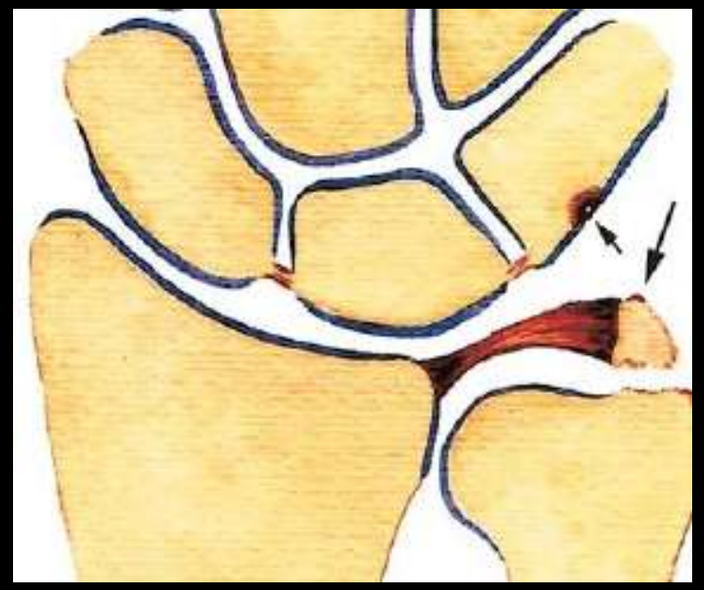


Type 1

Trampoline effect present

TFC is intact

Resect styloid process



Type 2

Trampoline effect absent

TFC is damaged

Ulnar styloid process and TFC are re-inserted into fovea

Cerezal L et al. Radiographics 2002; 22: 105-121

Ulnar Impaction Syndromes

D) Hamatolunate Impingement

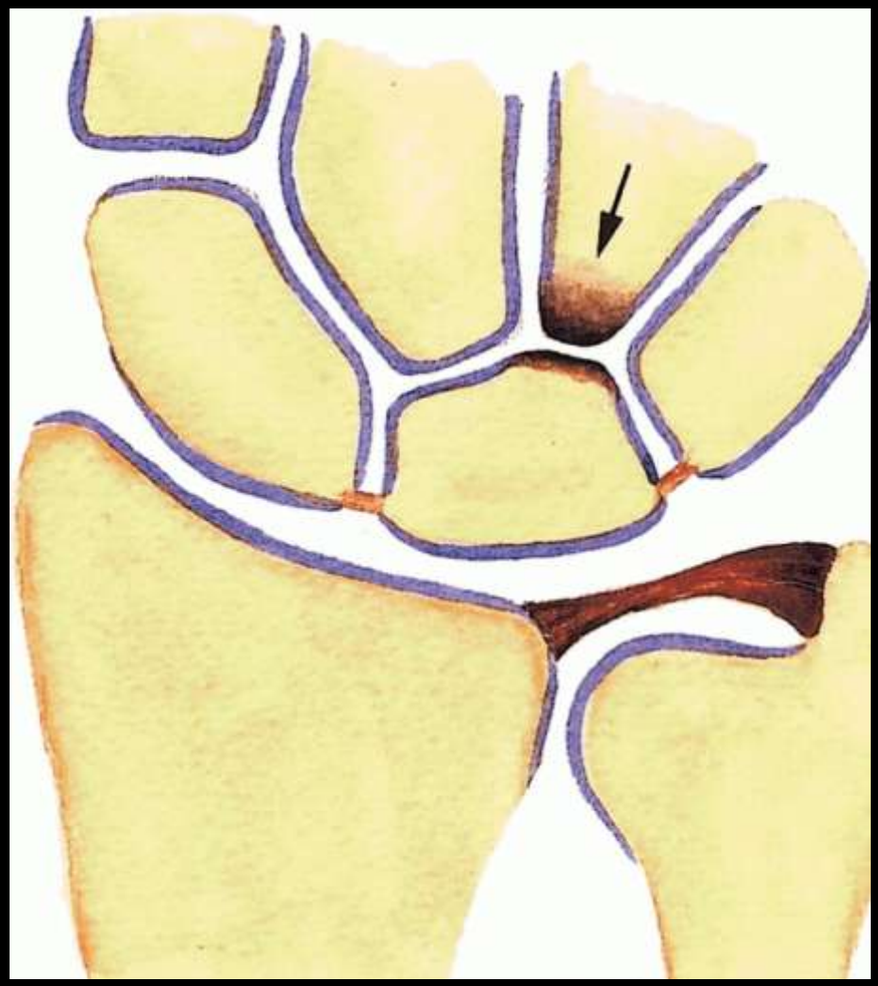
- variant articulation between the medial facet of the lunate and the proximal pole of the hamate bone

- seen in up to 50% of cadaveric wrists

Mechanism:

- ✓ repeated abrasion between the lunate and hamate bones when in full ulnar deviation

- 3-3.5x more likely to develop cartilage loss of the proximal pole of the hamate bone



Cerezal L et al. Radiographics 2002; 22: 105-121
Pfirmann CWA, Theumann NH, Chung CB, Trudell DJ, Resnick D. Skeletal Radiol; 2002: 31: 451-456

Ulnar Impaction Syndromes

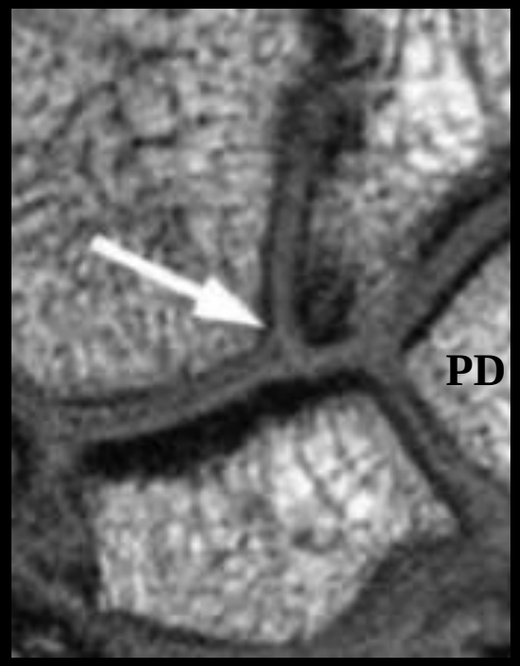
D) Hamatolunate Impingement

Radiographic Findings:

- ✓ osteophytosis between the proximal hamate and medial facet of the lunate bone

MRI findings:

- ✓ bone marrow edema and cartilage loss of the hamate and lunate at the variant articulation site
- ✓ eventual 4 corner arthrosis can develop



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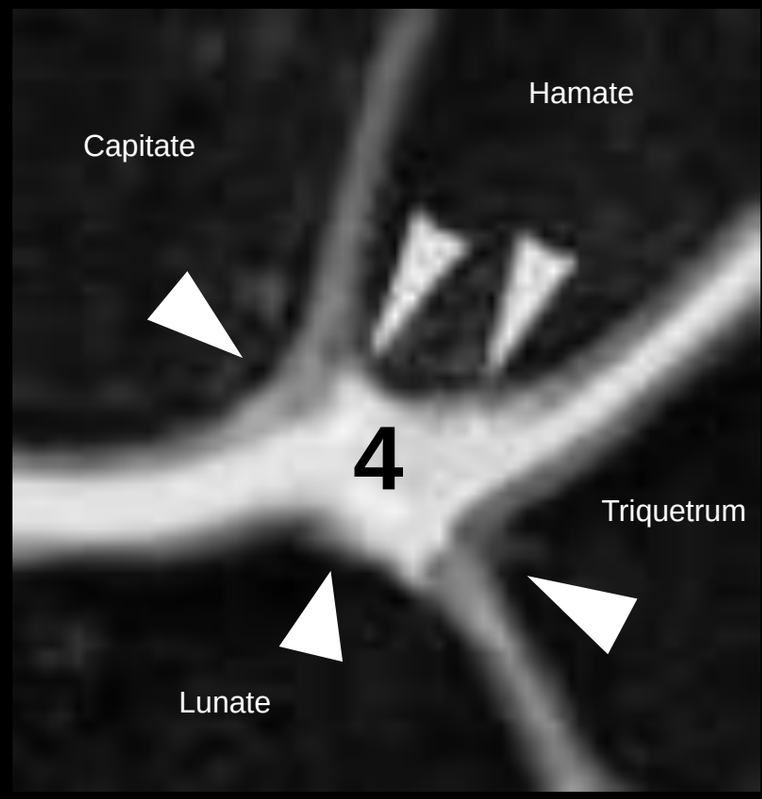

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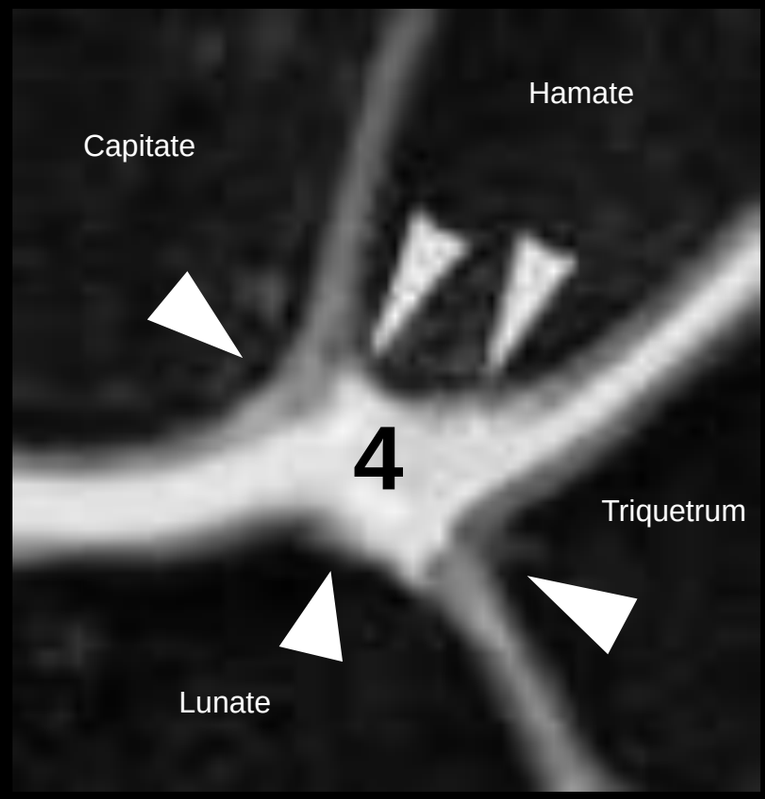
- ✓ osteophytosis between the proximal hamate and medial facet of the lunate bone

MRI findings:

- ✓ bone marrow edema and cartilage loss of the hamate and lunate at the variant articulation site
- ✓ eventual 4 corner arthrosis can develop

Treatment

- ✓ arthroscopic debridement of damaged cartilage
- ✓ 4 corner fusion



Pfirmann CWA, Theumann NH, Chung CB, Trudell DJ, Resnick D. Skeletal Radiol; 2002: 31: 451-456

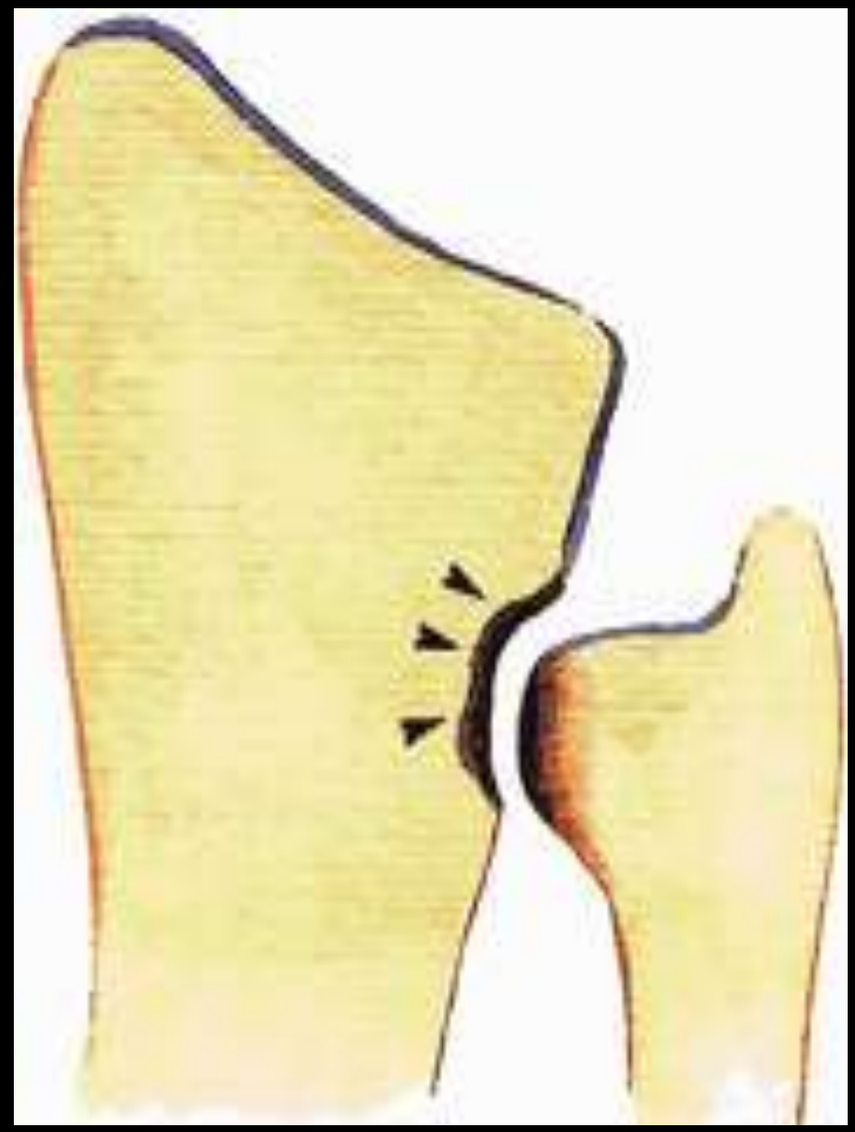
Ulnar Impingement Syndrome

- condition in which a shortened ulna impinges on the distal radius

- mimics ulnar impaction with excessive pain on pronation/supination of the forearm

Causes:

- ✓ surgery (Darrach, Bowers, and Sauvé-Kapandji)
- ✓ growth arrest (Madelung, multiple hereditary exostoses)
- ✓ erosive osteolysis (rheumatoid arthritis)



Cerezal L et al. Radiographics 2002; 22: 105-121

Ulnar Impingement Syndrome

- condition in which a shortened ulna impinges on the distal radius

- mimics ulnar impaction with excessive pain on pronation/supination of the forearm

Radiographic Findings:

- ✓ negative ulnar variance

- ✓ distal aspect of the ulna no longer articulates with the sigmoid notch of the radius

- ✓ scalloping/erosion of the ulnar aspect of the distal radius

Cerezal L et al. Radiographics 2002; 22: 105-121

Extensor Carpi Ulnaris (ECU)

Anatomy

- ECU origin: Two heads
  - ✓ common head originating from the lateral epicondyle of the humerus
  - ✓ ulnar head originating from the posterior aspect of the mid ulna

- Insertion:
  - ✓ ulnar aspect of the base of the 5th MC bone

- Function :
  - ✓ extension and ulnar deviation of the wrist joint

Amin Matin. Thank you

Extensor Carpi Ulnaris. MSK Atlas. Department of Radiology. University of Washington http://www.rad.washington.edu

Extensor Carpi Ulnaris (ECU)

Anatomy

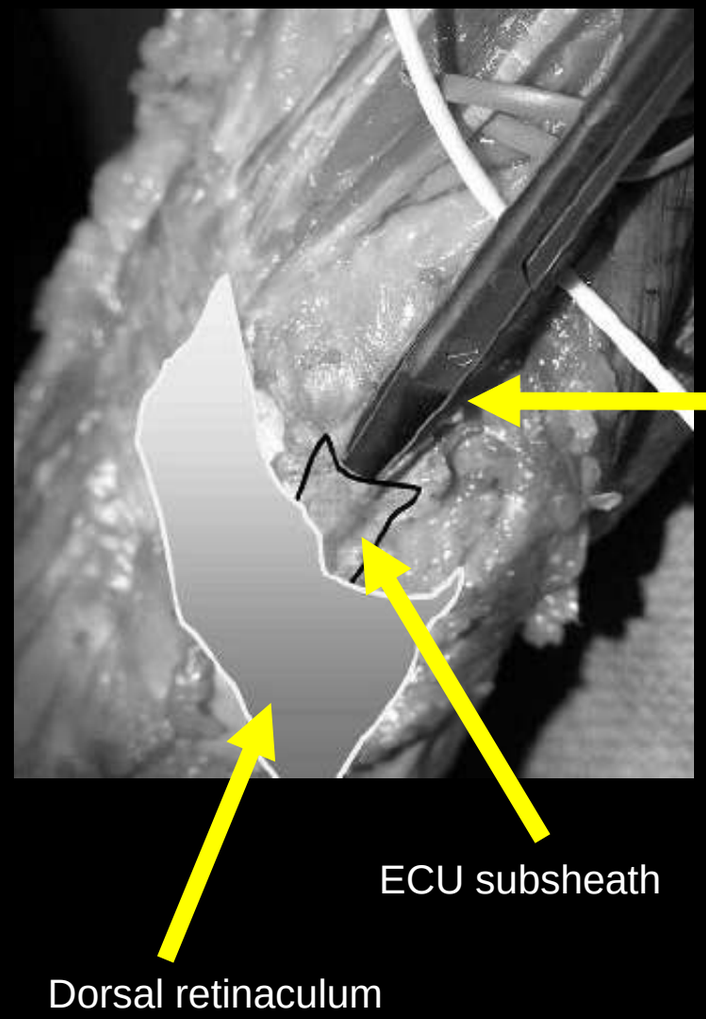
Course

- rests in the sixth extensor compartment along a groove in the ulna

- maintained in its ulnar groove by the ECU subsheath and the extensor retinaculum

- ECU subsheath:
  - ✓ 2 cm fibro-osseous tunnel that encircles the ECU
  - ✓ formed by duplication of the deep antebrachial fascia
  - ✓ inserts on the ulna and its styloid
  - ✓ merges with the DRUJ proximally and the TFC distally

- Extensor retinaculum
  - ✓ passes above the ECU subsheath like a bridge
  - ✓ inserts on the volar aspects of the pisiform and triquetral bones



Montalvan B et al. Br J Sports Med 2006; 40: 424-429

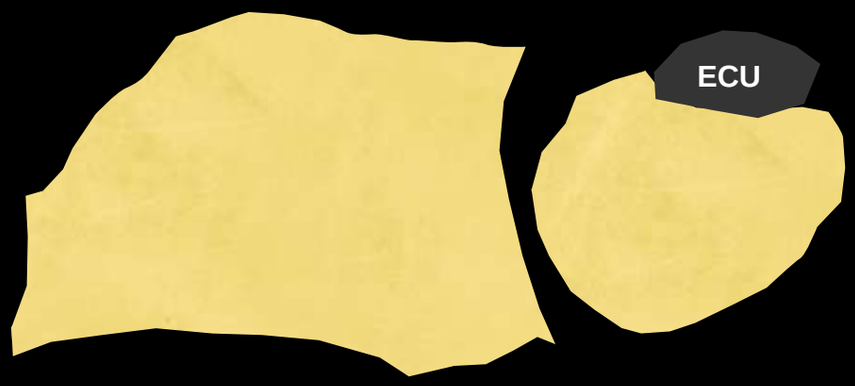
Extensor Carpi Ulnaris (ECU)

MR imaging Anatomy

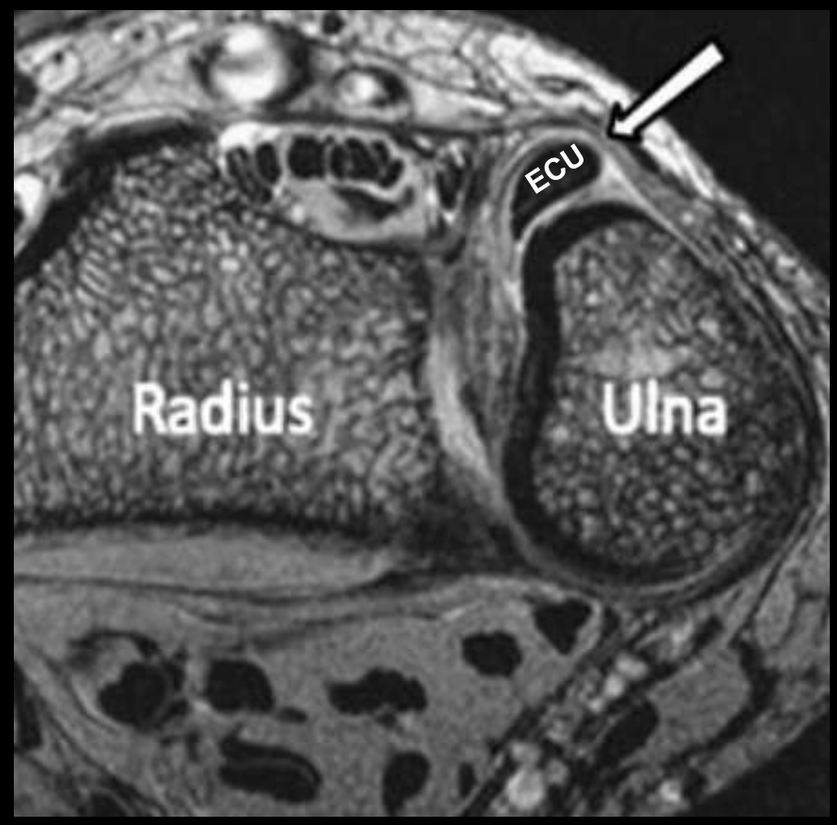
- In normal wrists, the ECU may be partially displaced in the :

  - ✓ dorsal direction with supination and wrist extension

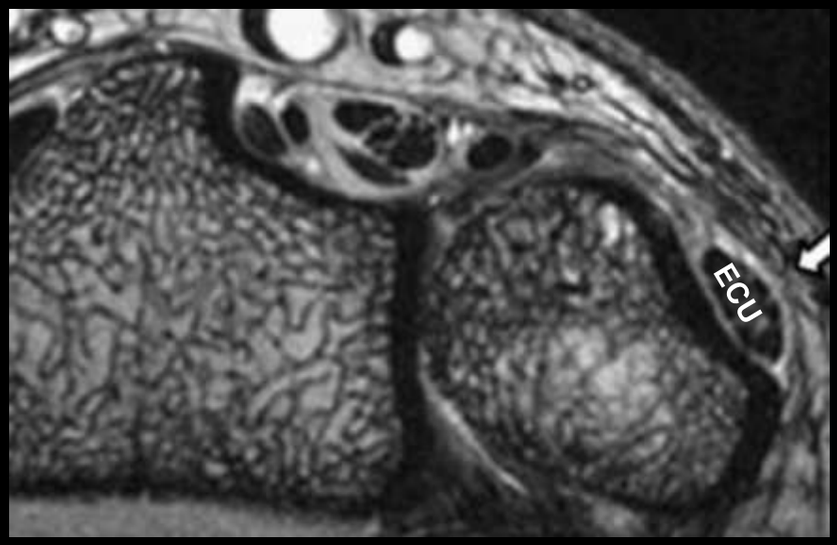
  - ✓ volar direction with pronation and wrist flexion



Neutral



Supination



Pronation

Extensor Carpi Ulnaris Disorders

ECU Tendinopathy

Tendinosis, Tenosynovitis, Tears, Subluxation/Dislocation

Symptoms:

- ✓ local pain, swelling, or clicking/snapping with interruption of ECU subsheath
- ✓ can clinically simulate a TFC injury

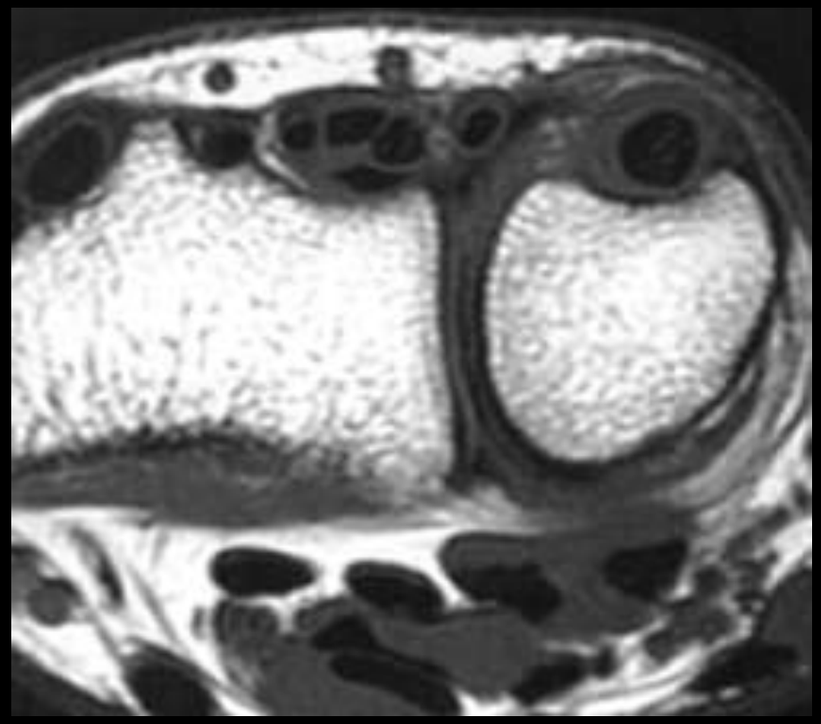
Causes:

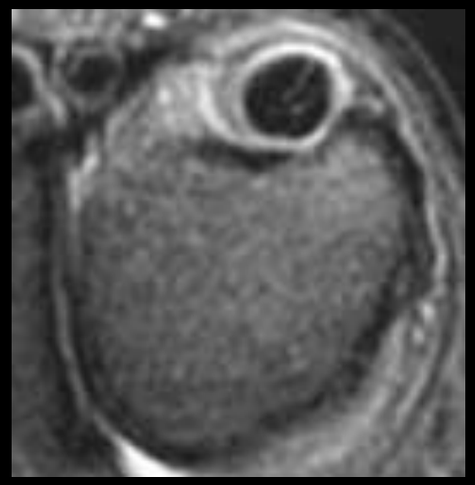
- ✓ acute trauma (hypersupination and ulnar deviation)
- ✓ chronic repetitive sports-related injuries (tennis, hockey, golf)
- ✓ chronic inflammatory processes (rheumatoid arthritis)

Extensor Carpi Ulnaris (ECU)

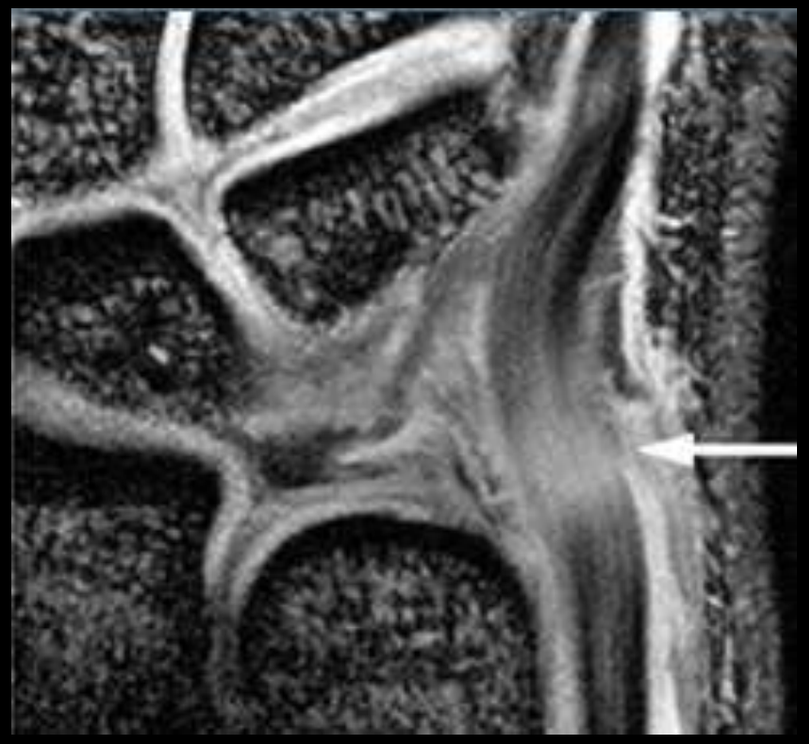
Tendinosis, Tenosynovitis, Tears, Subluxation/Dislocation

- Chronic repetitive microtrauma





ECU tendinosis and tenosynovitis



ECU tenosynovitis
and
partial thickness tear

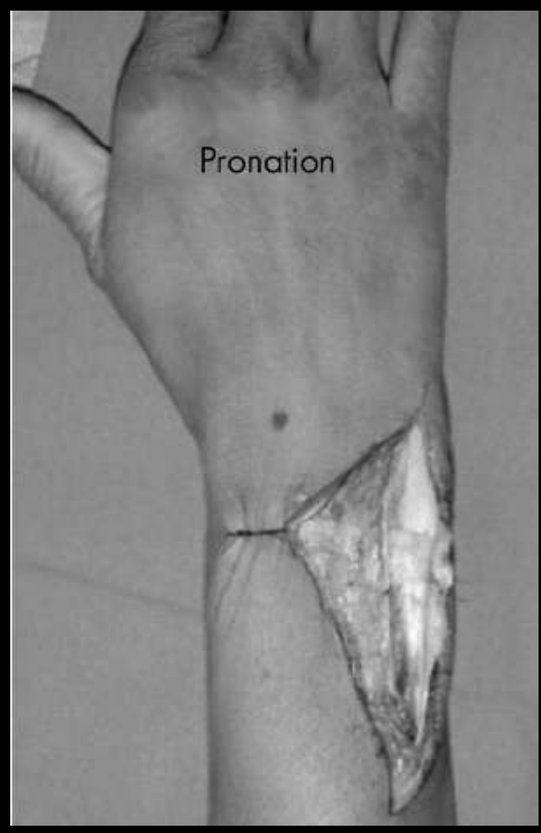
Extensor Carpi Ulnaris (ECU)

Patterns of Traumatic ECU Injuries in Tennis Players

- observed ECU injuries in the non dominant hand of two-handed backhand tennis players

Cause:

- ✓ damage of the ECU retinaculum was related to changes in anatomical position of the ECU:
  - during pronation, the ECU has a direct course to its insertion
  - during supination, the ECU adopts a 30^{o} angle to reach its insertion

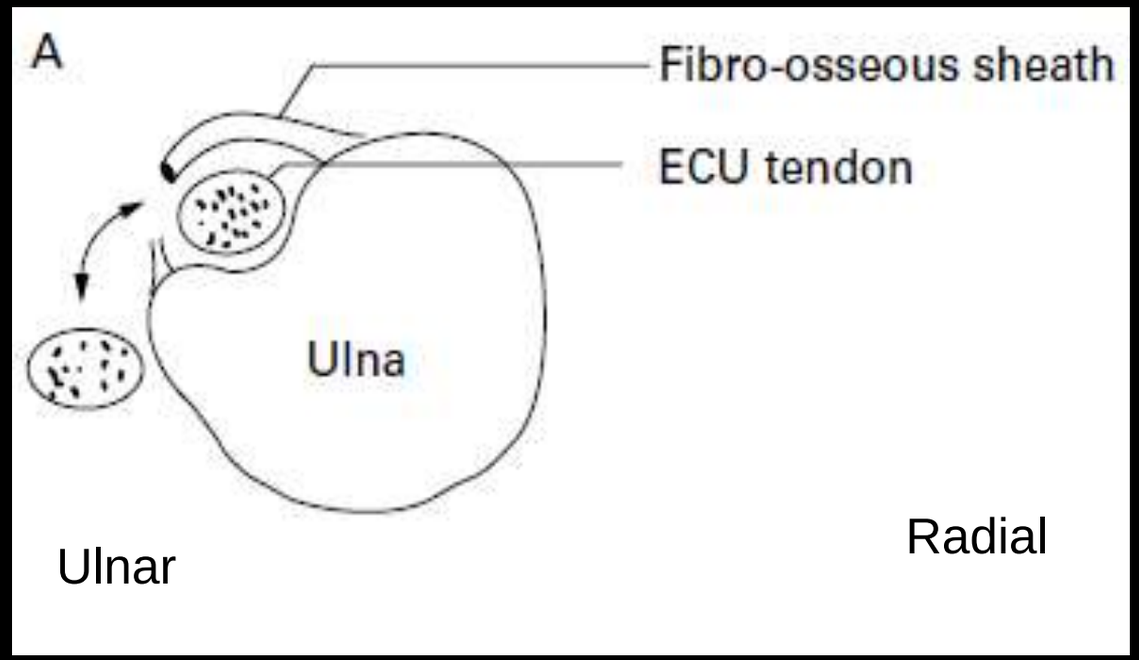


Montalvan B et al. Br J Sports Med 2006; 40: 424-429

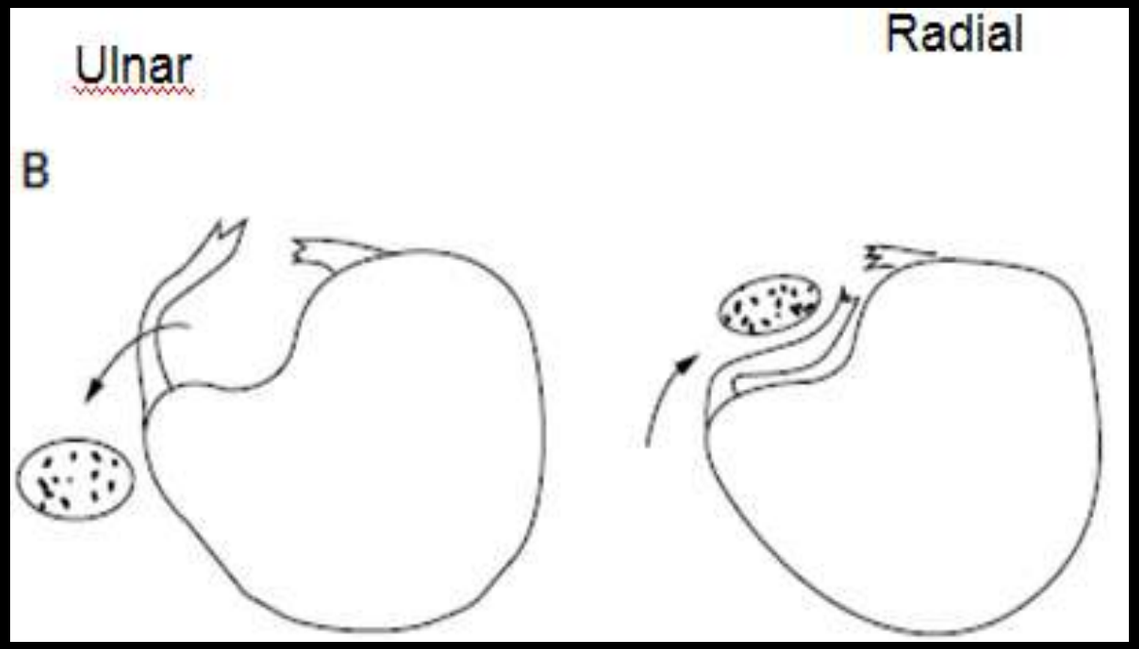
Extensor Carpi Ulnaris (ECU)

Patterns of Traumatic ECU Injuries in Tennis Players

- Type A
  - ✓ ulnar sided tear of the ECU fibro-osseous sheath
    - ECU dislocates
    - returns to the ulnar groove underneath the torn sheath
    - treated with reconstruction of the sheath utilizing a portion of the extensor retinaculum



- Type B
  - ✓ radial sided tear of the ECU fibro-osseous sheath
    - ECU dislocates
    - sheath is caught in between the ECU and the distal ulna upon return of the ECU
    - treated with ECU re-location and direct suture of the sheath over the ECU tendon

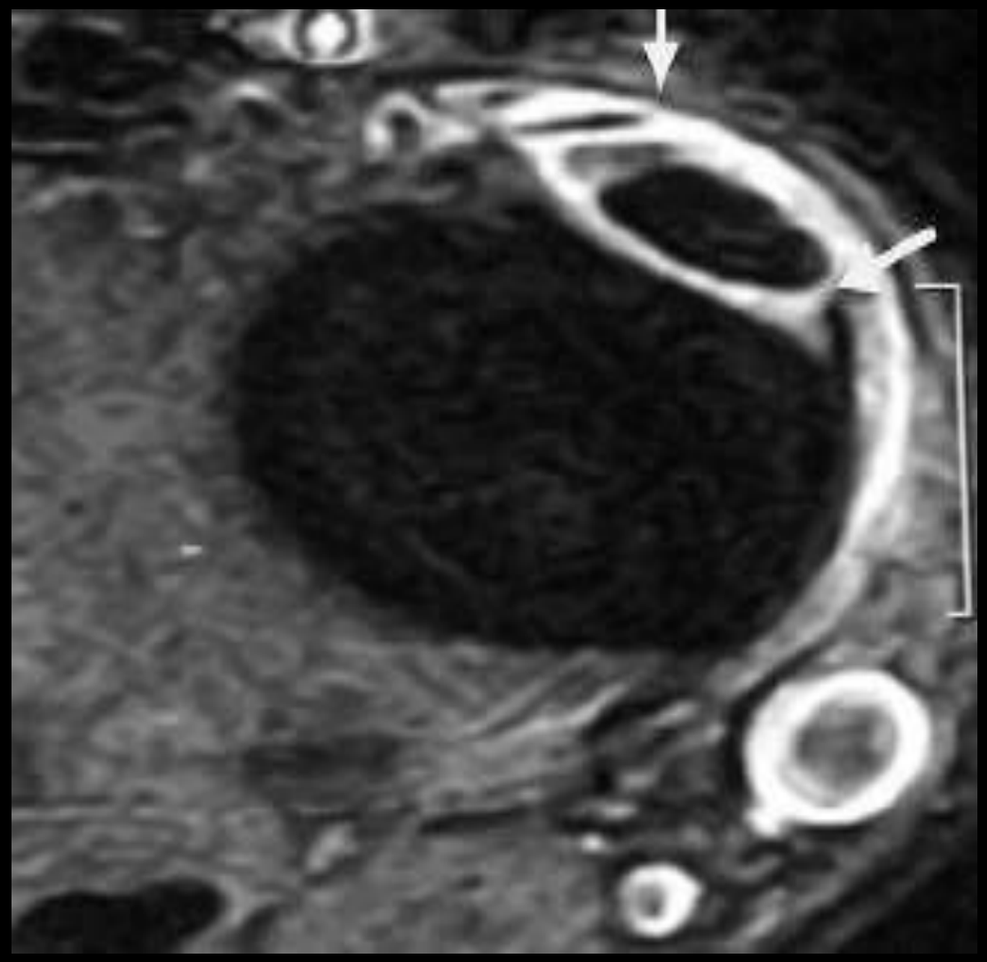


Inoue G et al. Br J Sports Med 1998; 32: 172-174

Extensor Carpi Ulnaris (ECU)

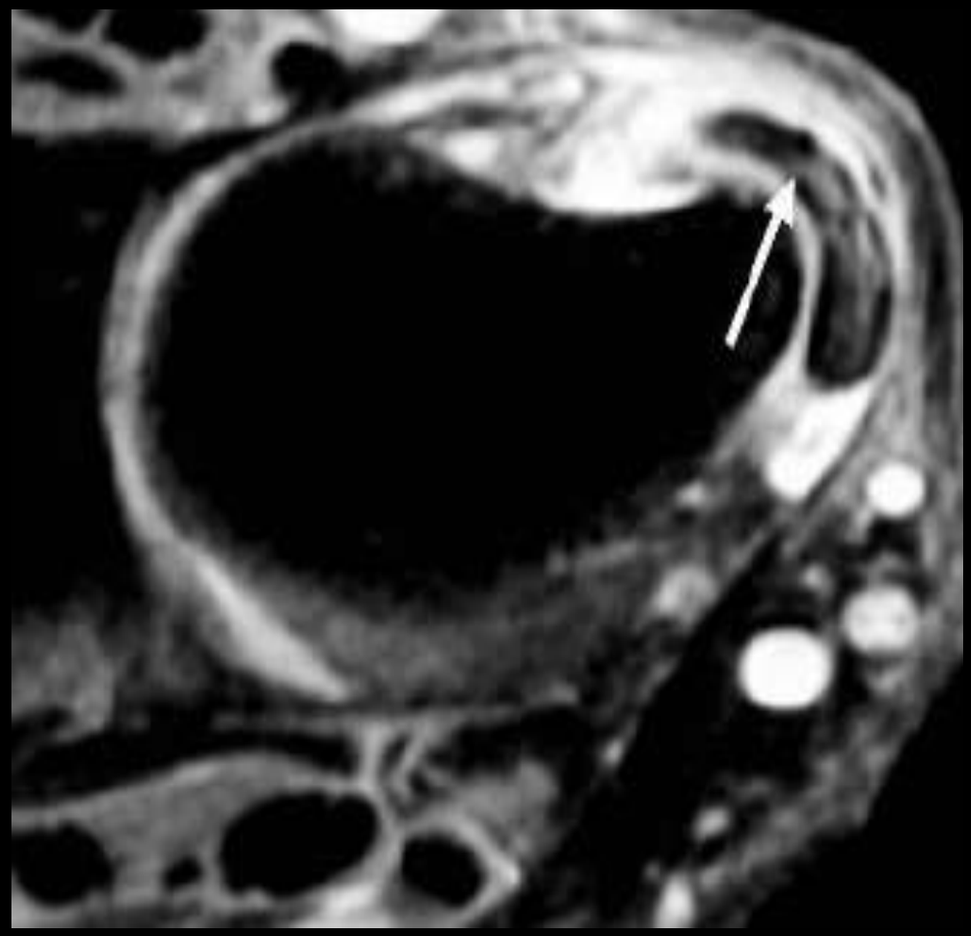
Patterns of Traumatic ECU Injuries in Tennis Players

Tear of central and ulnar aspects of the ECU subsheath (Type A lesion)



ECU tenosynovitis and partial tearing

Ulnar subluxation of the ECU



Montalvan B et al. Br J Sports Med 2006; 40: 424-429

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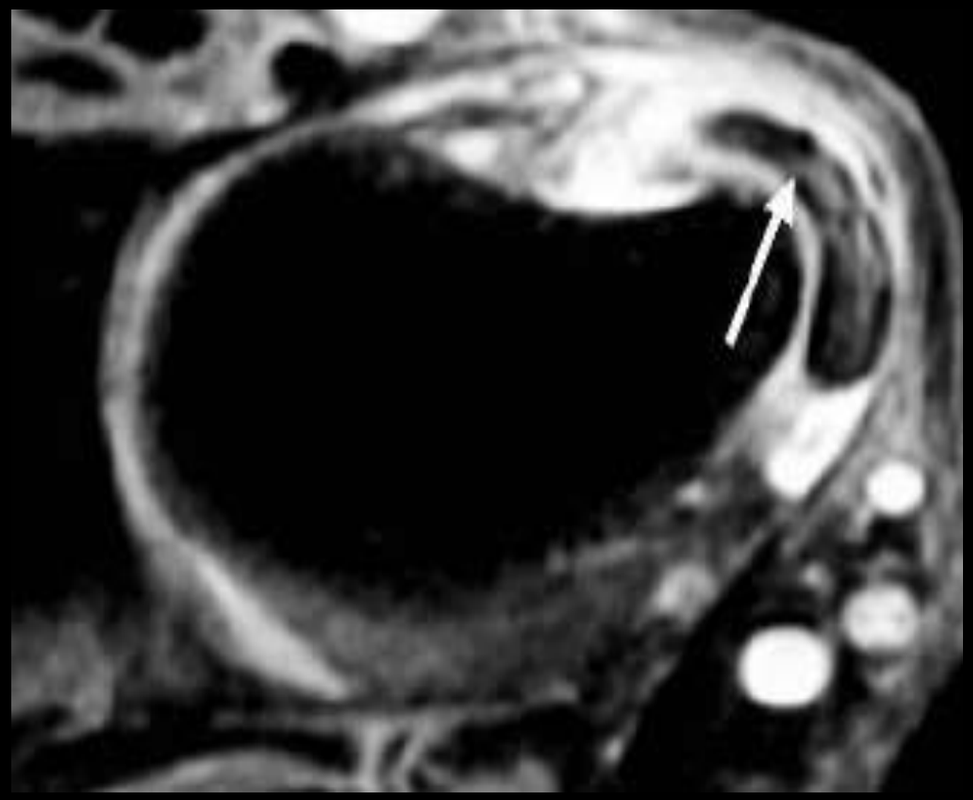
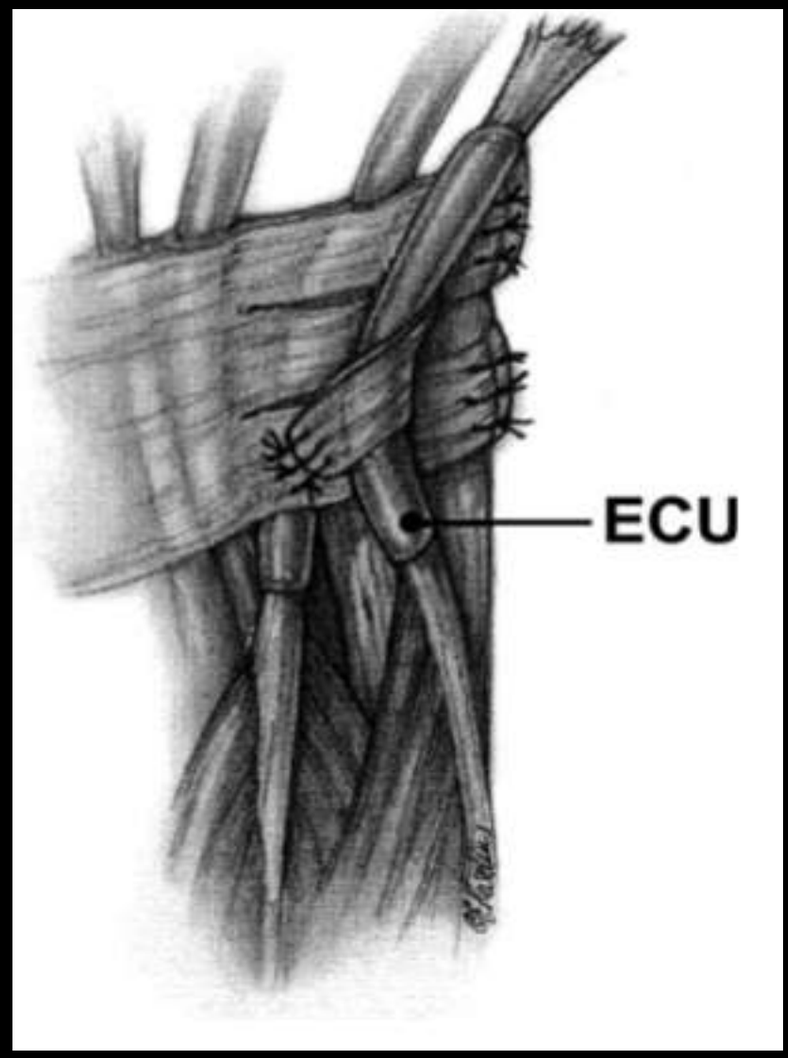




Treatment

Reconstruction of the ECU subsheath utilizing a portion of the extensor retinaculum

Montalvan B et al. Br J Sports Med 2006; 40: 424-429

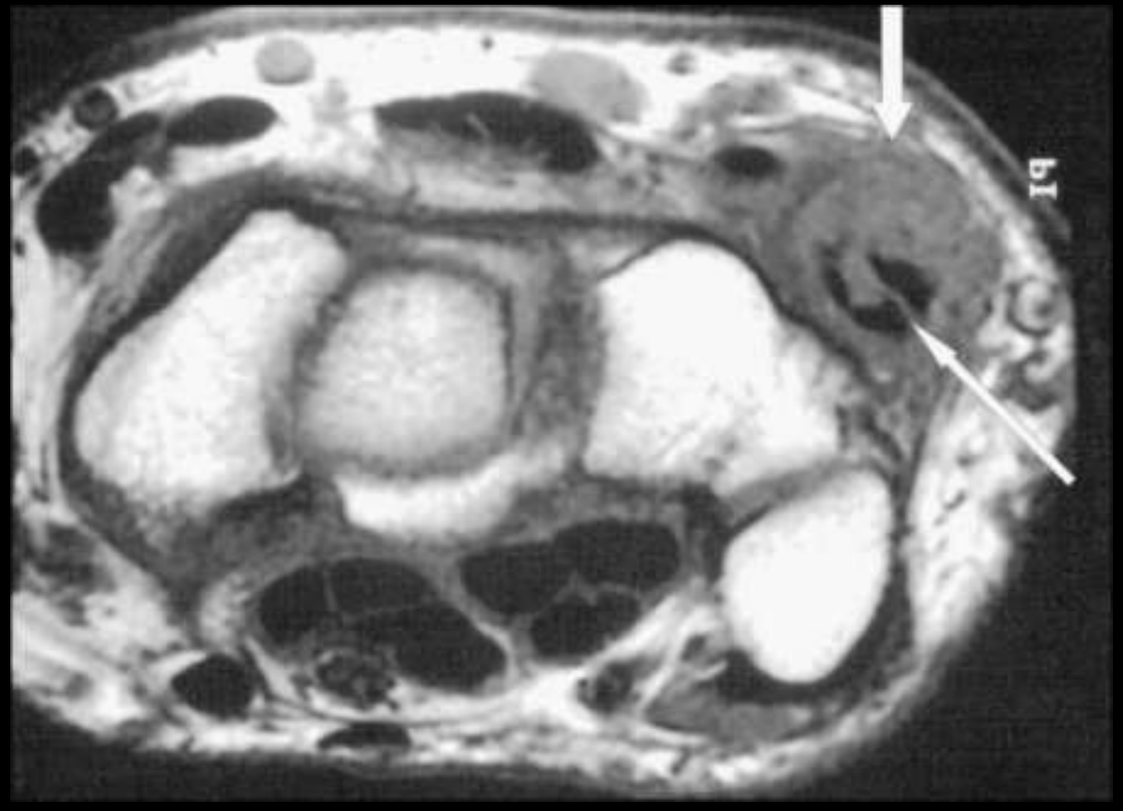
Extensor Carpi Ulnaris (ECU)

Tendinosis, Tenosynovitis, Tears, Subluxation/Dislocation

- Chronic inflammatory processes (rheumatoid arthritis)

Marked ECU inflammatory tenosynovitis

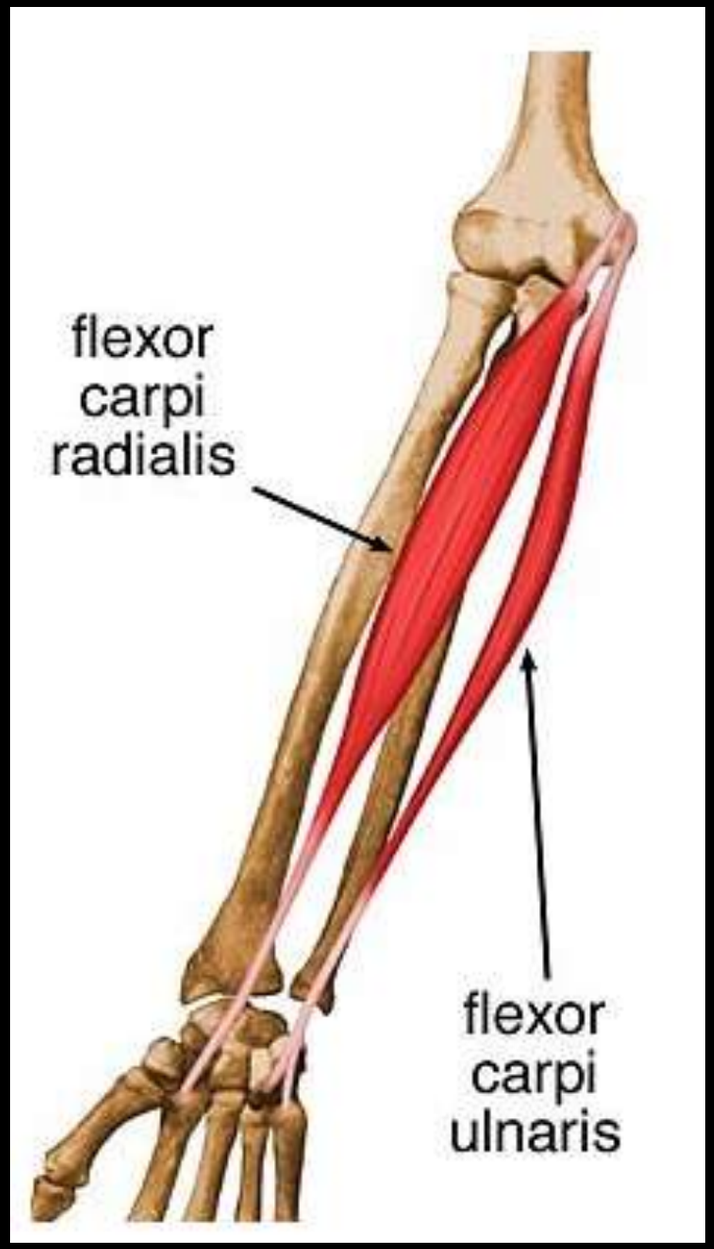
Pannus extending into a partial thickness tear



Flexor Carpi Ulnaris (FCU)

Anatomy

- FCU origin: Two heads
  - ✓ humeral head arises from the common flexor tendon origin from the medial epicondyle
  - ✓ ulnar head arises from the olecranon and posterior aspect of proximal ulna
- Insertion:
  - ✓pisiform, hamate, and base of the 5th metacarpal bone
- Function:
  - ✓flexion and ulnar deviation of the wrist
  - ✓important stabilizer of the pisotriquetral joint
  - ✓stabilizer of the distal radioulnar joint



Amin Matin. Thank you

Extensor Carpi Ulnaris. MSK Atlas. Department of Radiology. University of Washington http://www.rad.washington.edu

Flexor Carpi Ulnaris (ECU)

Tendinopathy

Causes:

- ✓ repetitive wrist flexion
- ✓ classified as either calcific (HADD) or non calcific in origin (tendinosis)
- ✓ FCU is extrasynovial and does not have a surrounding sheath; unable to develop tenosynovitis

Symptoms:

- ✓ pain with restricted flexion and ulnar deviation
- ✓ in contrast to pisotriquetral joint (PTJ) osteoarthrosis, the pain from FCU tendinopathy is elicited 3 cm proximal to the pisiform along the palpable tendon

Treatment:

- ✓ conservative
- ✓ surgical: FCU debridement (uncommon)

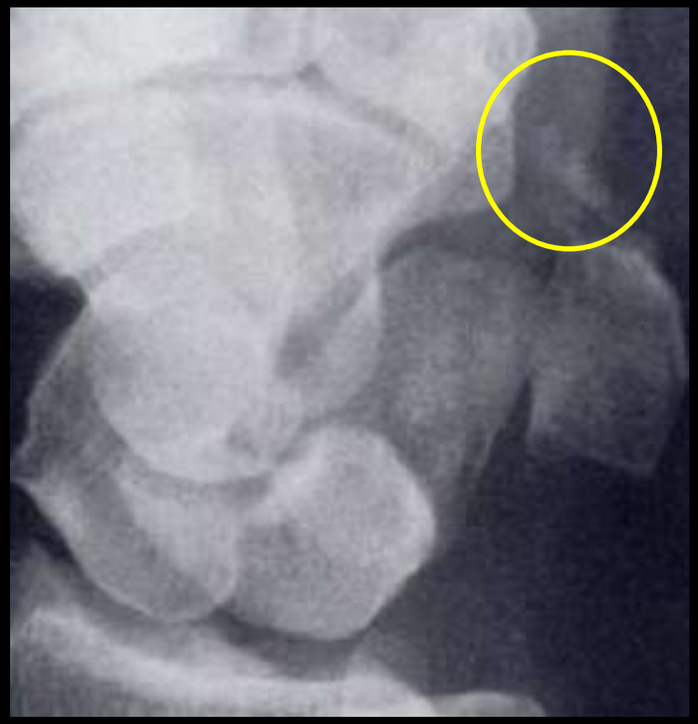
Budoff JE et al. J Hand Surg [Am}. 2005; 30 (1):125-9

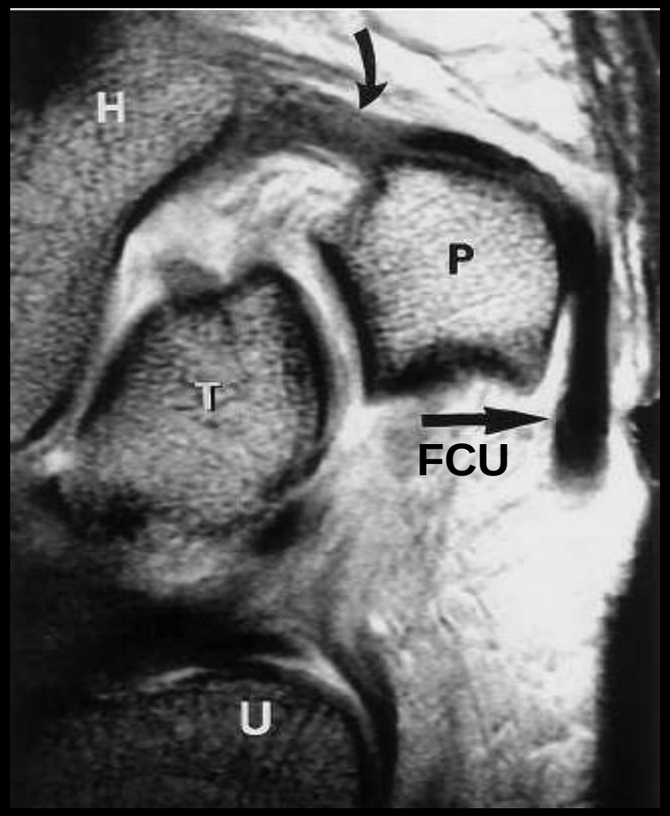
Flexor Carpi Ulnaris (FCU)

Hydroxyapatite Deposition

Within the substance of the FCU tendon

Likely along the pisohamate ligament





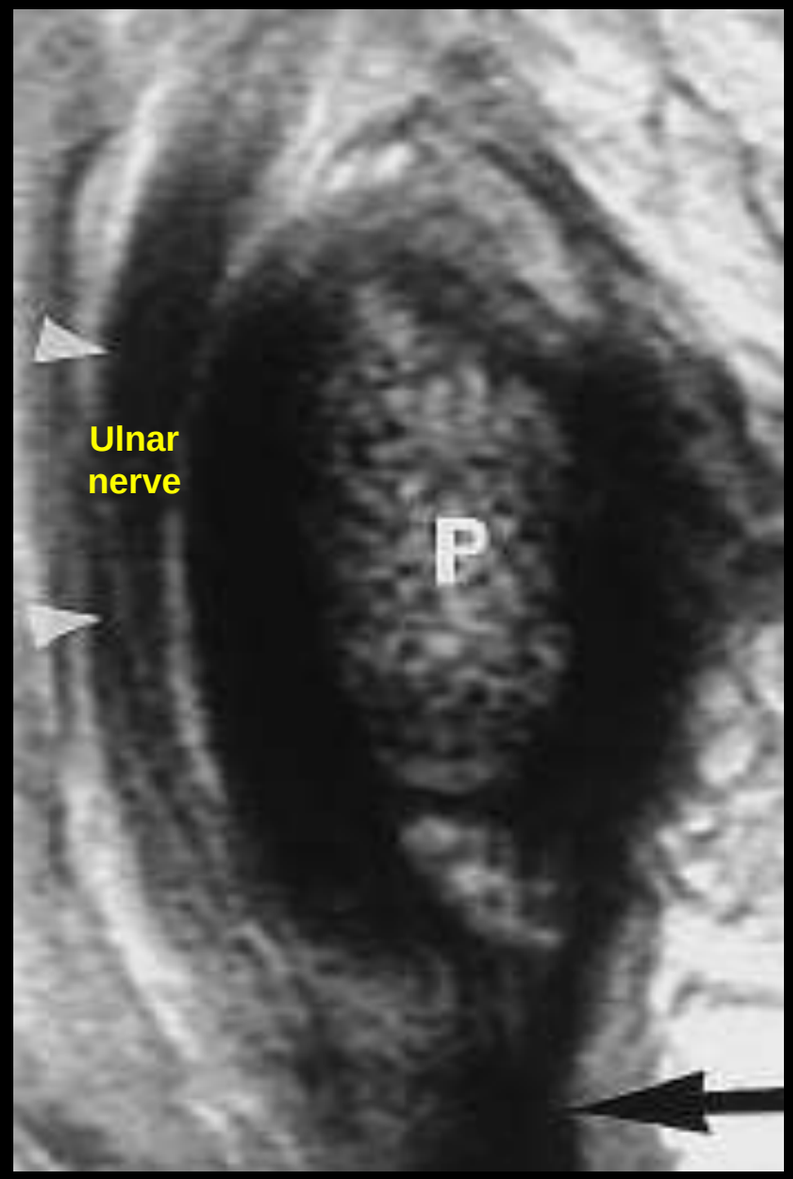
Thank you Mini

Gandee RW et al. AJR. 1979; 133 (6): 1139-41

Guyon's Canal

Anatomy

- may become the site of ulnar nerve compression
- fibro-osseous tunnel located along the anterior and medial aspects of the wrist
- extends from the pisiform bone to the hook of the hamate and spans a 4 cm distance



Zeiss et al. AJR; 1992: 1081-1085

Theumann NH, Pfirmann CWA, Chung CB, Antonio GE, Trudell DJ, Resnick D. Radiology. 2002; 222(3):763-70

Ulnar Nerve and Guyon's Canal

Anatomy

- contains fat, and the ulnar neurovascular bundle

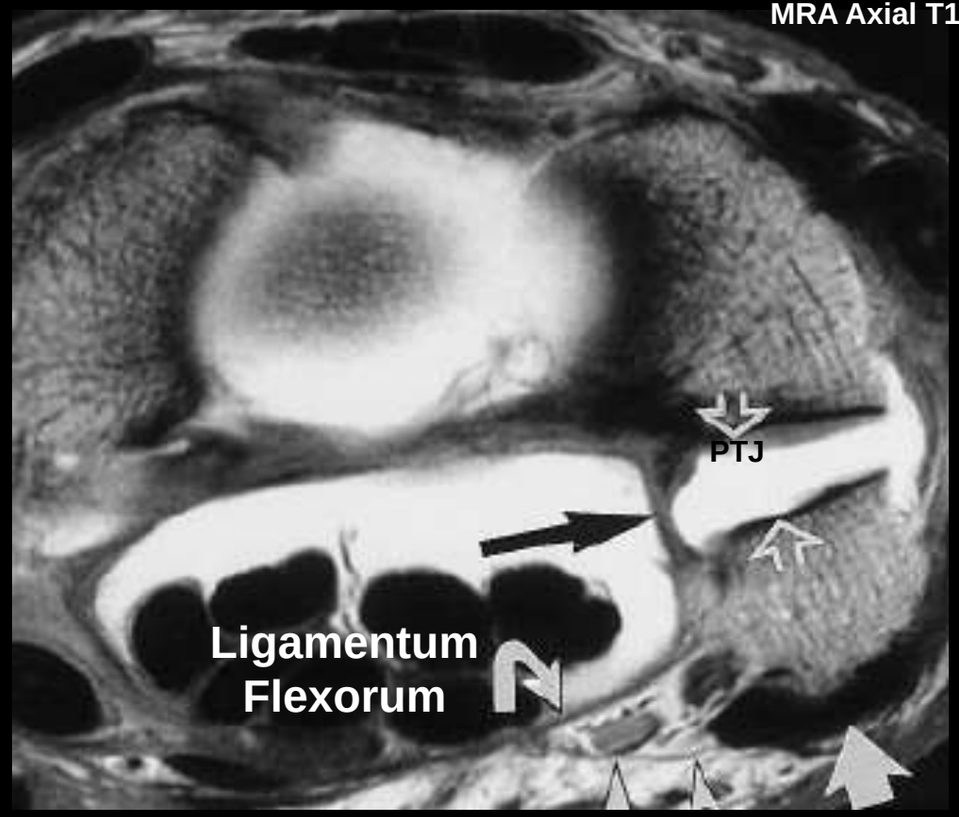
Walls of the canal:

✓consist of the pisiform bone medially and the hook of the hamate laterally

- Floor of the canal:
  - ✓ composed of the flexor retinaculum
  - ✓ origin of the hypothenar muscles

Roof of the canal

- ✓ flexor retinaculum
- ✓ palmar fascia
- ✓ antebrachial fascia
- ✓ palmaris brevis muscle



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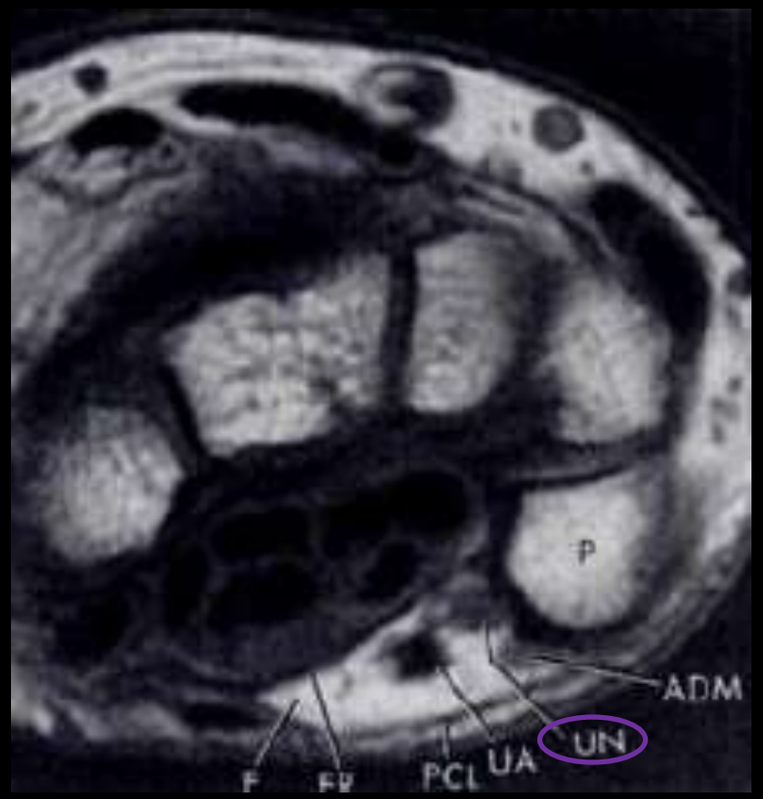
Theumann NH, Pfirmann CWA, Chung CB, Antonio GE, Trudell DJ, Resnick D. Radiology. 2002; 222(3):763-70

Ulnar Nerve and Guyon's Canal

Anatomy

Proximal portion – Level of the pisiform bone

- ulnar nerve enters the canal medial to the artery
- both structures course through fatty tissue
- ulnar nerve's average transverse dimension is 3 mm at the level of the pisiform bone
- carries sensory and motor branches



Zeiss et al. AJR; 1992: 1081-1085

Ulnar Nerve and Guyon's Canal

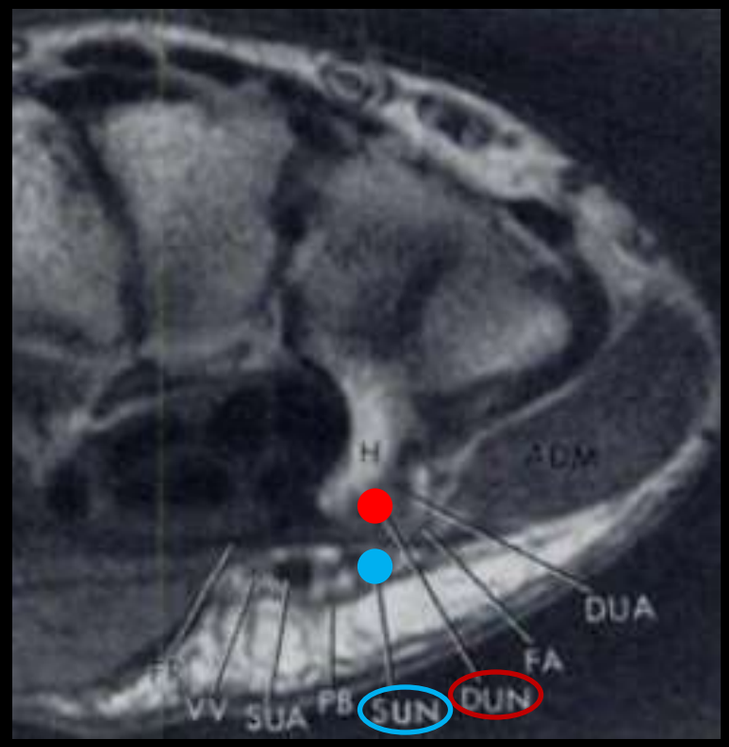
Anatomy

Distal Portion – Level of the hook of the hamate bone

- ulnar nerve divides into superficial sensory and deep motor branches

  - ✓ superficial sensory branch:
    - provides sensation to the 5th finger and the ulnar half of the 4th finger
    - courses within the superficial portion of the canal

  - ✓ deep motor branch:
    - the hypothenar muscles
      - ✓ abductor digiti minimi,
      - ✓ flexor digiti minimi
      - ✓ opponens digiti minimi
    - the adductor pollicis
    - the 3rd and 4th lumbricals
    - all of the interossei muscles



Zeiss et al. AJR; 1992: 1081-1085

Guyon's Canal Syndrome (Ulnar Tunnel Syndrome)

- compression of the ulnar nerve in Guyon's canal

Causes:

- ✓ extrinsic compression:
  - soft tissue masses (ganglion cysts, lipoma, fibrolipomatous hamartoma)
  - PTJ osteophytes
  - anomalous muscles (accessory abductor digiti minimi)
  - ulnar artery aneurysms (hypothenar hammer syndrome)
- ✓ trauma (pisiform or hamate fractures, cycling)
- ✓ bursitis

Capitani D et al. J Neurol 2002; 249: 1441-1445

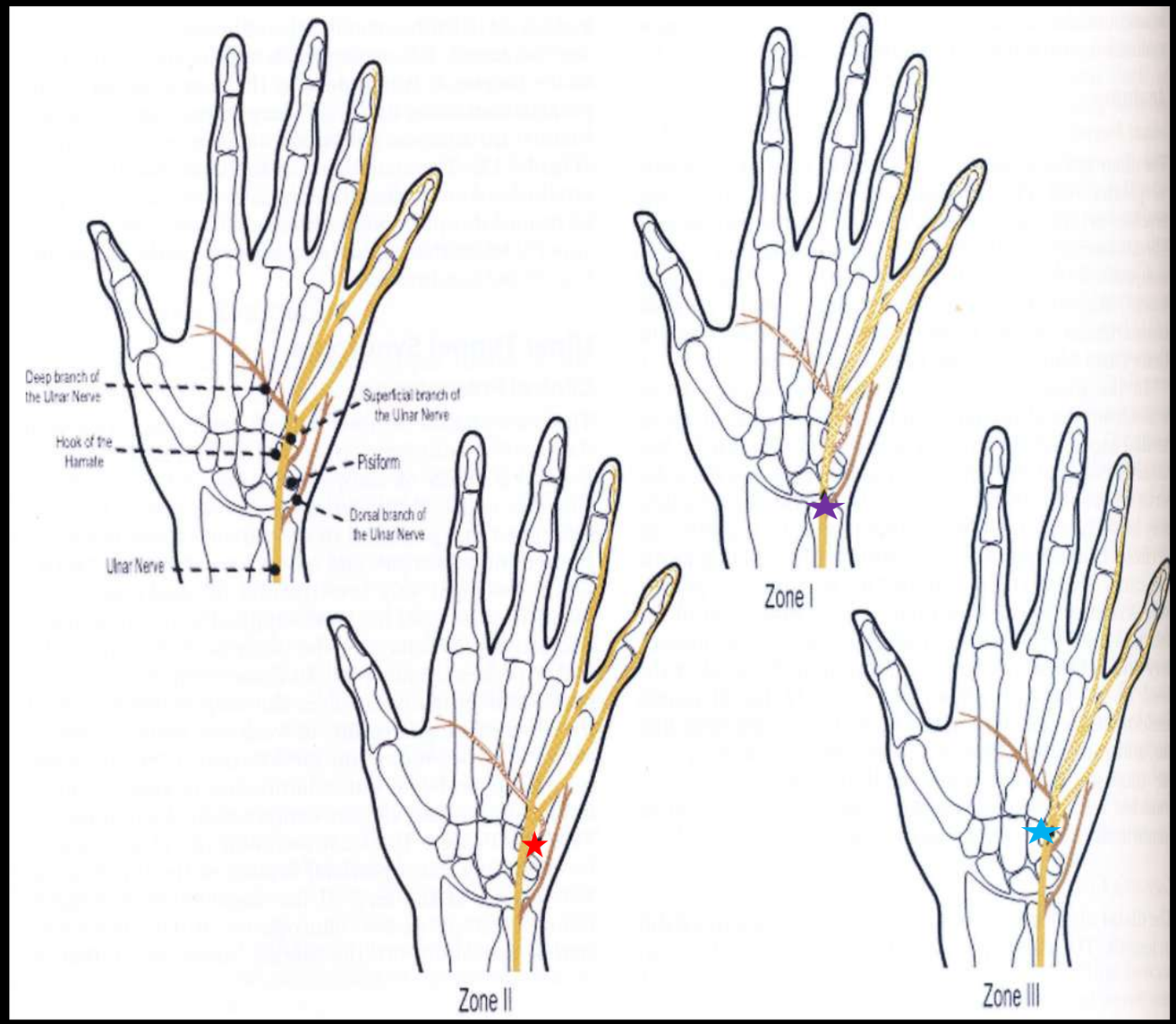
Guyon's Canal Syndrome (Ulnar Tunnel Syndrome)

- Three zones of ulnar nerve compression in Guyon's canal:

- Zone 1
  - ✓ proximal palmar carpal ligament to ulnar nerve bifurcation
  - ✓ cause combined motor/sensory deficits

- Zone 2
  - ✓ contains the deep motor branch of the ulnar nerve
  - ✓ ulnar nerve bifurcation to hypothenar muscular fibrous arch
  - ✓ ulnar aspect of the hook of hamate
  - ✓ pure motor deficits

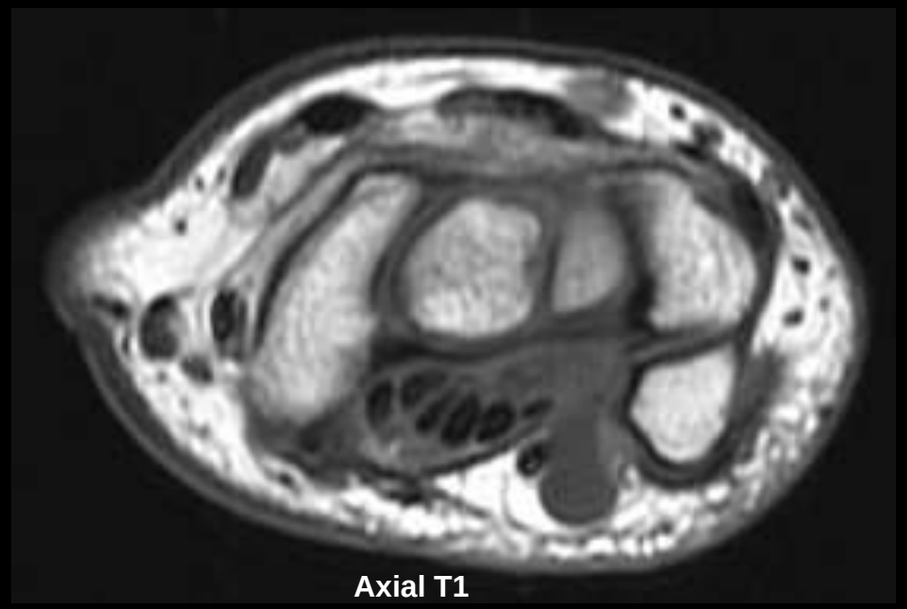
- Zone 3
  - ✓ parallel to zone 2
  - ✓ contains the superficial sensory branch of the ulnar nerve
  - ✓ radial aspect of the hook of hamate
  - ✓ isolated sensory deficits



Malfair D. The Carpal Tunnel and Guyon's Canal. *In* Chung CB and Steinbach LS. MRI of the Upper Extremity: Shoulder, Elbow, Wrist and Hand. 1st ED. 2010, p 580

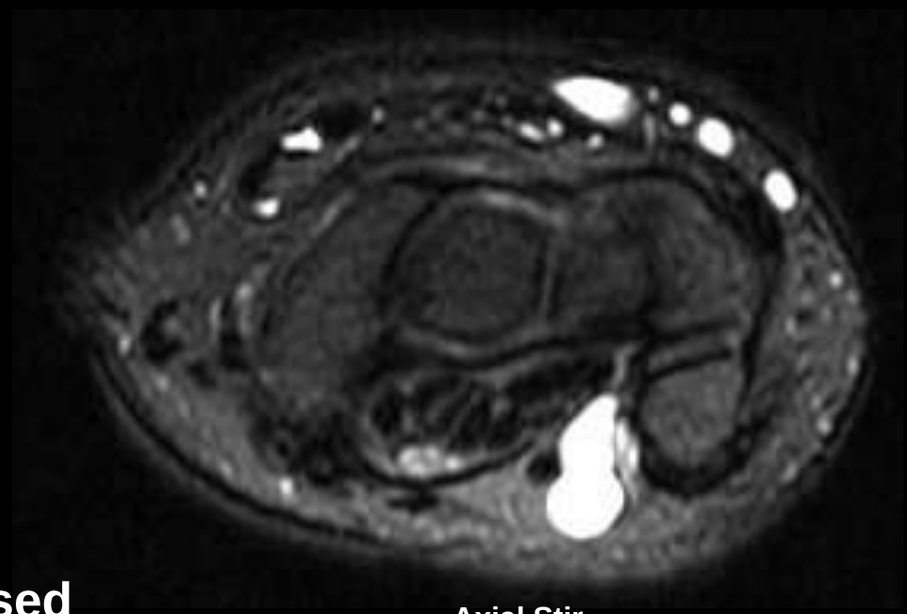
Guyon’s Canal Syndrome (Ulnar Tunnel Syndrome)

Most common cause of ulnar tunnel syndrome : Ganglion cysts

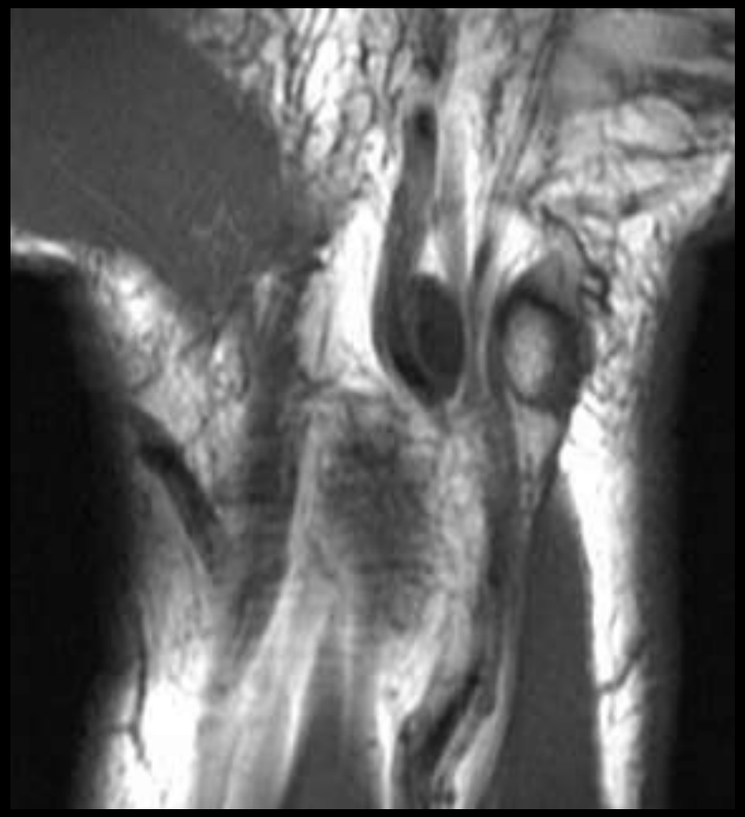


Axial T1

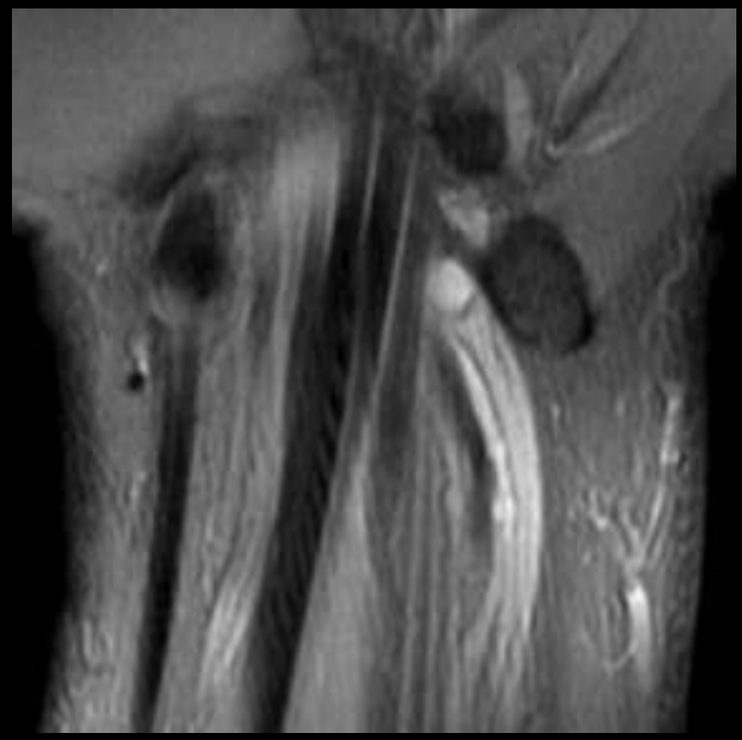
Ganglion cyst interposed between the ulnar artery and nerve



Axial Stir



Coronal T1



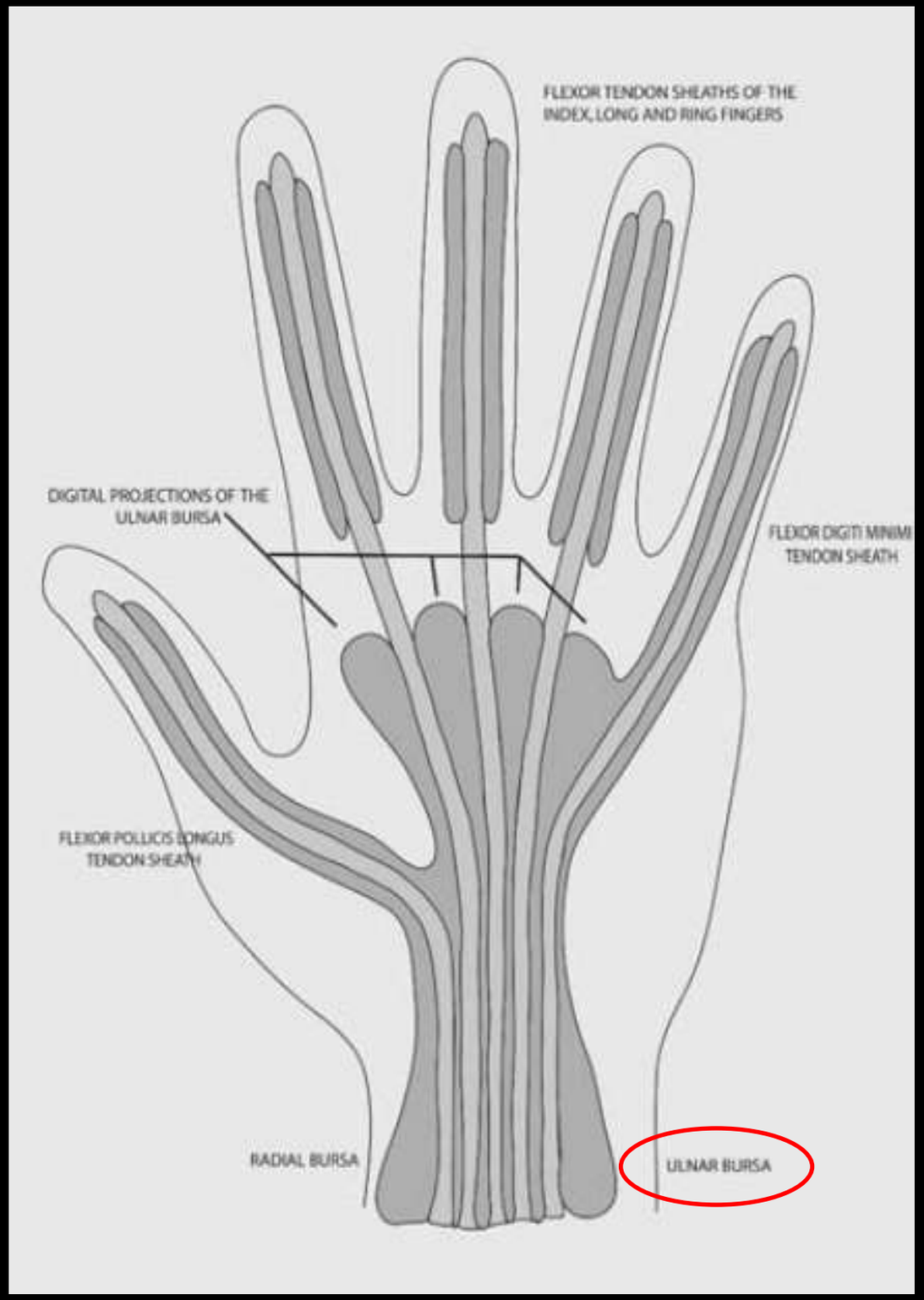
Coronal PD

Mini Thank you

Radial and Ulnar Bursae of the Wrist

Anatomy

- synovial membrane lined sac-like structures
- localized in the palmocarpal area
- Ulnar Bursa:
  - ✓ larger of the two bursae
  - ✓ extends from the pronator quadratus muscle through carpal tunnel
  - ✓ terminates 1-3 cm proximal to the flexor tendon sheaths of the 2nd through 4th fingers
  - ✓ communicates with the tendon sheath of the flexor digiti minimi (FDM) in majority of cases



Aguiar ROC, Gasparetto EL, Escuissato DL, Marchiori E, Trudell DJ, Haghighi P, Resnick D.Skeletal Radiol (2006) 35:828-832

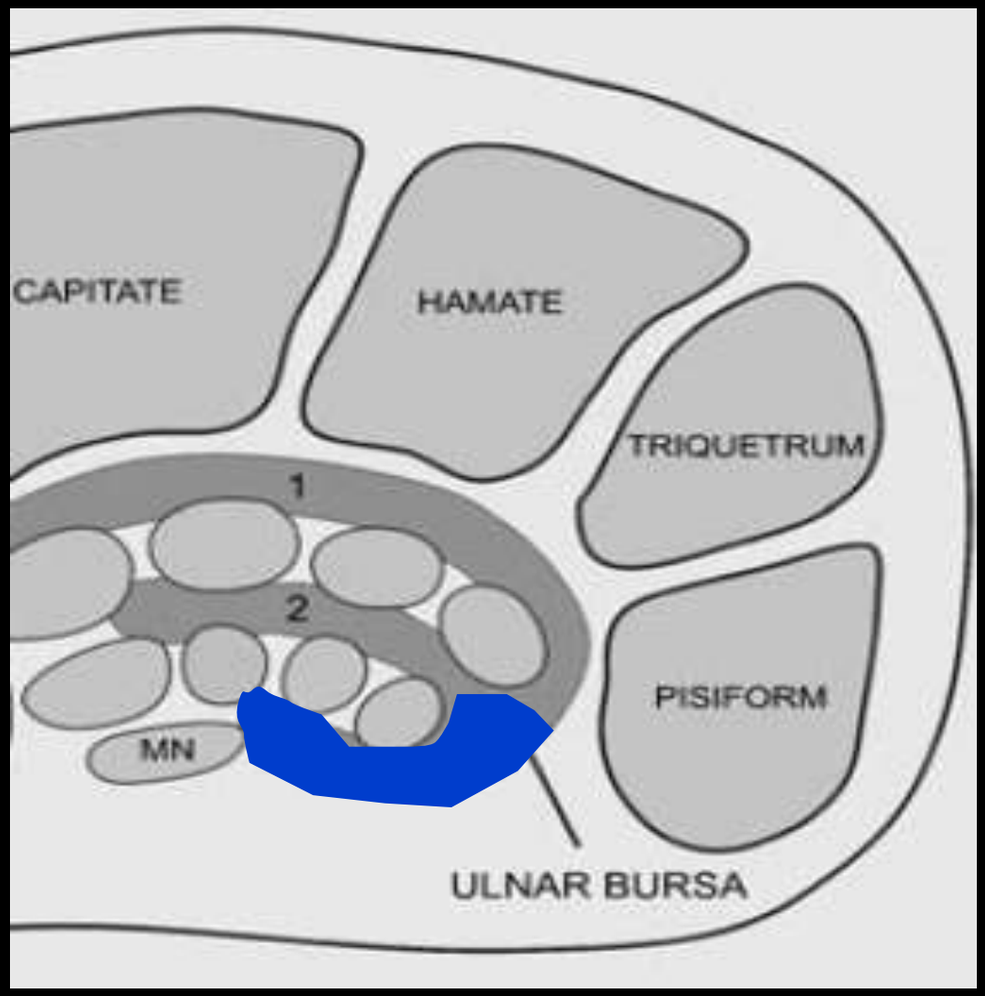
Radial and Ulnar Bursae of the Wrist

Anatomy

- composed of three invaginations that extend about the flexor tendons at the level of the carpal tunnel:

1) Superficial Extension

- ✓ situated between the transverse carpal ligament and the flexor digitorum superficialis (FDS) tendons
- ✓ smallest extension



Aguiar ROC, Gasparetto EL, Escuissato DL, Marchiori E, Trudell DJ, Haghighi P, Resnick D.Skeletal Radiol (2006) 35:828-832

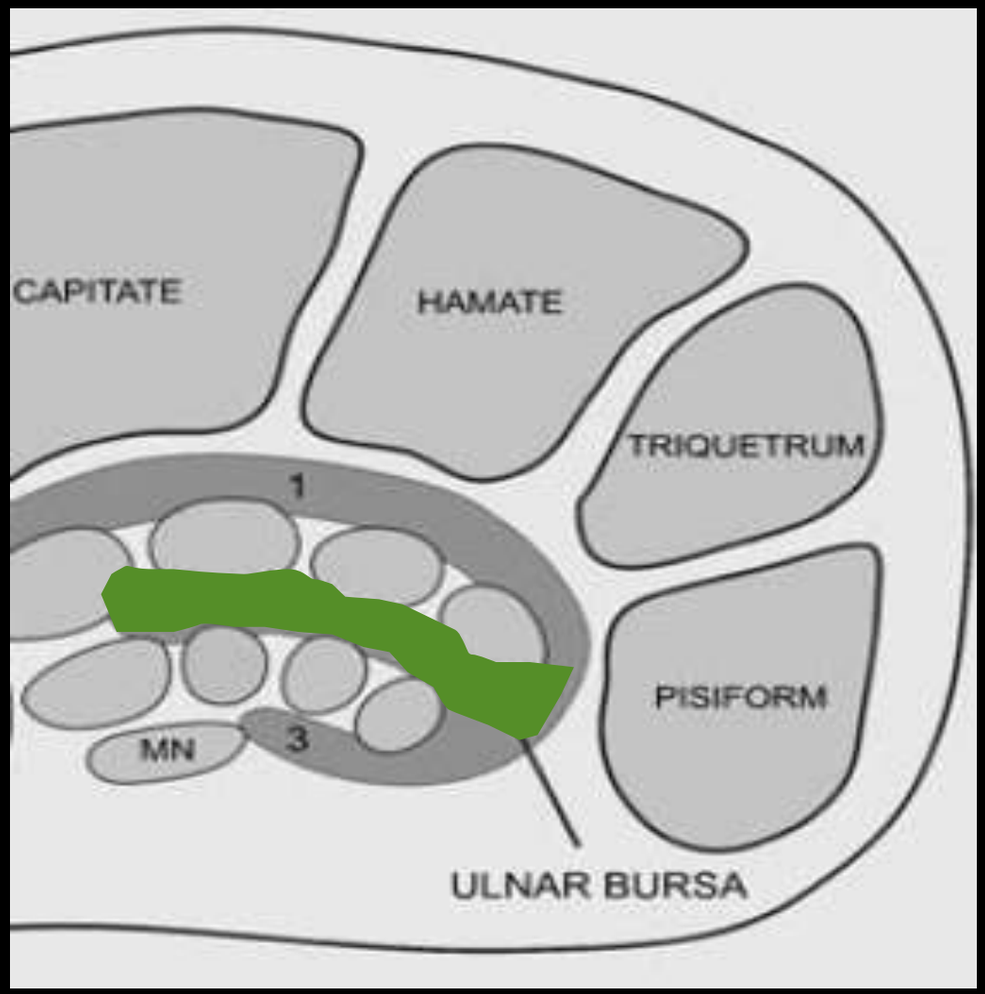
Radial and Ulnar Bursae of the Wrist

Anatomy

- composed of three invaginations that extend about the flexor tendons at the level of the carpal tunnel:

2) Middle Extension

✓ located between the FDS tendons and the flexor digitorum profundus (FDP) tendons



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Radial and Ulnar Bursae of the Wrist

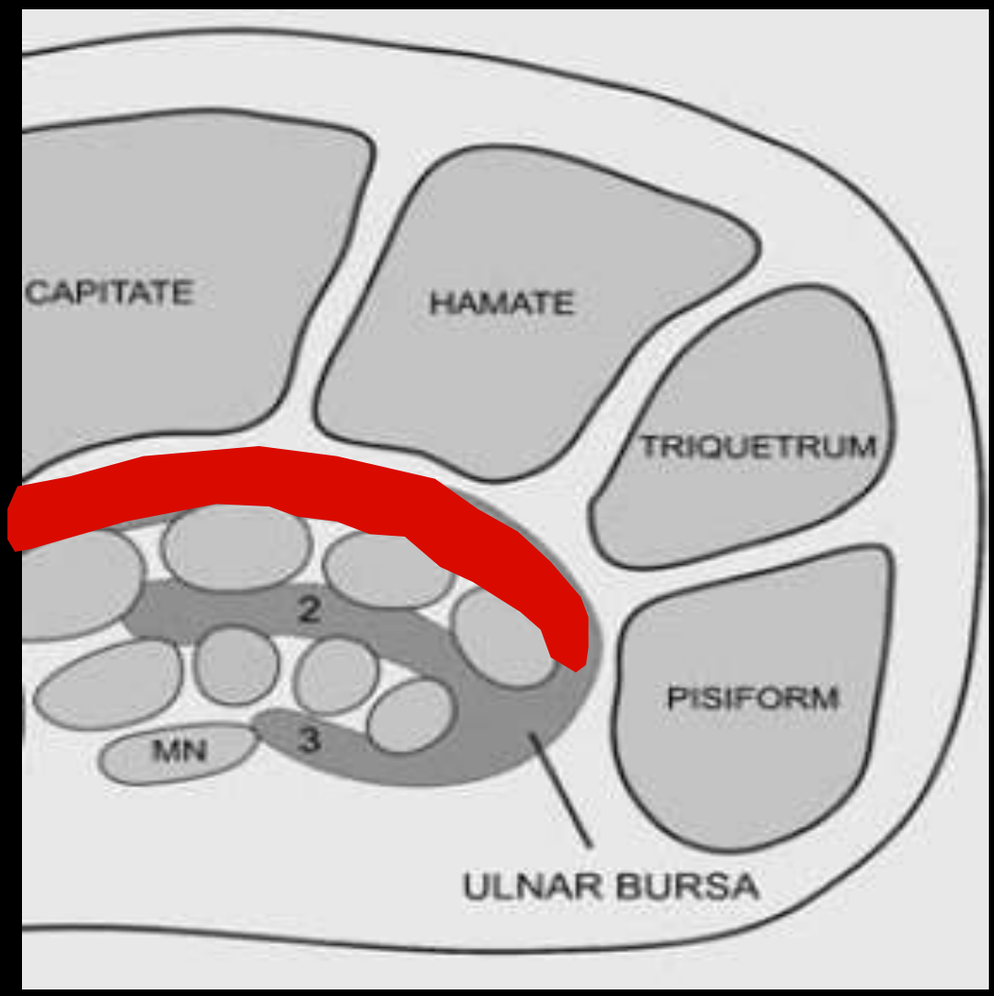
Anatomy

- composed of three invaginations that extend about the flexor tendons at the level of the carpal tunnel:

3) Deep Extension

✓ dorsal to the FDP tendons

✓ largest extension

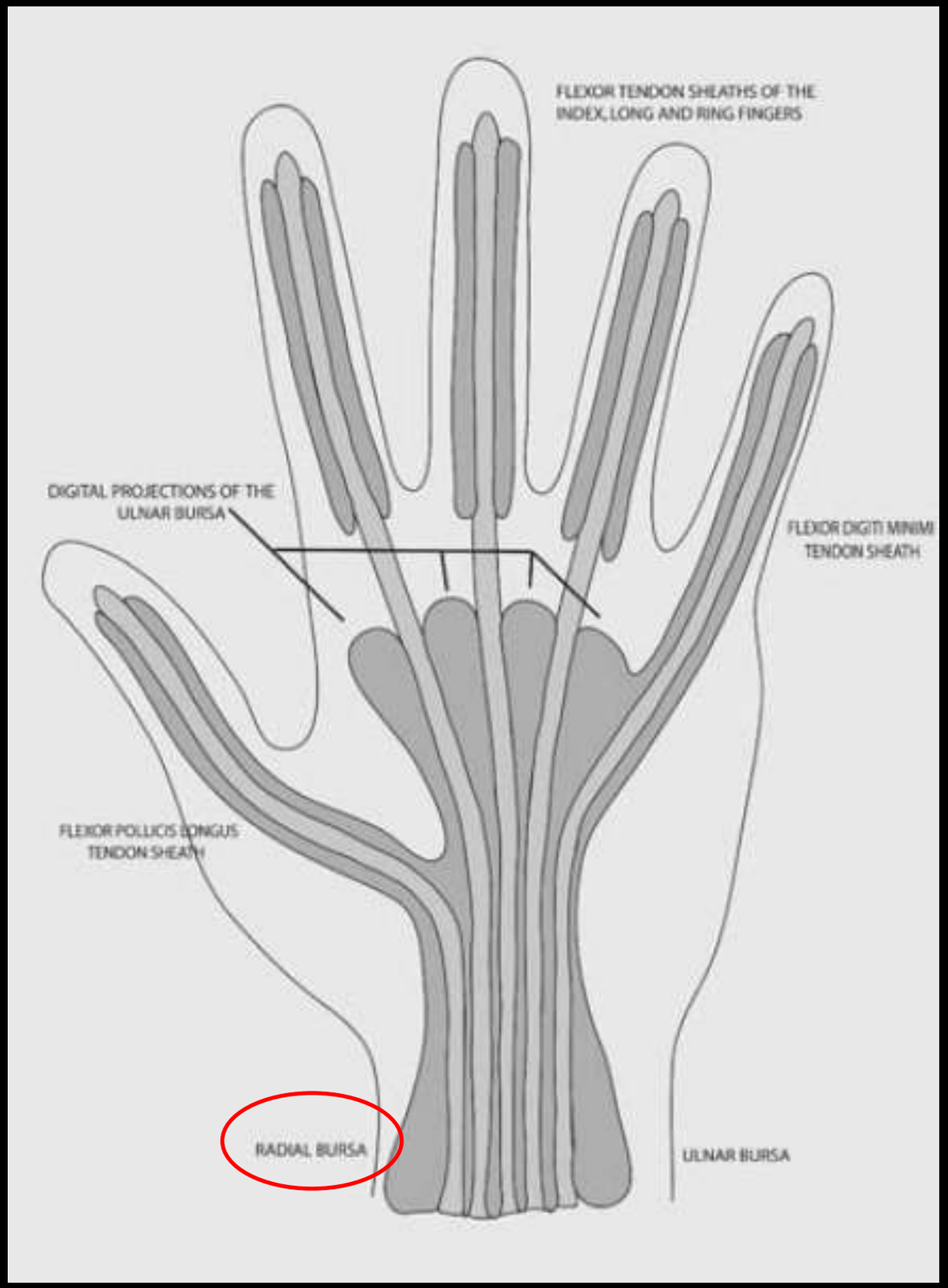


Aguiar ROC, Gasparetto EL, Escuissato DL, Marchiori E, Trudell DJ, Haghighi P, Resnick D.Skeletal Radiol (2006) 35:828-832

Radial and Ulnar Bursae of the Wrist

Anatomy

- Radial Bursa:
  - ✓ begins at the level of the pronator quadratus muscle
  - ✓ extends along the radial aspect of the wrist through the carpal tunnel
  - ✓ typically communicates with the tendon sheath of the flexor pollicis longus (FPL)

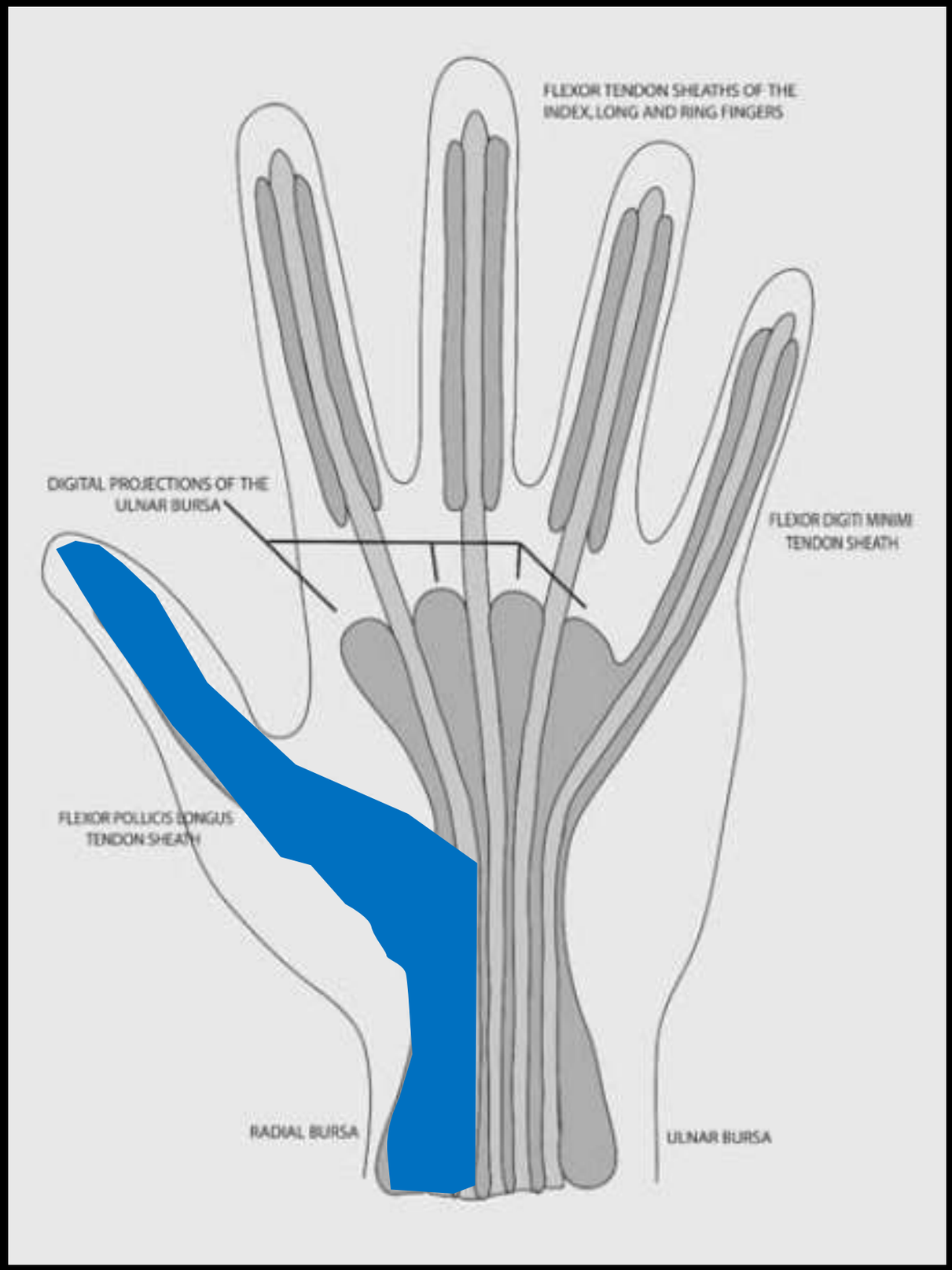


Aguiar ROC, Gasparetto EL, Escuissato DL, Marchiori E, Trudell DJ, Haghighi P, Resnick D.Skeletal Radiol (2006) 35:828-832

Radial and Ulnar Bursae of the Wrist

Anatomy

- Typical Communications:
  - ✓ radial bursa and the flexor pollicis longus (FPL) tendon sheath



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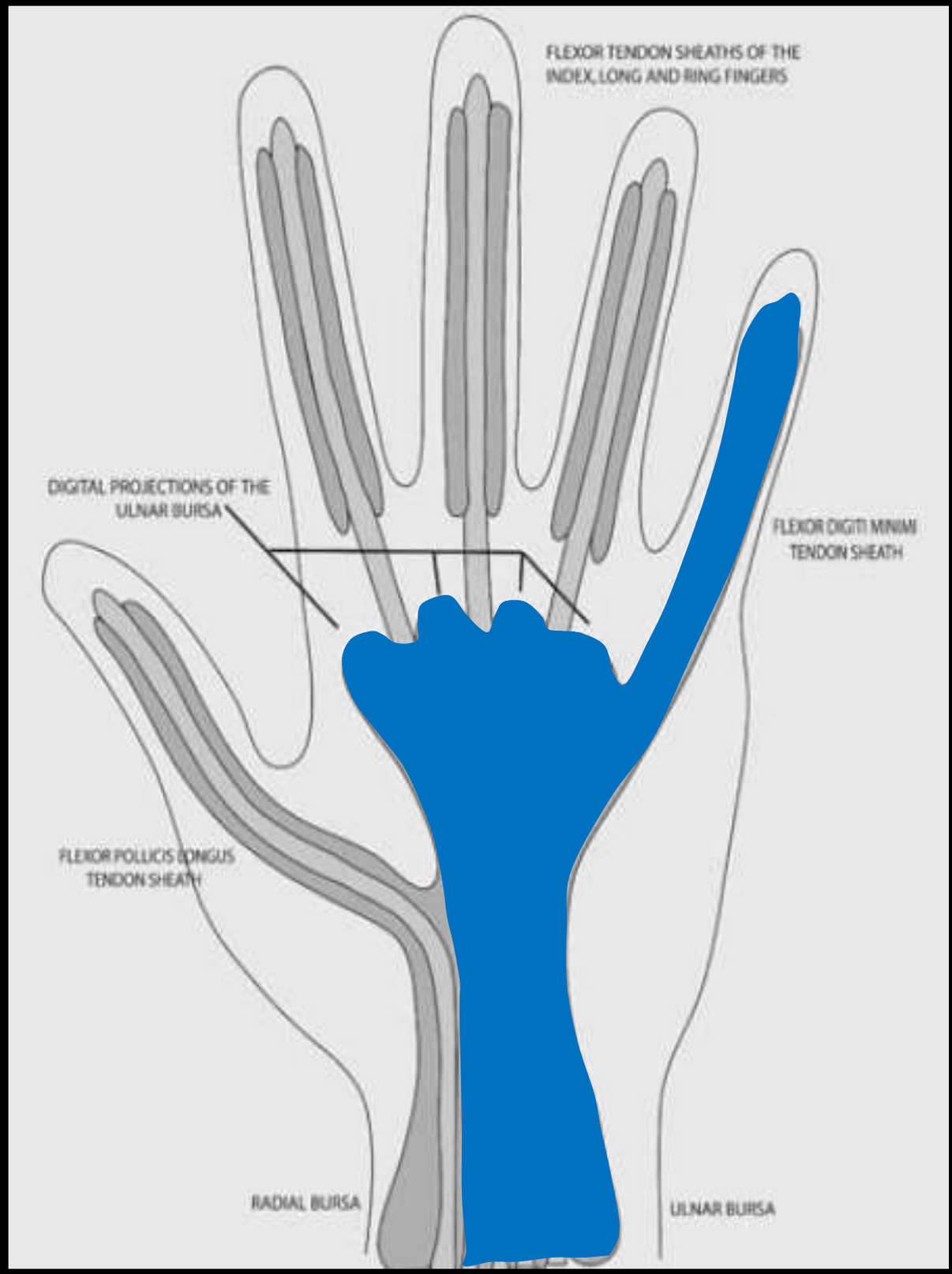
Radial and Ulnar Bursae of the Wrist

Anatomy

- Common communications (50-85%):
  - ✓ ulnar bursa and the FDM tendon sheath



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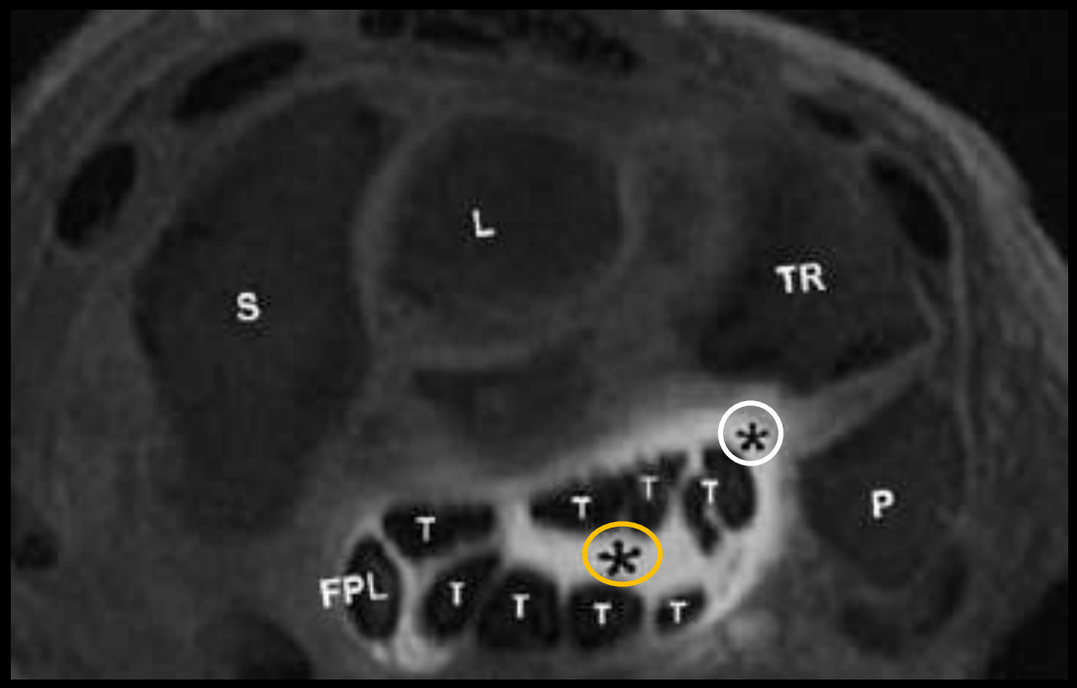
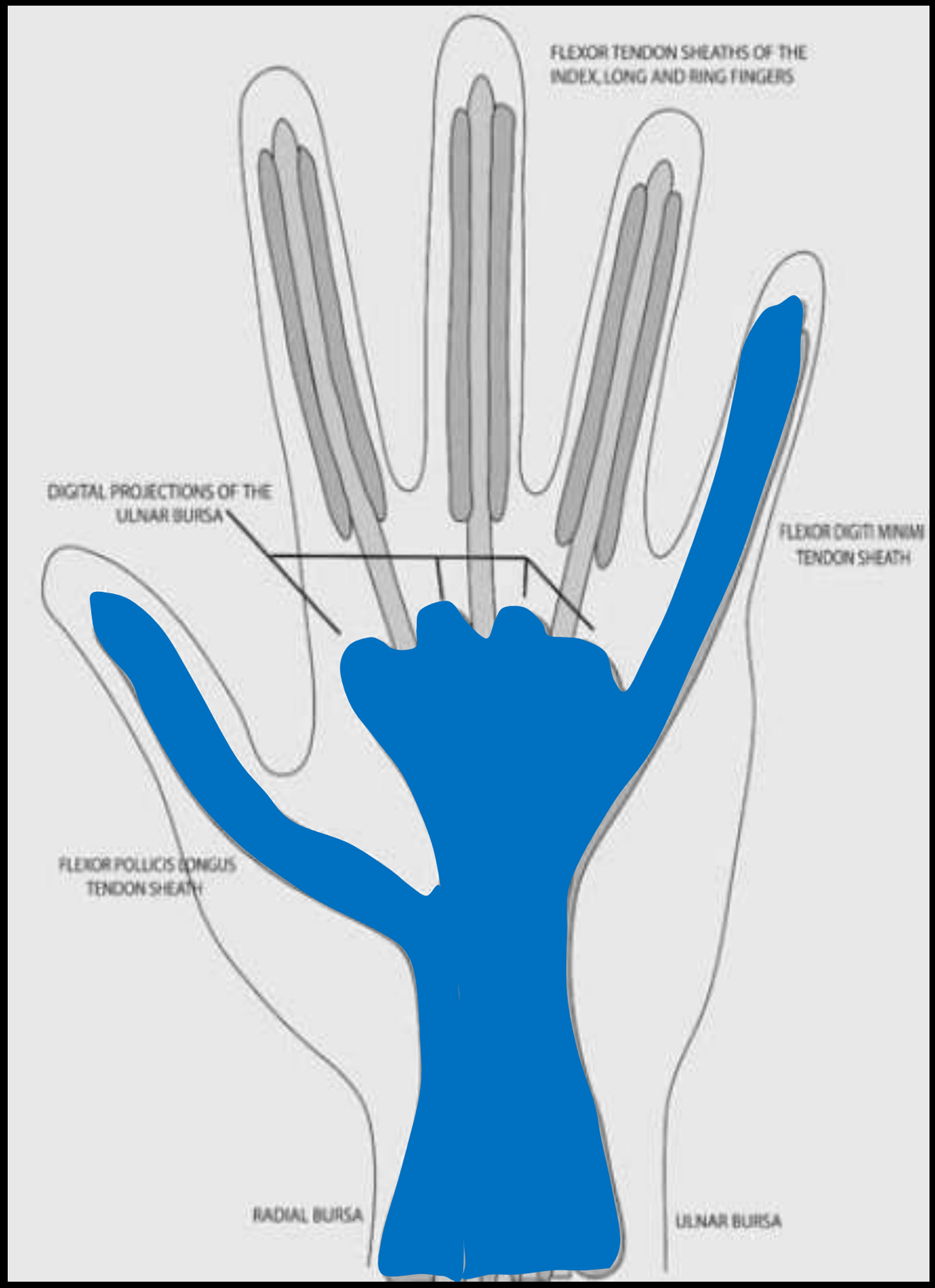
Radial and Ulnar Bursae of the Wrist

Anatomy

- Common communications (50-85%):
  - ✓ Intermediate bursa:
    - communication between radial and ulnar bursae
      - ✓ through the deep layer of the ulnar bursa
      - ✓ between FDS and FDP of the 2nd fingers



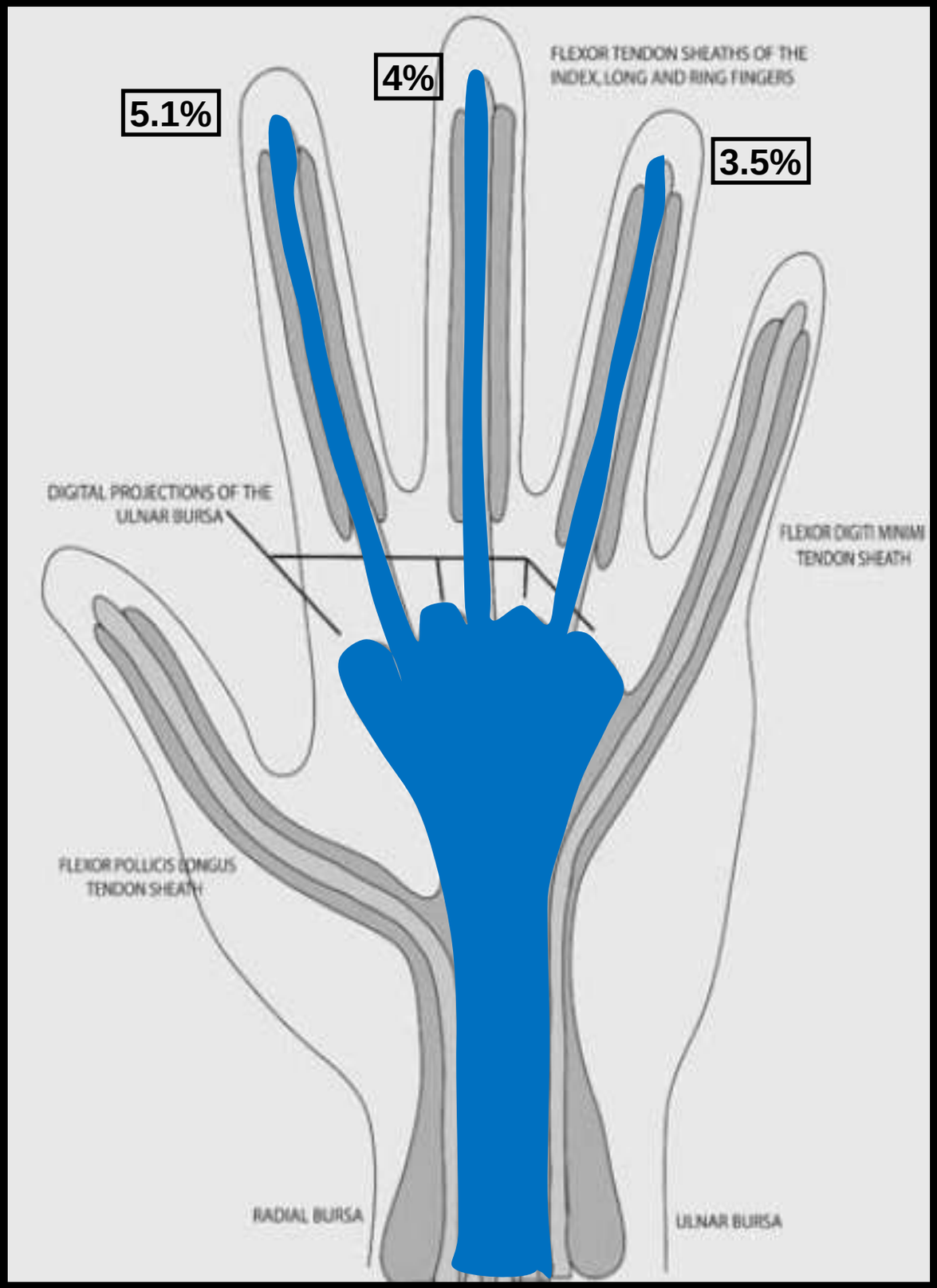


Aguiar ROC, Gasparetto EL, Escuissato DL, Marchiori E, Trudell DJ, Haghighi P, Resnick D.Skeletal Radiol (2006) 35:828-832

Radial and Ulnar Bursae of the Wrist

Anatomy

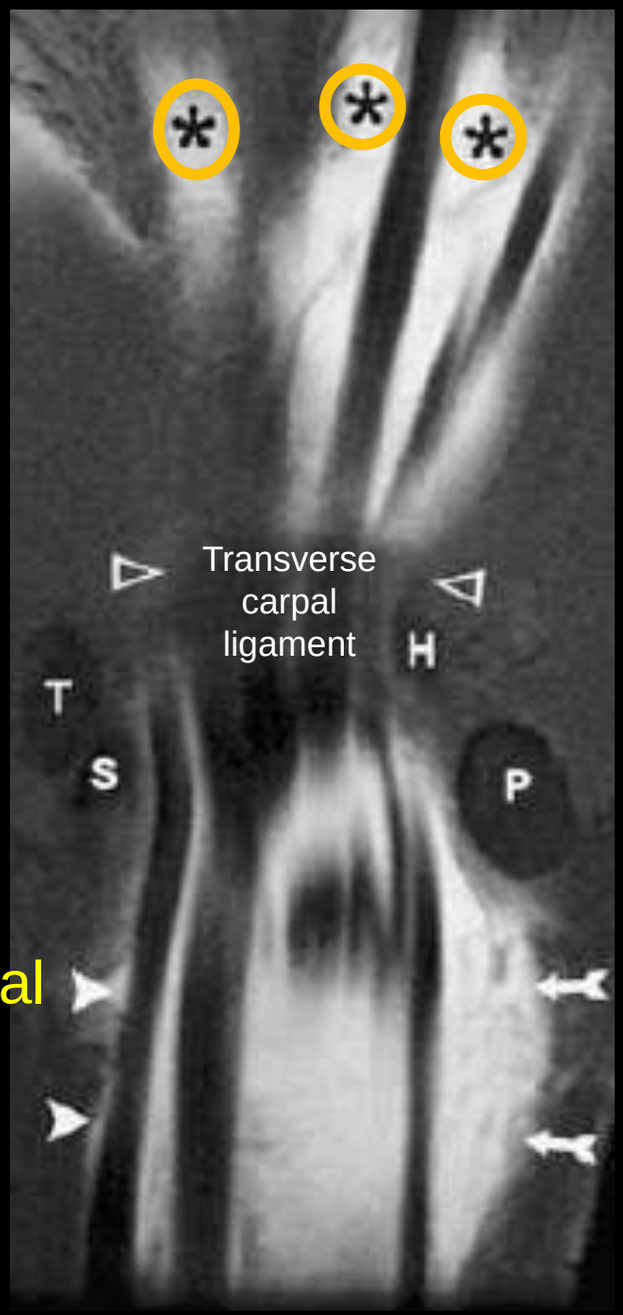
- Possible communications:
  - ✓ ulnar bursa and tendon sheaths of:
    - 2nd finger
    - 3rd finger
    - 4th finger



Aguiar ROC, Gasparetto EL, Escuissato DL, Marchiori E, Trudell DJ, Haghighi P, Resnick D.Skeletal Radiol (2006) 35:828-832

Radial and Ulnar Bursae of the Wrist

Typical Figure of Eight or Hourglass Configuration
of the Radial and Ulnar Bursae



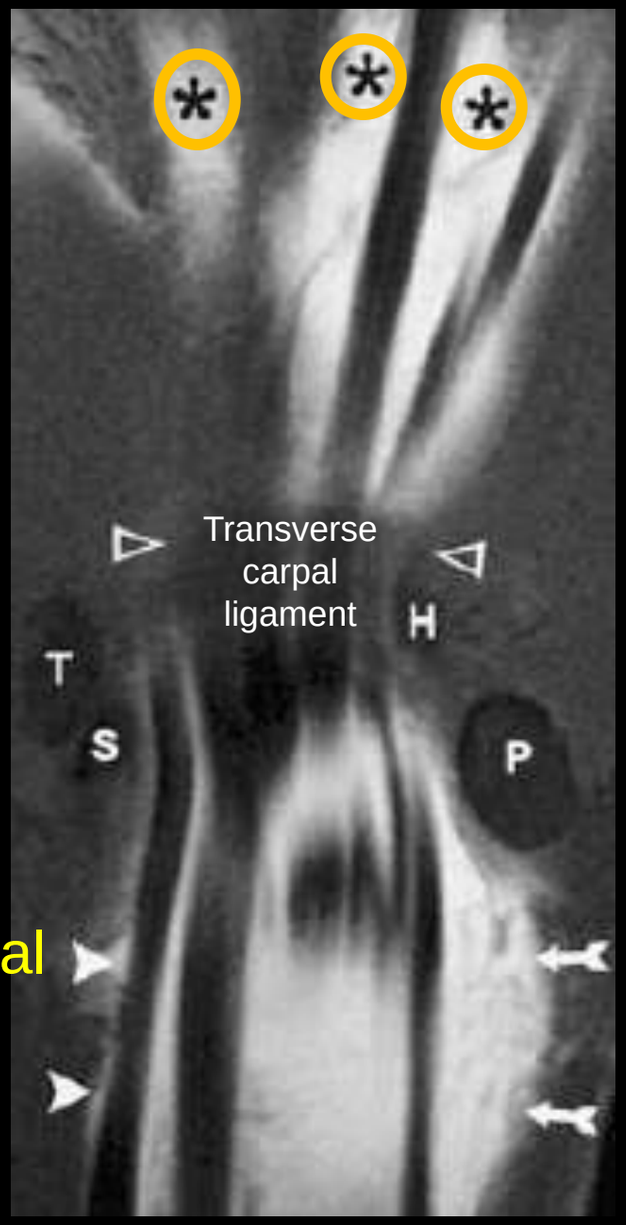
Radial

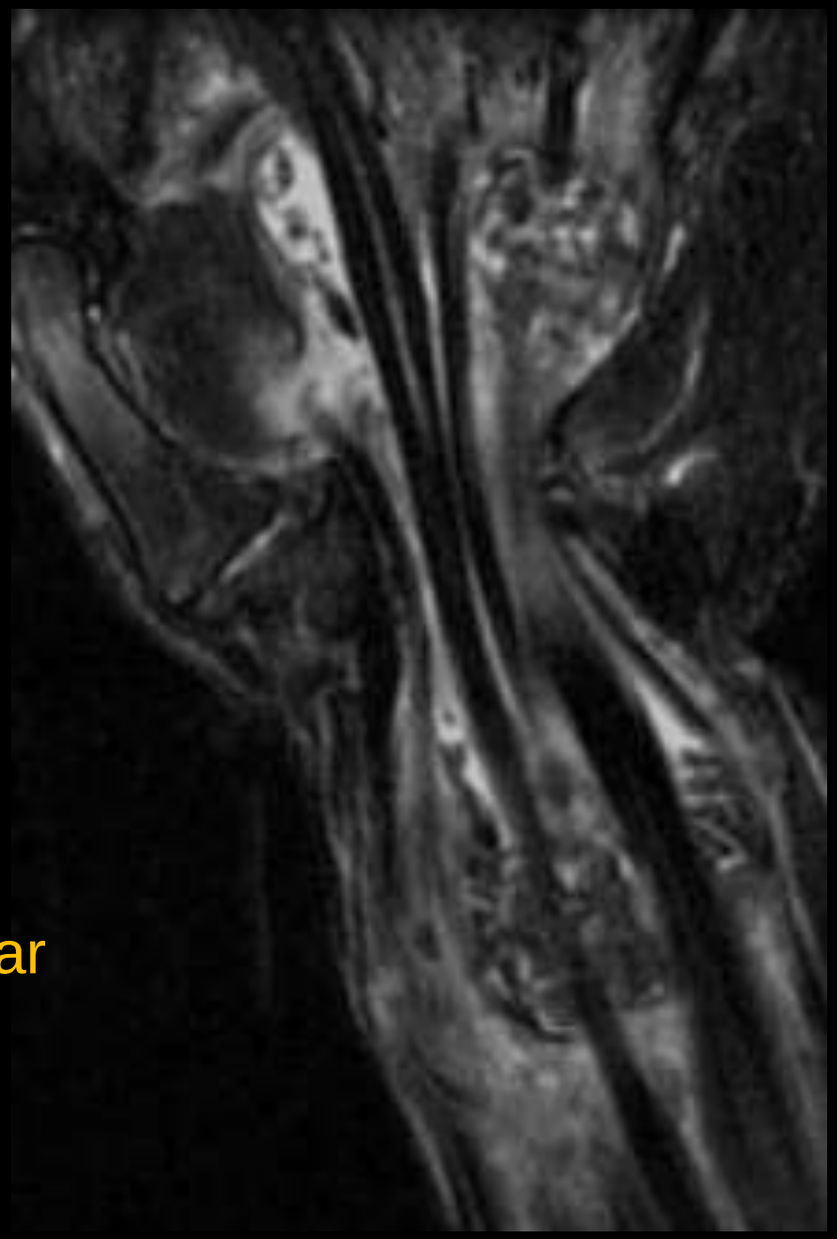
Ulnar

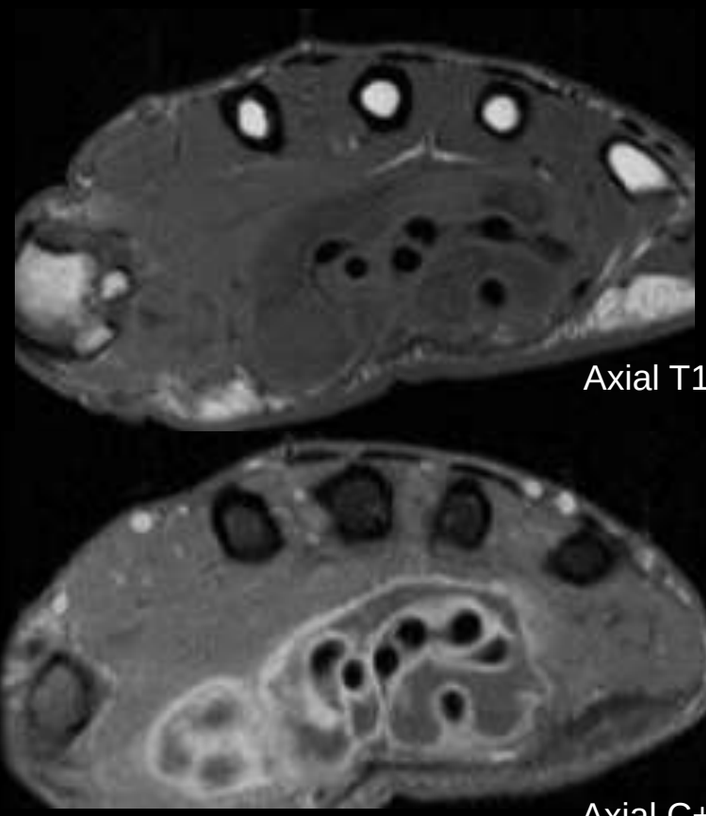
Aguiar ROC, Gasparetto EL, Escuissato DL, Marchiori E, Trudell DJ, Haghighi P, Resnick D.Skeletal Radiol (2006) 35:828-832

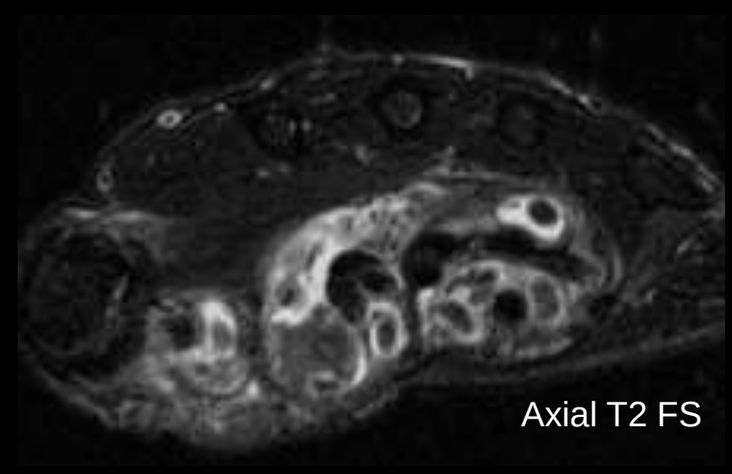
Radial and Ulnar Bursae of the Wrist

Horseshoe Abscess









Radial and Ulnar Bursae of the Wrist

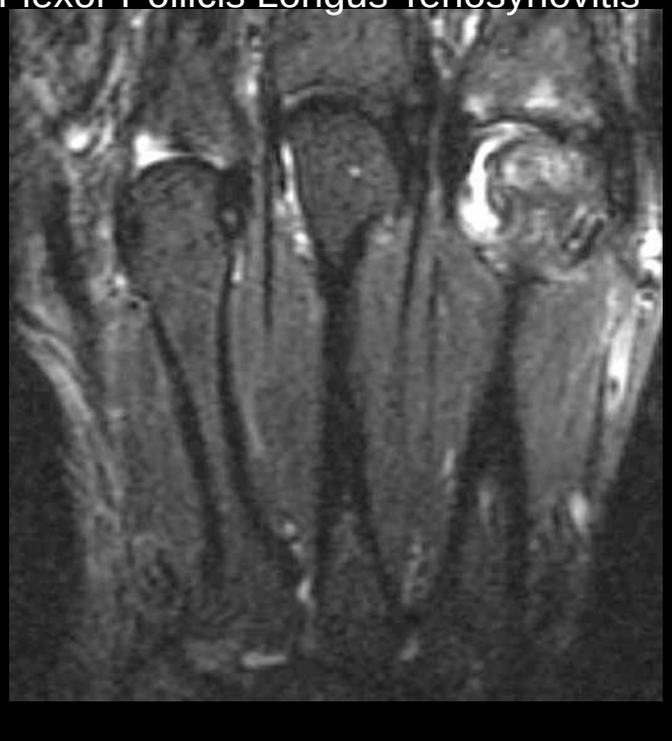
Bursitis

- inflammation of the lining of the radial and ulnar bursae

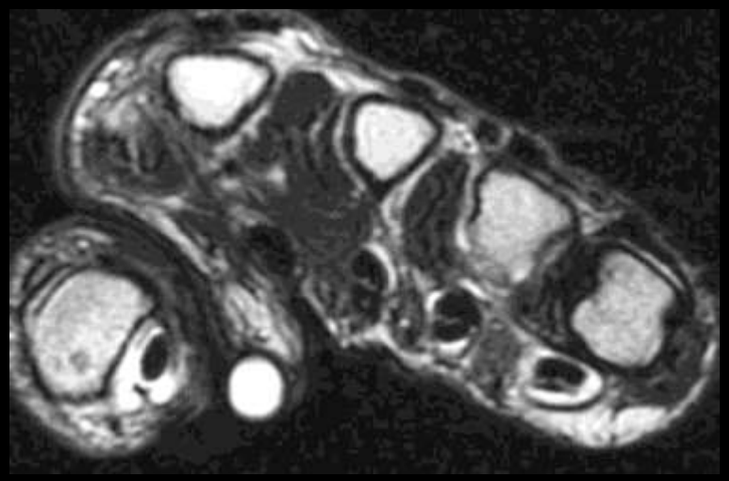
Causes:

- ✓chronic frictional trauma or overuse
- ✓ infection (bacterial/mycobacterial/fungal)
- ✓ inflammatory arthropathies (rheumatoid or seronegative arthritis)
- ✓ sarcoidosis - rare

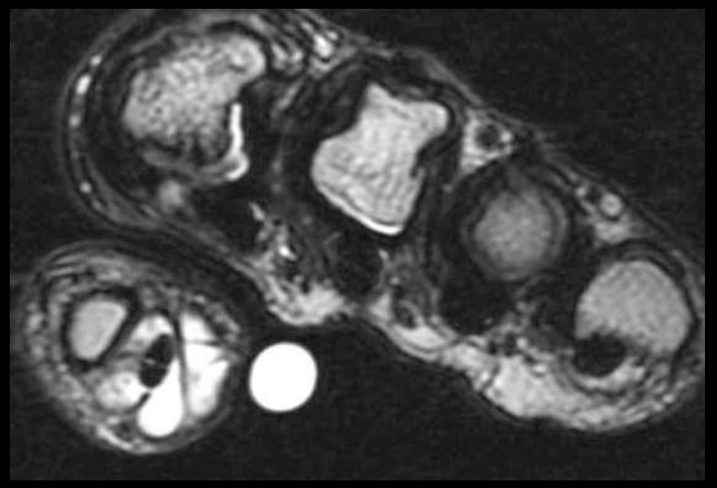
Radial and Ulnar Bursitis
Flexor Pollicis Longus Tenosynovitis



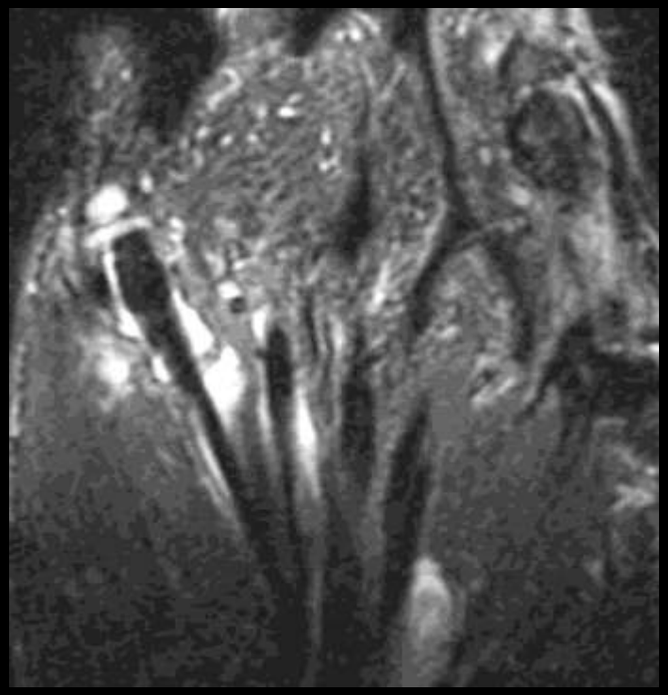
Coronal T2 FS



Axial T2



Axial T2



Thank you Mini

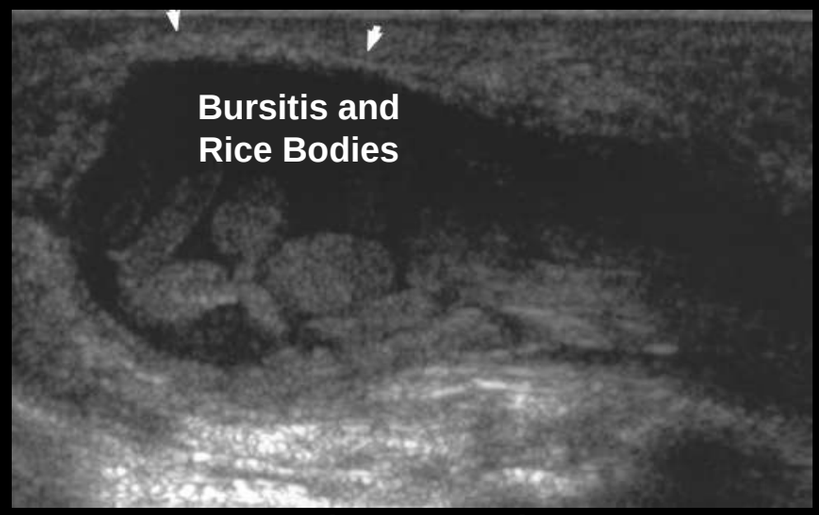
Radial and Ulnar Bursae of the Wrist

Bursitis and rice bodies

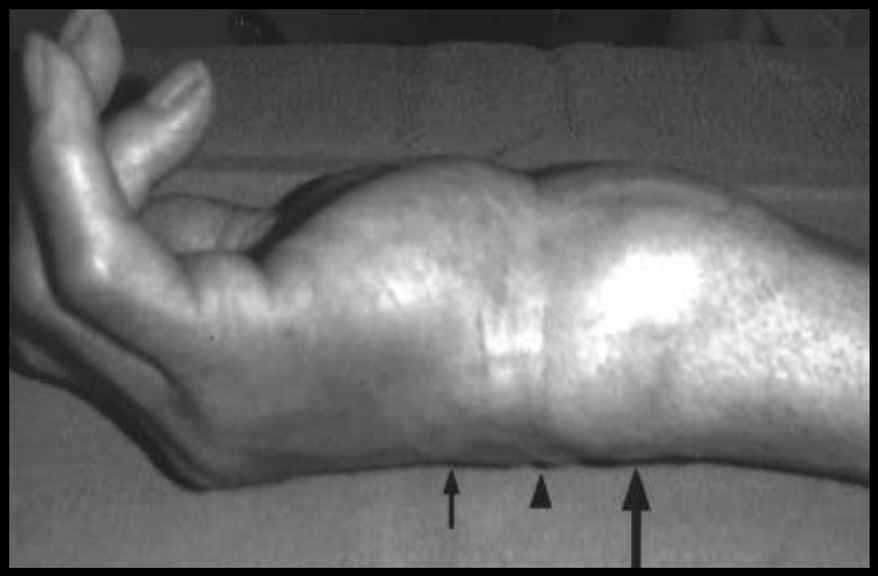
Causes:

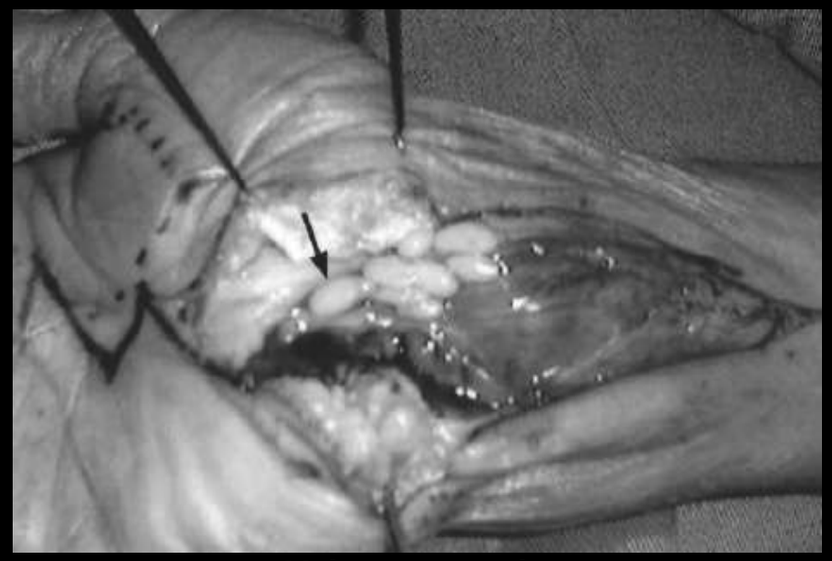
- ✓ infection (tuberculosis, atypical mycobacterial, and fungal)
- ✓ inflammatory arthropathies (rheumatoid arthritis)
- ✓ sarcoidosis - rare

Atypical Mycobacterial
Radial and Ulnar Bursitis



Volar approach





Volar approach

Chau CLF et al. AJR; 2003 (180): 1455-1459

Conclusion

- Ulnar sided wrist pain is a common complaint
- Reviewed many conditions that may contribute to ulnar sided wrist pain
- A surface coil improves imaging quality and the detection of pathology
- Familiarity with clinical findings and pertinent anatomy considerably aids in making accurate diagnoses

Thank you

Happy April fools' day

Practical Joke regarding Copenhagen's new metro system

The little guy is not buying it.

Wikipedia. April Fool's Day. http://en.wikipedia.org/wiki/April_Fools'_Day

References (other)

1) Resnick D et al. Internal Derangements of Joints, 2nd Ed. 2007. Elsevier Inc.

2) Vezeridis PS et al. Ulnar-sided wrist pain. Part I: Anatomy and physical examination. Skeletal Radiol; September 2009

3) Watanabe A et al. Ulnar-sided wrist pain. Part II: Clinical imaging and treatment. Skeletal Radiol; December 2009

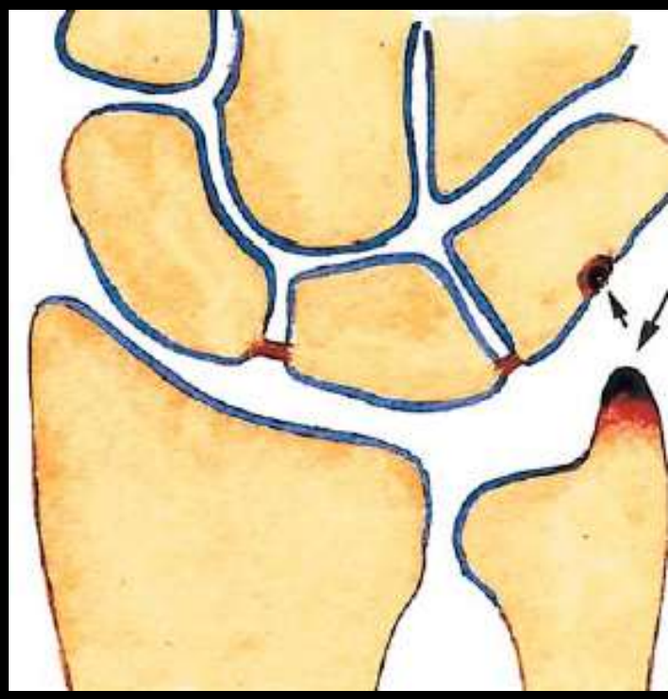
4) Stoller, David W. Magnetic Resonance Imaging in Orthopaedics and Sports Medicine, 3rd Edition Copyright ©2007 Lippincott Williams & Wilkins.

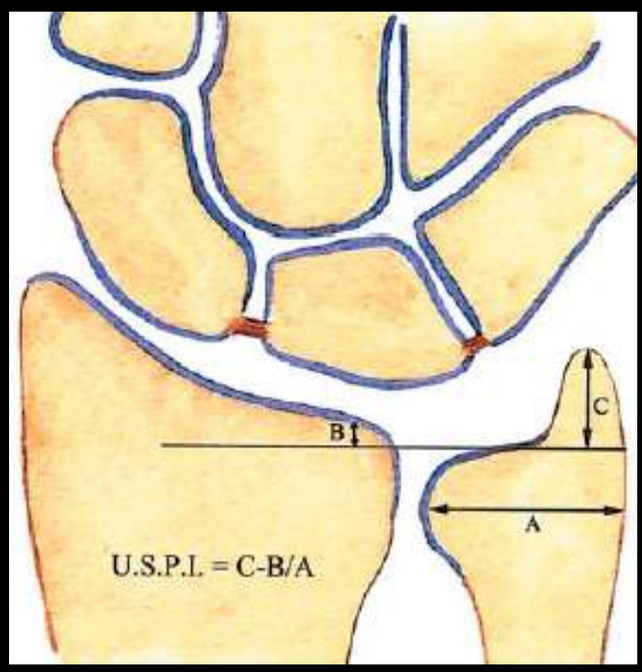
Imaging of Ulnar Sided Wrist Pain

Federico Discepola
April 1st 2010

Ulnar Impaction Syndromes

B) Ulnar Styloid Impaction Syndrome





Radiographic Findings:

- Long, volar or radial curved styloid process or a non united ulnar styloid process fracture

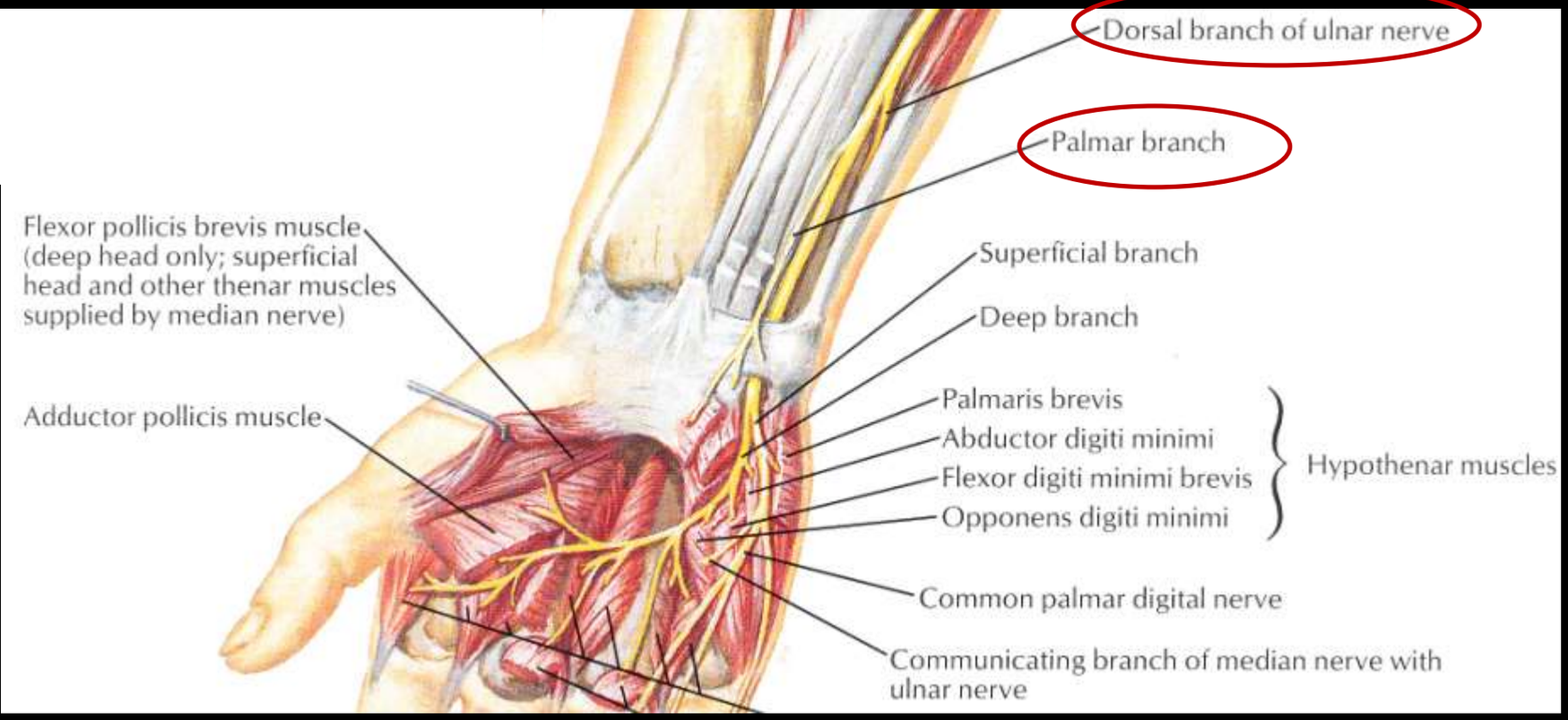
- Long ulnar styloid process
- > 6 mm or
- ulnar styloid process index (USPI) over 0.22 (styloid length – ulnar variance/ width of ulnar head)

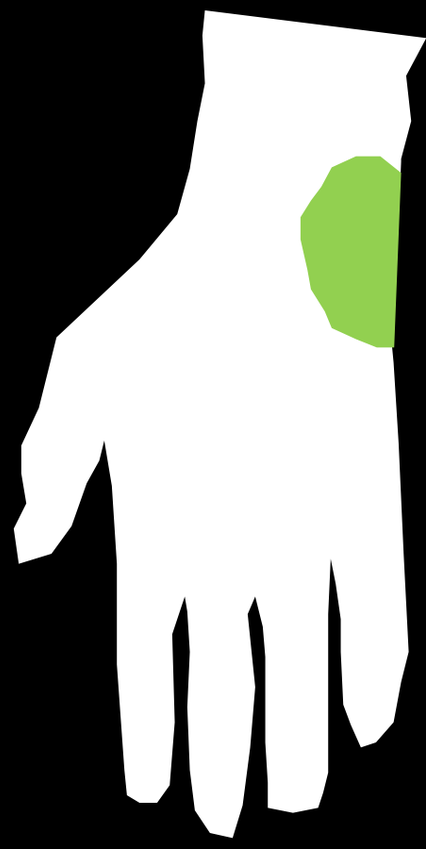
- Subchondral cystic changes in the proximal triquetrum and lunotriquetral joint osteoarthrosis

- Acute impaction can fracture the dorsal aspect of the triquetrum

Ulnar Nerve

Anatomy – Sensory Distribution Proximal To Guyon's Canal





Palmar Cutaneous Branch

Dorsal Cutaneous Branch

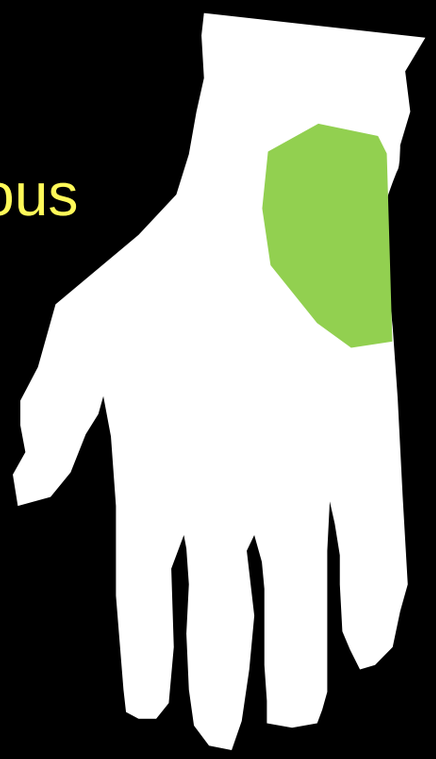
- Proximal to Guyon's canal, the ulnar nerve supplies:
  - the skin overlying the dorsal/palmar and ulnar aspects of the hand via dorsal and palmar cutaneous branches
  - loss of sensation in these regions points to a lesion proximal to the wrist and is different from the sensory deficit noted in Guyon's canal syndrome

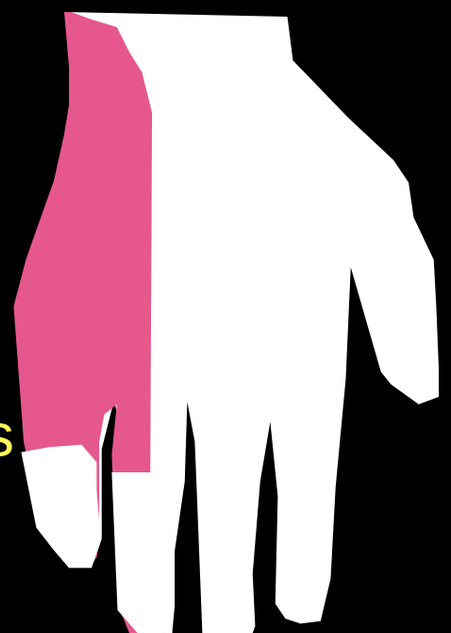
Netter Anatomy

Sensory Distribution of the Ulnar Nerve

Ulnar nerve abnormality proximal to Guyon's canal

Palmar Cutaneous Branch



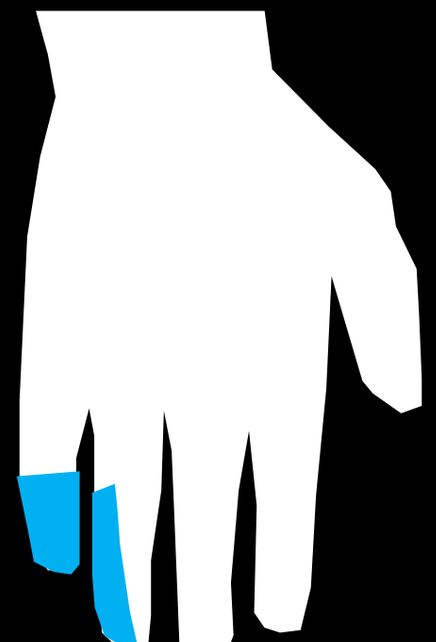


Dorsal Cutaneous Branch

Ulnar nerve abnormality within Guyon's canal

Superficial Sensory Branch

Guyon's Canal Syndrome



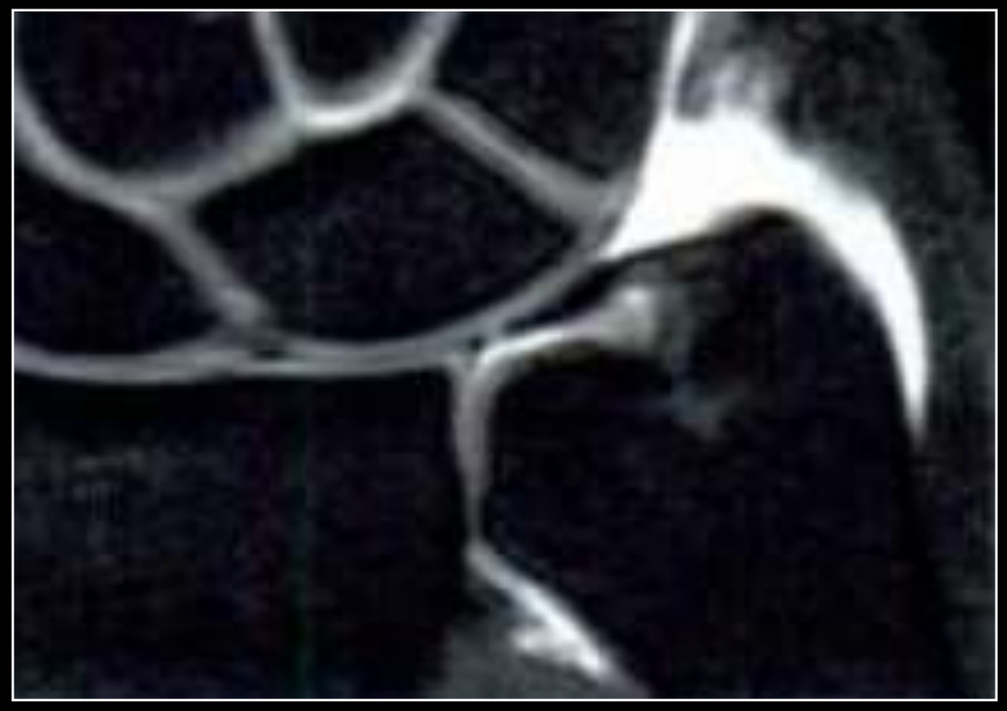
Superficial Sensory Branch

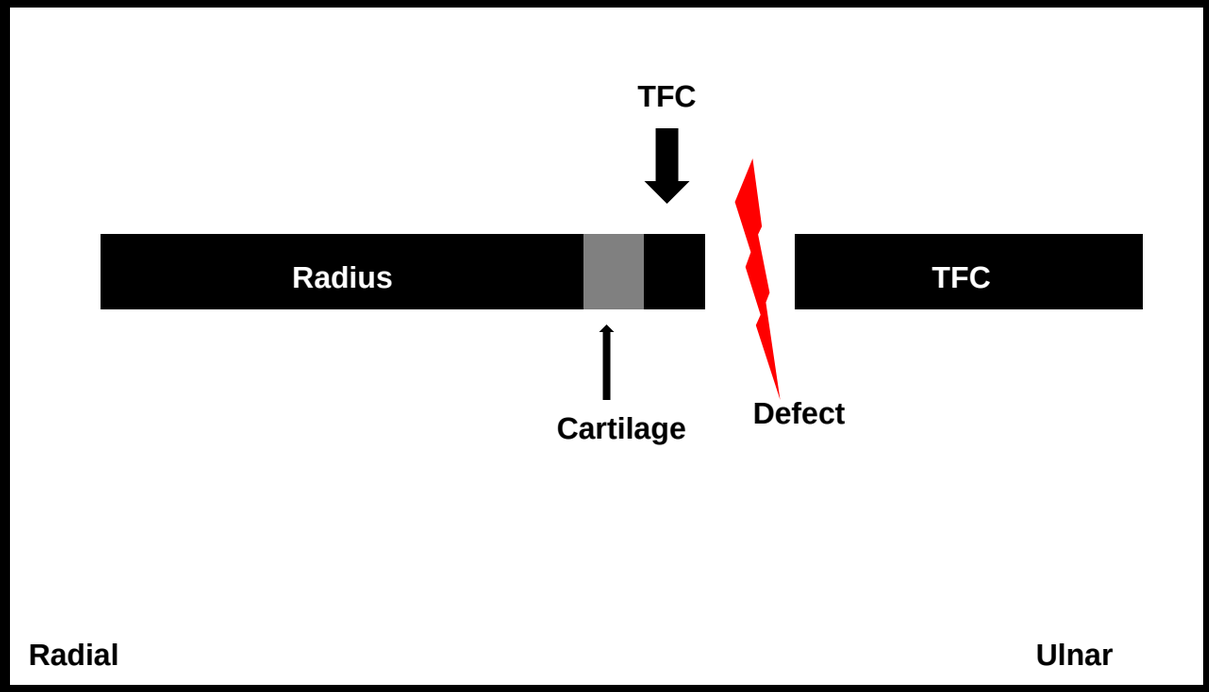
Triangular Fibrocartilage Complex (TFCC)

MR Imaging – Palmer Classification of Traumatic TFCC Injuries

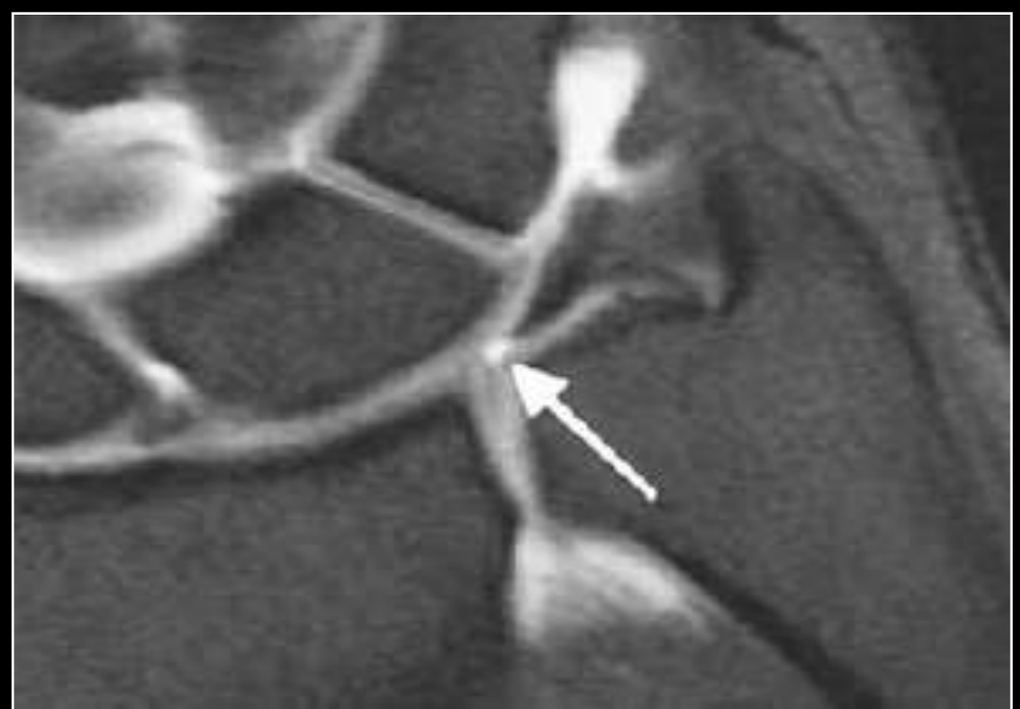
Palmer class 1A vs 1D

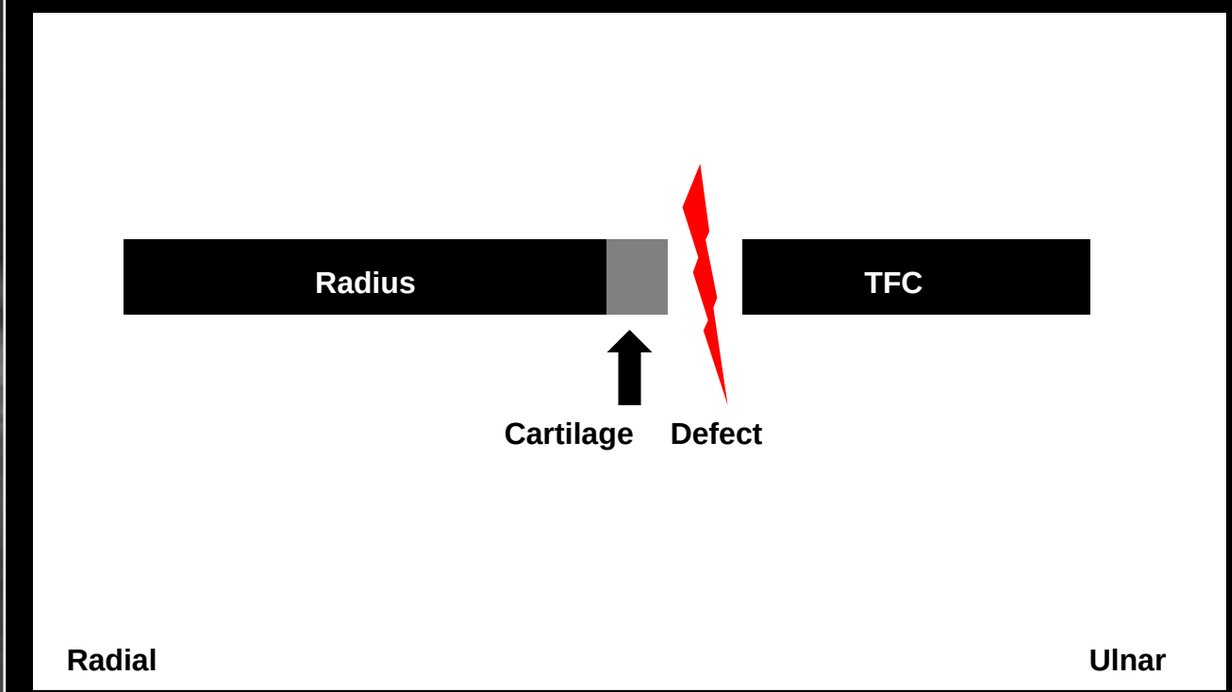
1A





1D





Triangular Fibrocartilage Complex (TFCC)

Anatomy

Ulnomeniscal Homologue (UMH) Variants of the Styloid Component – Wrist Position

Narrow-opening of the pre-styloid recess

Radial Deviation

Wide-opening of the pre-styloid recess

Radial Deviation

No opening of the pre-styloid recess

Ulnar deviation

Extensor Carpi Ulnaris (ECU)

ECU Tendon Erosion of the Floor of the Sixth Extensor Compartment

- repetitive wrist movements in golf and tennis players

Cause:

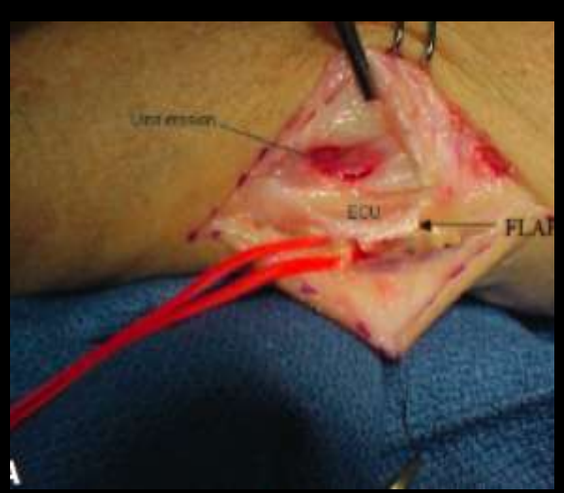
- ✓disruption of soft tissue which connects the ulnar styloid process to the antebrachial fascia

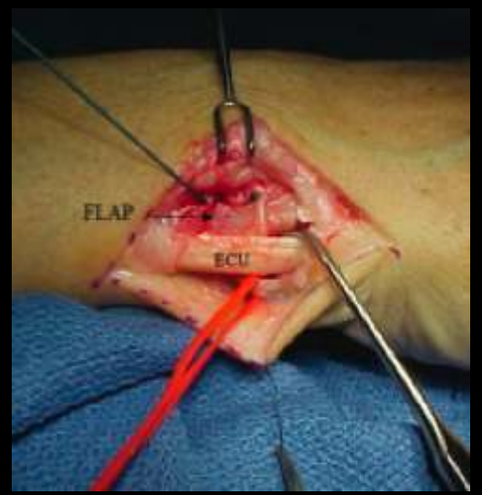
Complication:

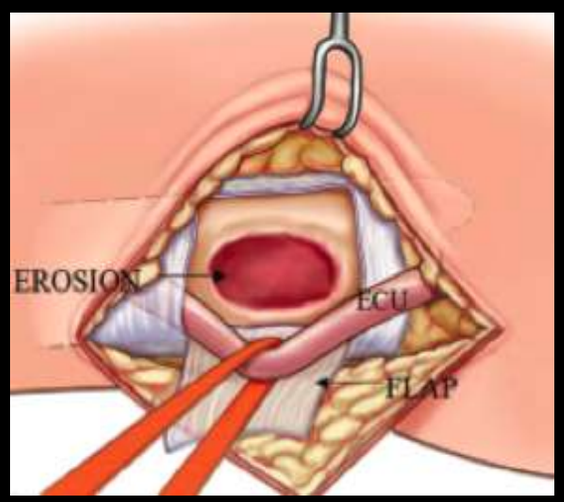
- ✓ECU tendon instability
- ✓mechanical erosion of the ulna

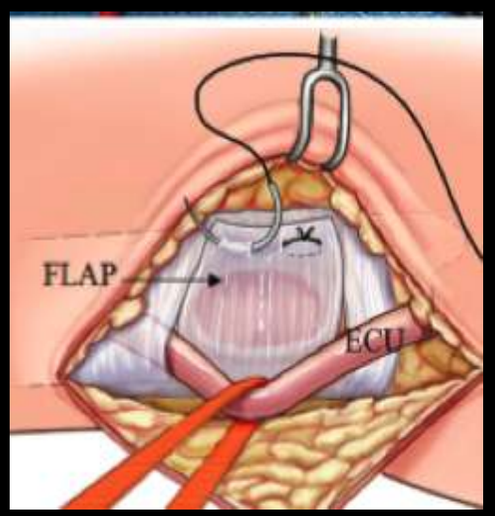
Treatment

- ✓ flap of the extensor retinaculum used to cover osseous defect in the ulna









Carneiro RS et al. Am J Sports M; 2005: 33:1910

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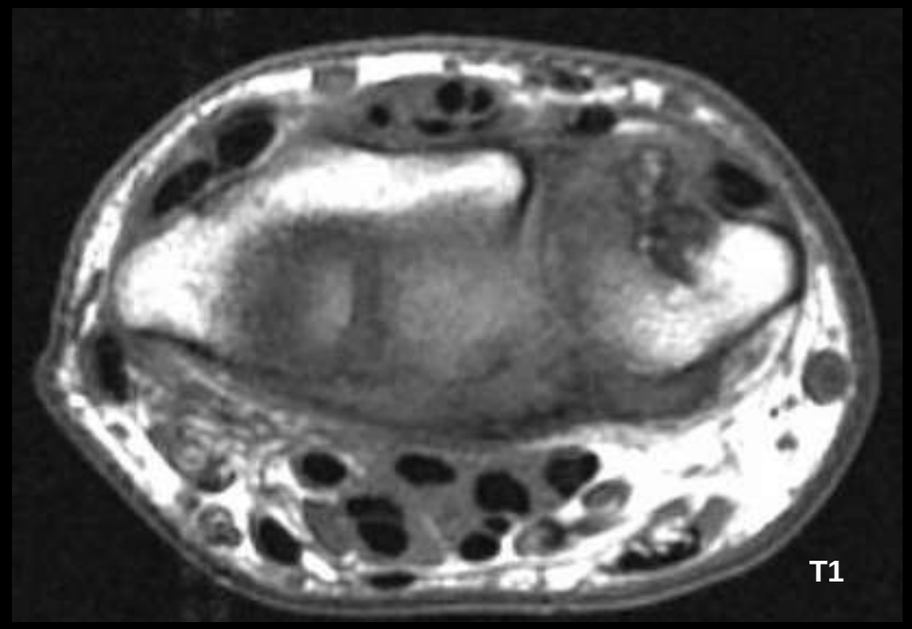

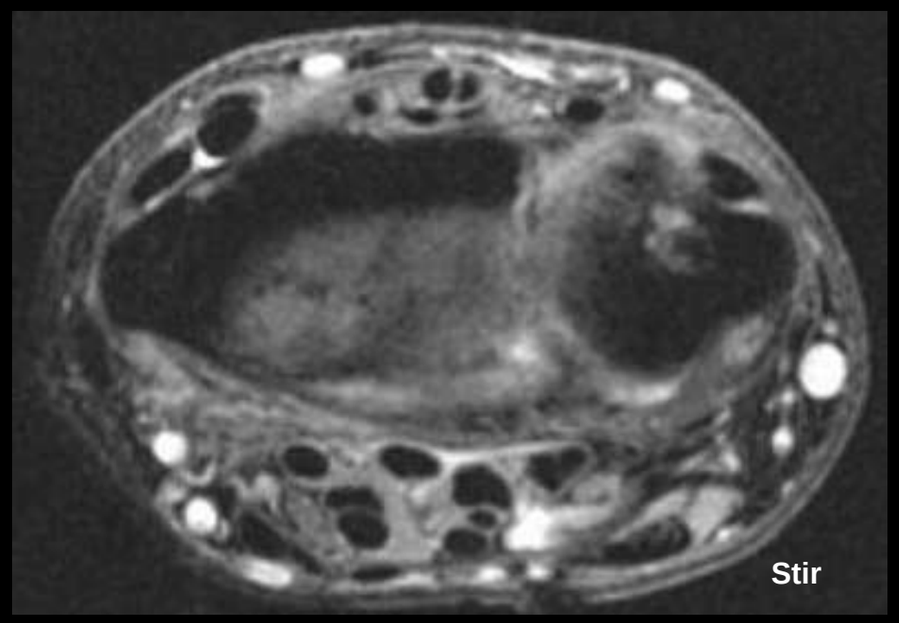

Thank you Mini

Carneiro RS et al. Am J Sports M; 2005: 33:1910