

Wrist/Hand MR II: Bones and Tendons

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Disclosures:

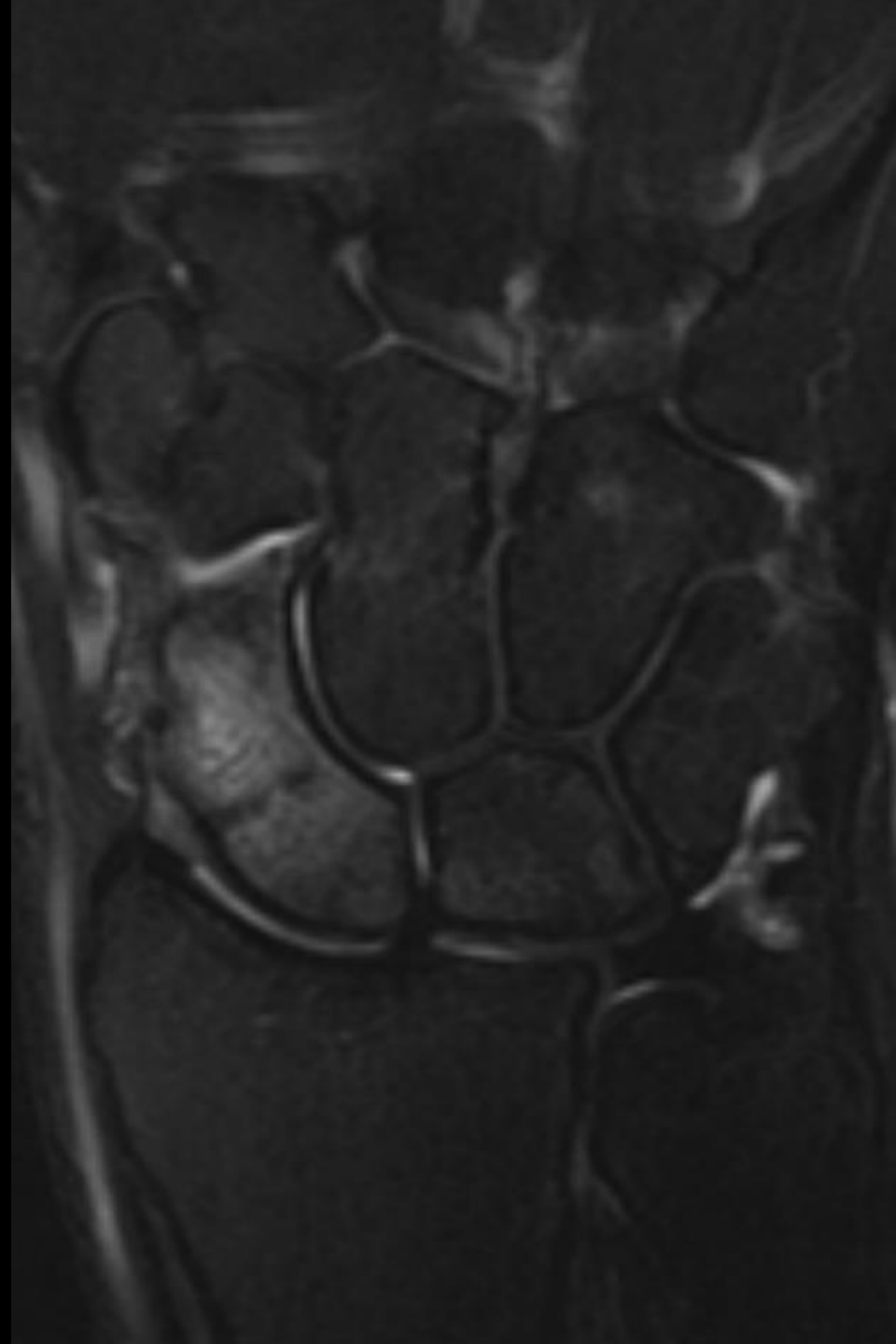
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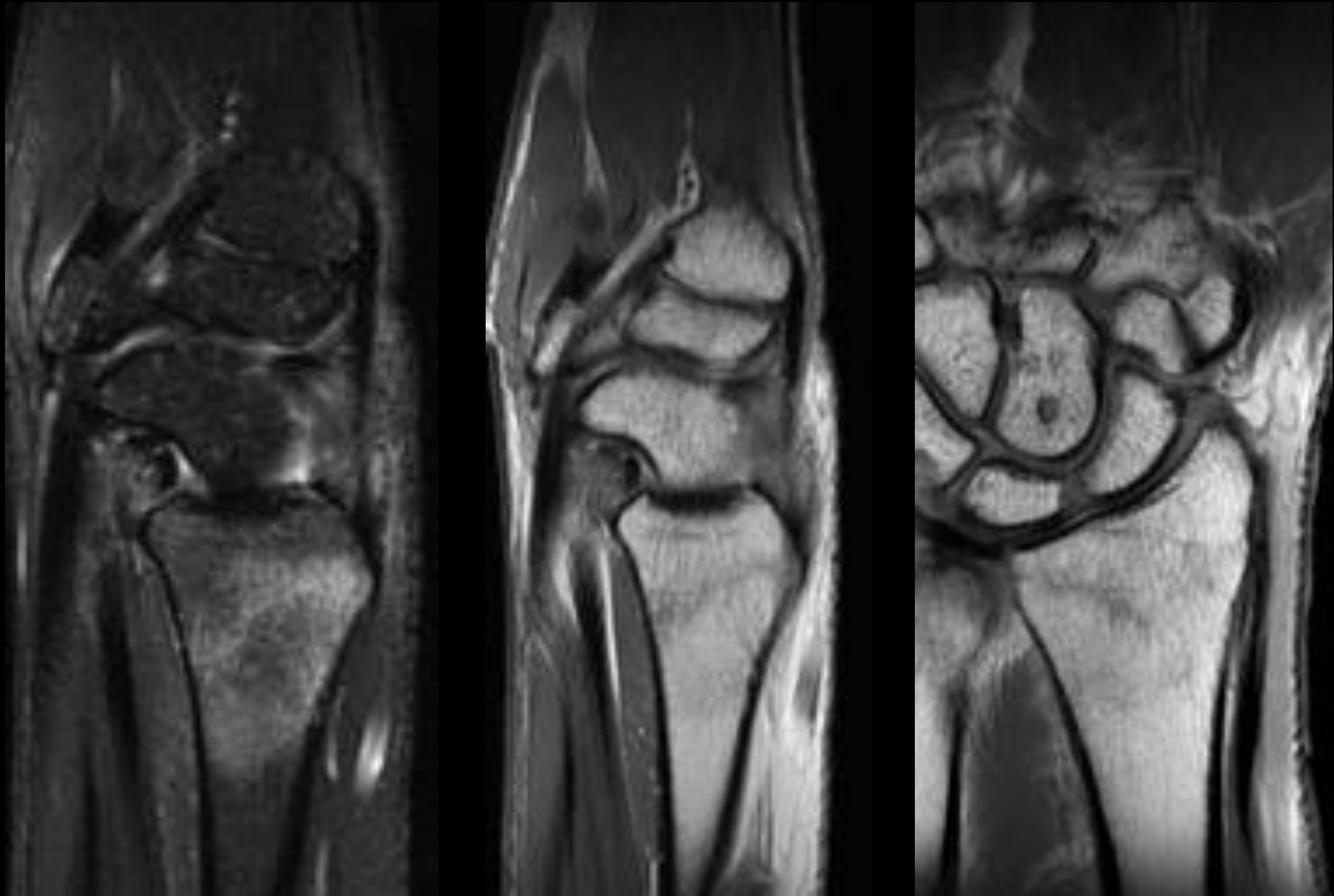
Outline

- Bones
 - Occult fractures
 - Avascular necrosis
 - Scaphoid, Lunate
 - Hamatolunate impaction
- Wrist tendons
 - ECU, De Quervain's, intersection syndrome
- Finger tendons
 - Tendon tears, pulley injuries

Occult Fractures

- Suspected occult fractures
 - Repeat x-ray, CT, MRI
- MRI protocol
 - **Limited: Coronal T1 and T2 fat sat or STIR**
 - Full wrist series
- Detect occult fracture
 - Scaphoid (10%-25%) and distal radius (10%-25%) most common
 - Other carpal bones (5%-15%)

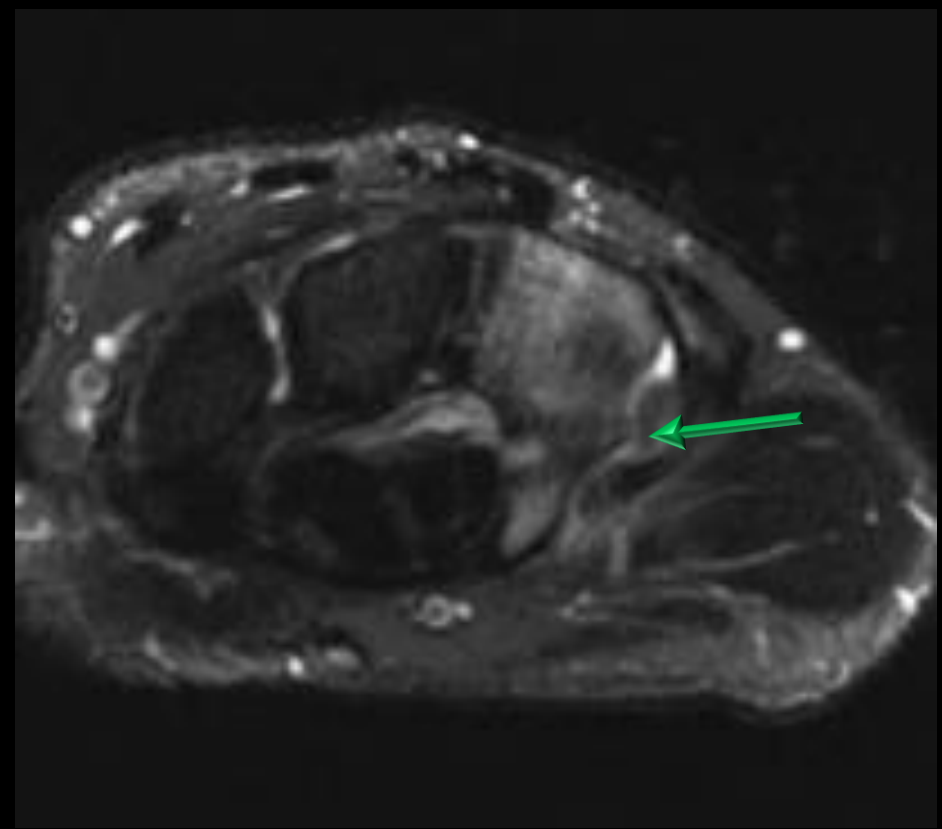
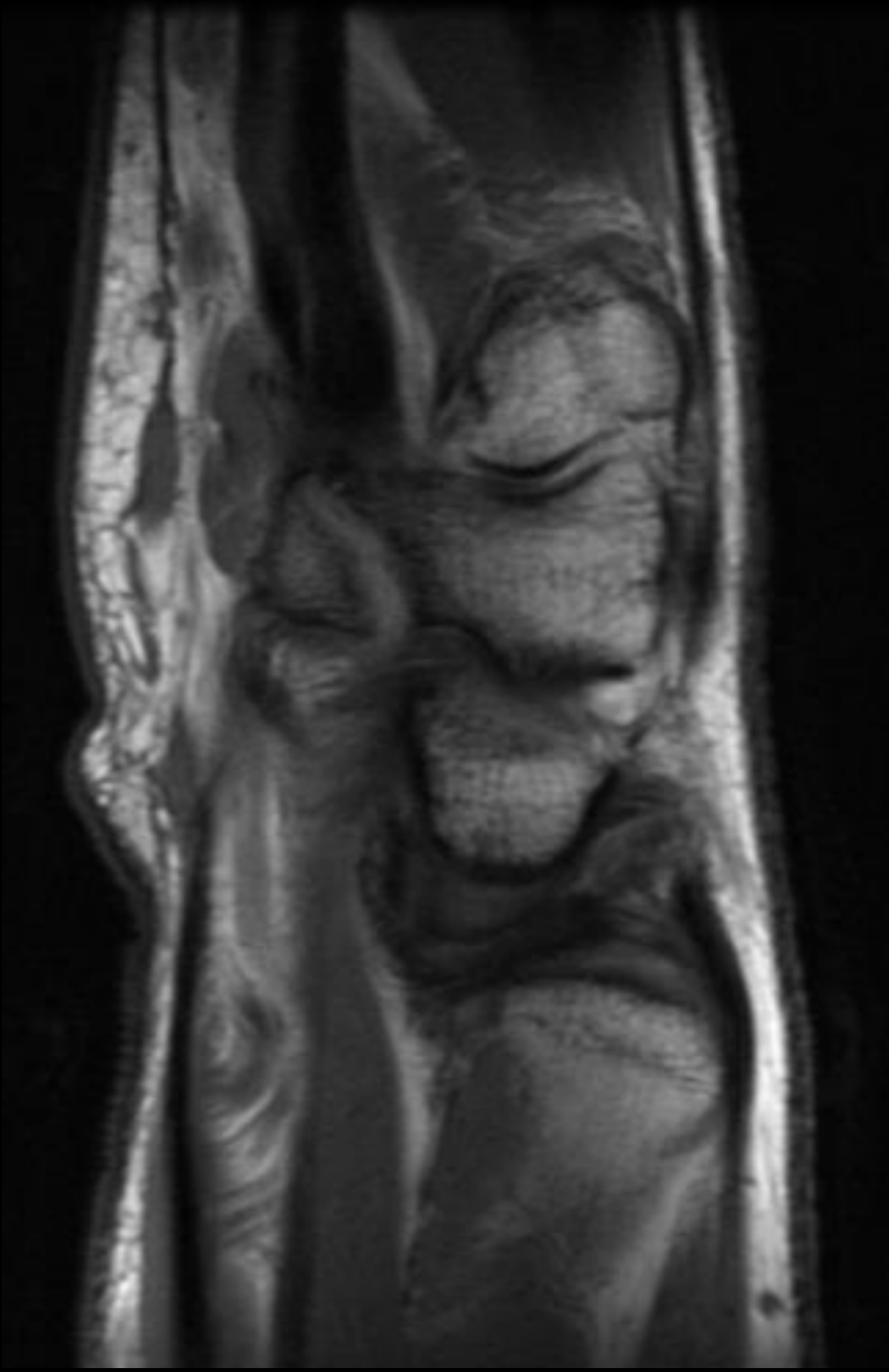




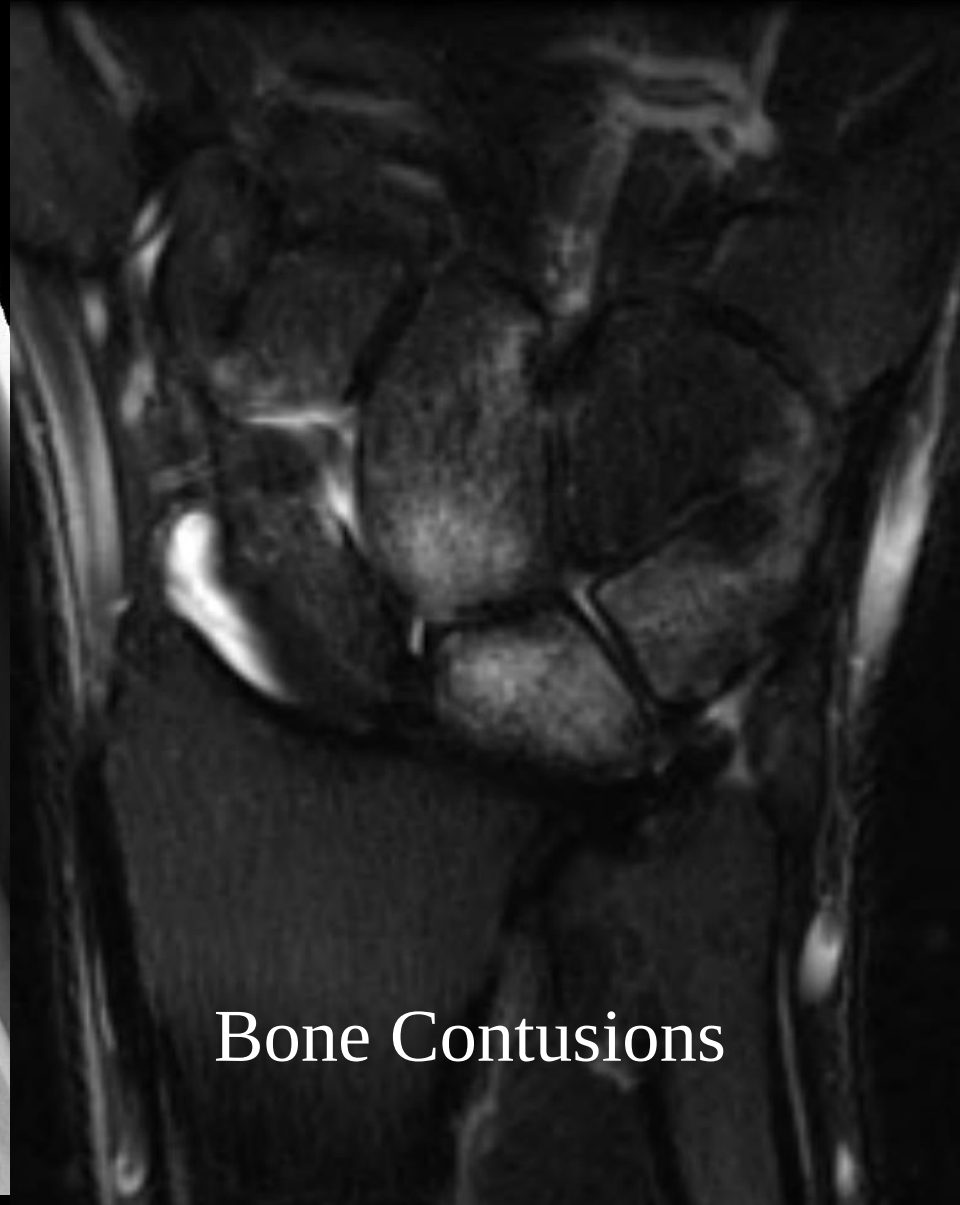
Distal Radial Fracture



Wrist Pain
X-ray Negative



Wrist Pain
Hook of Hamate Fracture



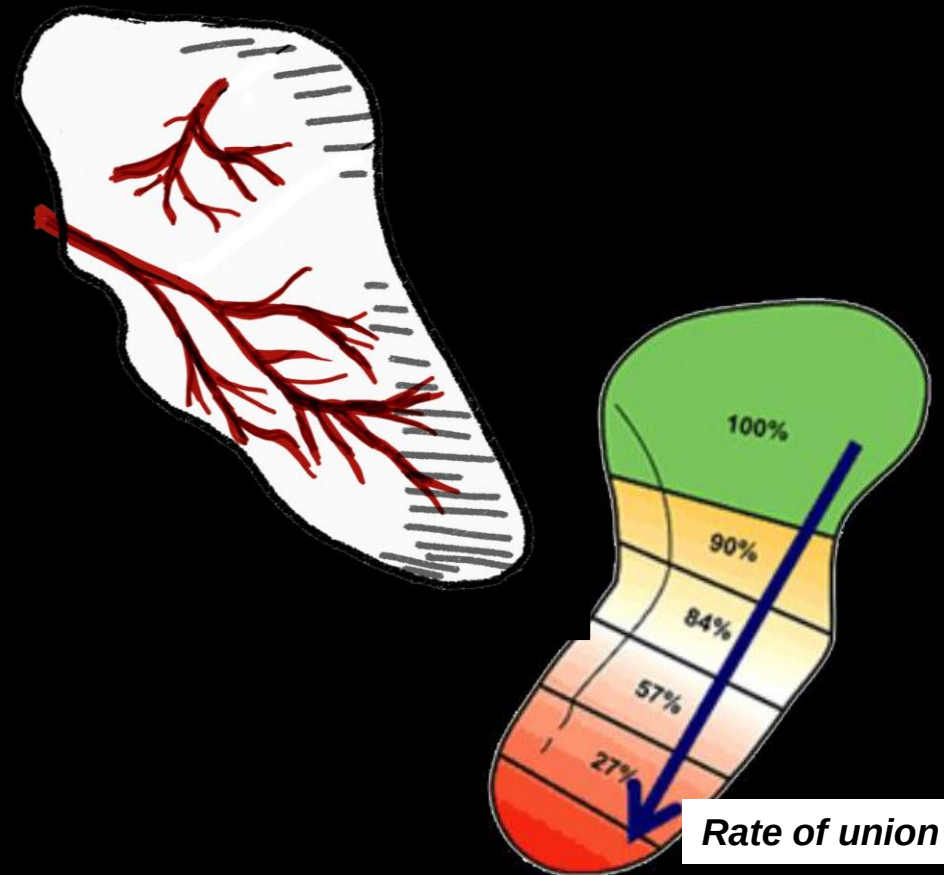
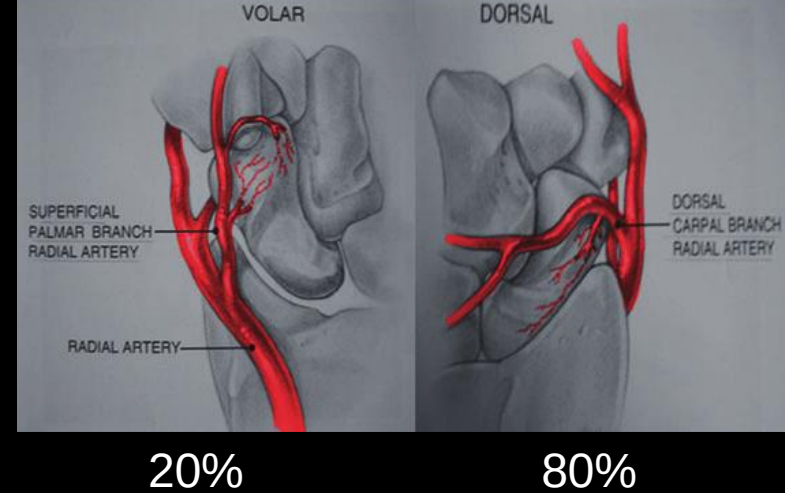
Bone Contusions

Occult Fractures - MRI

- Detect contusions
- Detect ligamentous injuries
 - Extrinsic ligaments, TFCC, SL
- Final diagnosis reached several **weeks earlier** than clinical and repeats x-rays
- Alter initial management in up to 60%-90%

Scaphoid AVN

- scaphoid fractures
 - Risk of avascular necrosis
 - middle third: 30%
 - proximal pole: 100%
- vascular supply
 - radial artery
 - palmar branch
 - dorsal branch
 - proximal pole is terminal perfusion zone

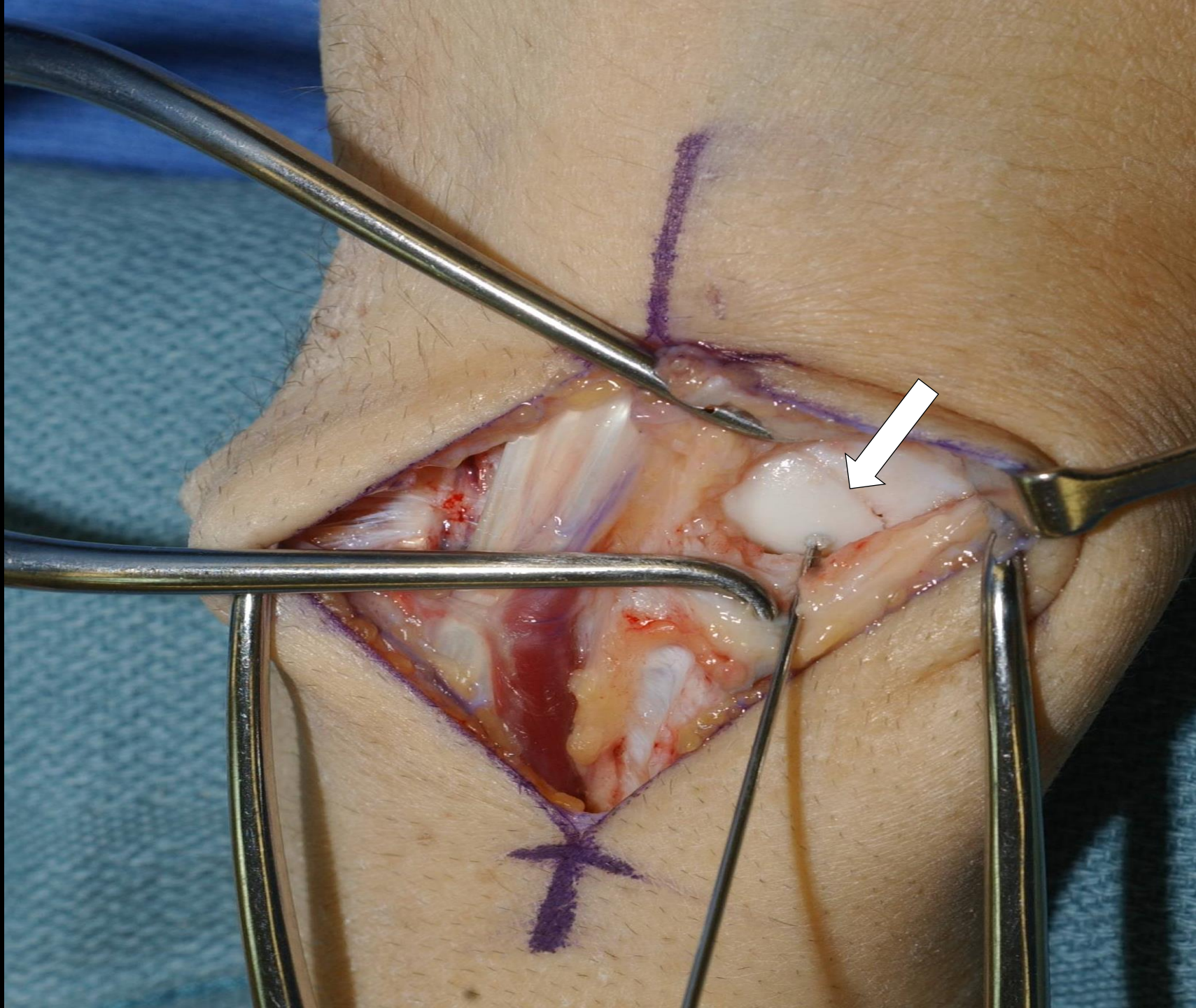


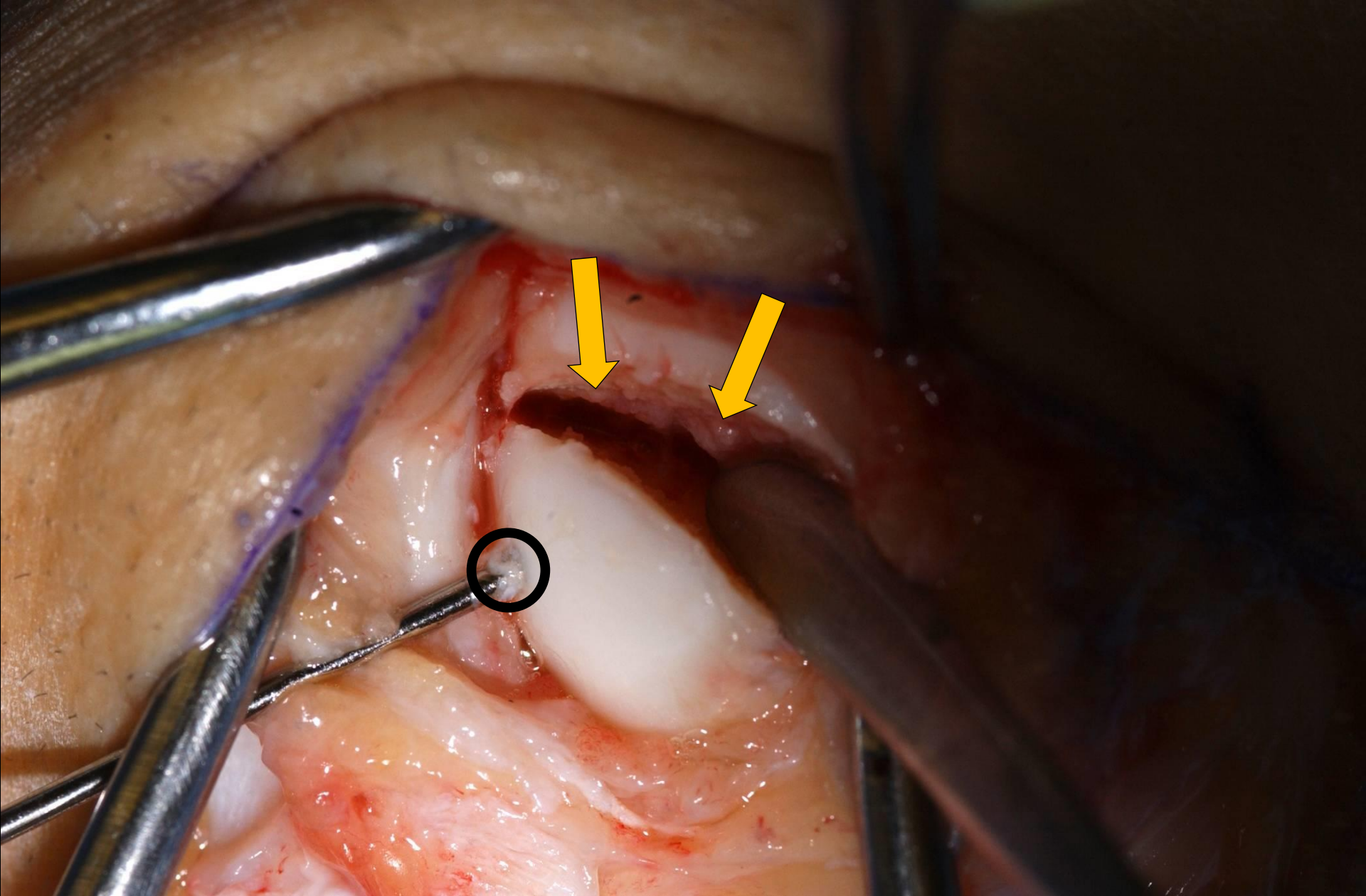
MRI in Avascular Necrosis

- Viable bone marrow
 - High SI on both T1 & T2
 - Enhancement on T1 FS post contrast
- Ischemic (but potentially viable) bone marrow
 - High T2 FS
- Nonviable bone marrow
 - Low SI on both T1 & T2
 - No enhancement on T1 FS post contrast

MRI in Avascular Necrosis

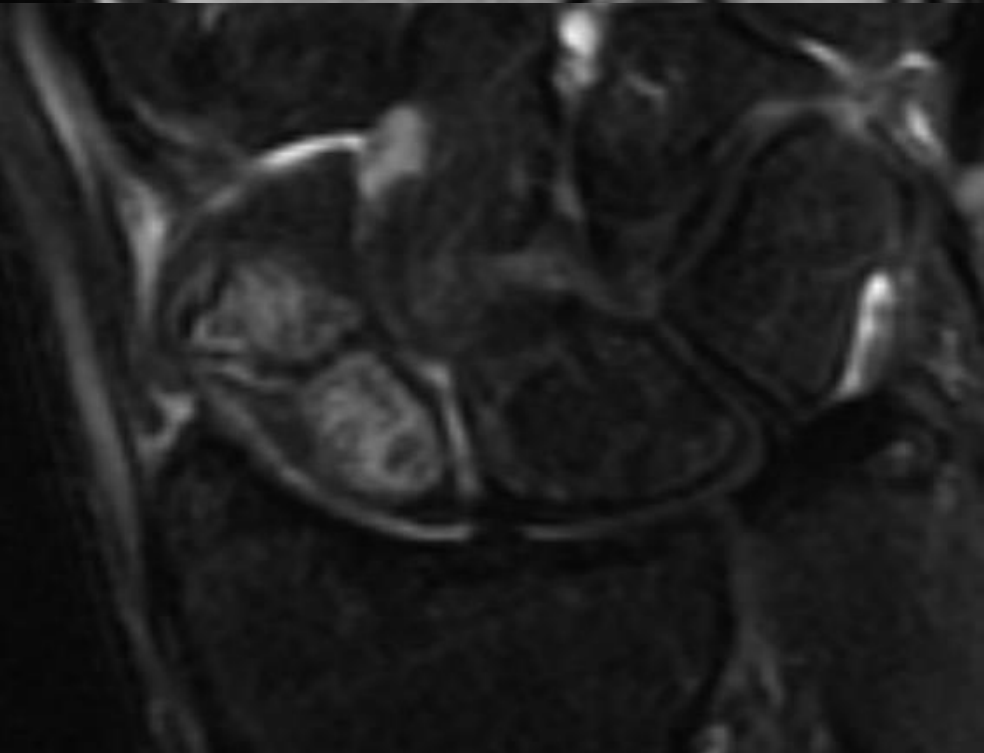
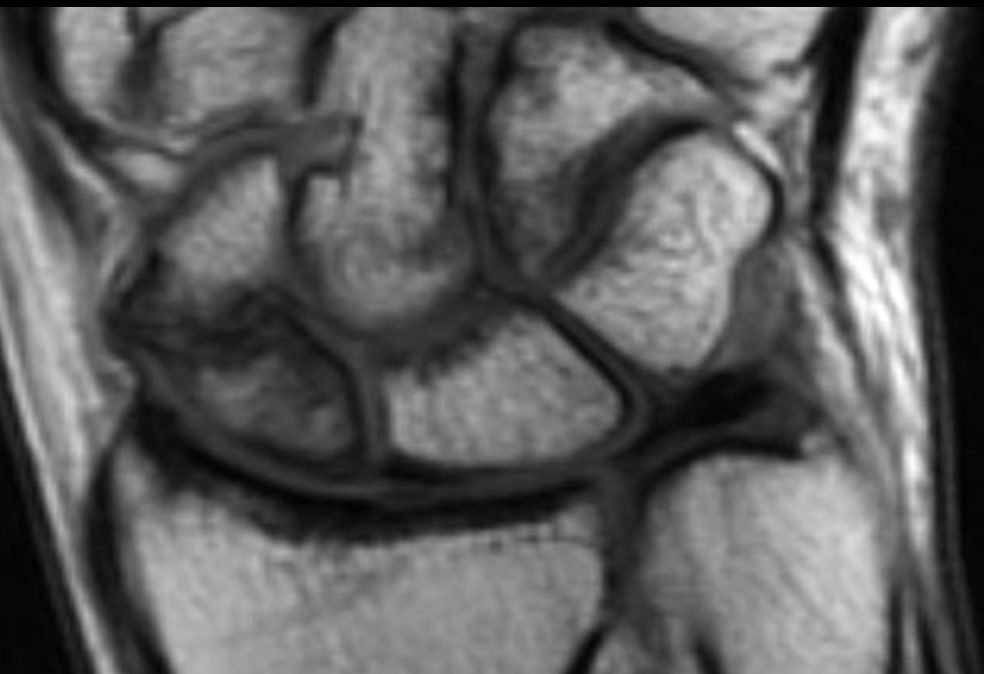
- The need for gadolinium?
 - Variable results
 - Gadolinium higher sensitivity and specificity for detection of AVN
 - Unenhanced MRI:
 - Sensitivity as low as 6%. Typically 60%-70%
 - Enhanced MRI: Sensitivity 80%-90%
 - AVN may show delayed enhancement
- Diffuse low T1 best sign on unenhanced MRI (86% accuracy, 83% sensitivity, 86% specificity)







Courtesy of Dr D Linda, Toronto



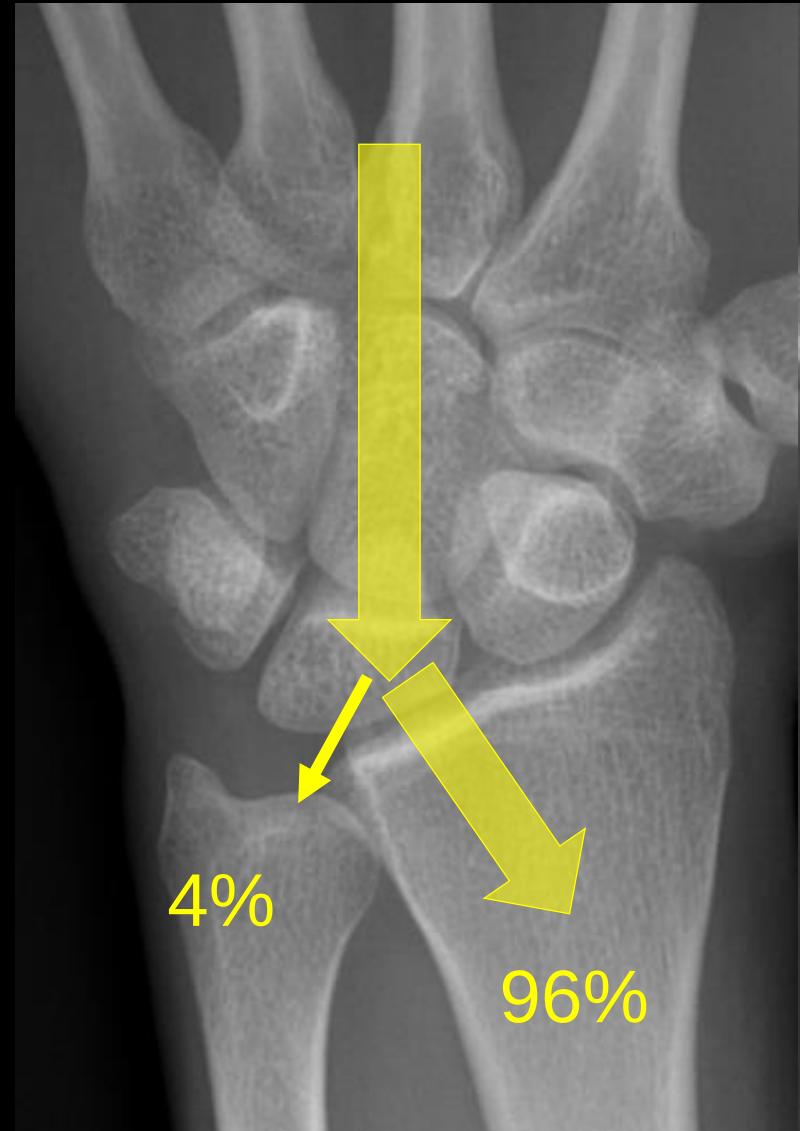
Kienbock Disease

- Demographics
 - Men > women
 - Manual workers
 - Dominant hand
- Cause
 - Vascular vs mechanical
 - Poor anastamoses in some
 - Negative variance:
 - 23% normals vs 74% Kienbock



Load Distribution

- Dependent on ulnar variance:
 - Normal
 - Radial 80%, Ulnar 20%
 - 2.5mm ulnar negative
 - Radial 96%, ulnar 4%
 - 2.5mm ulnar positive
 - Radial 58%, ulnar 42%



Kienbock Disease

- Staging (Lichtman)
- **I:** Normal radiograph, abnormal MRI
- **II:** Sclerotic lunate
 - +/- mild loss of height radial side of lunate
- **III:** Lunate collapse in coronal plane
 - **A:** Normal kinematics - No scaphoid flexion
 - **B:** Carpal collapse, Scaphoid flexion
 - **C:** Coronal fracture lunate
- **IV:** Radiocarpal arthritis

Kienbock Disease

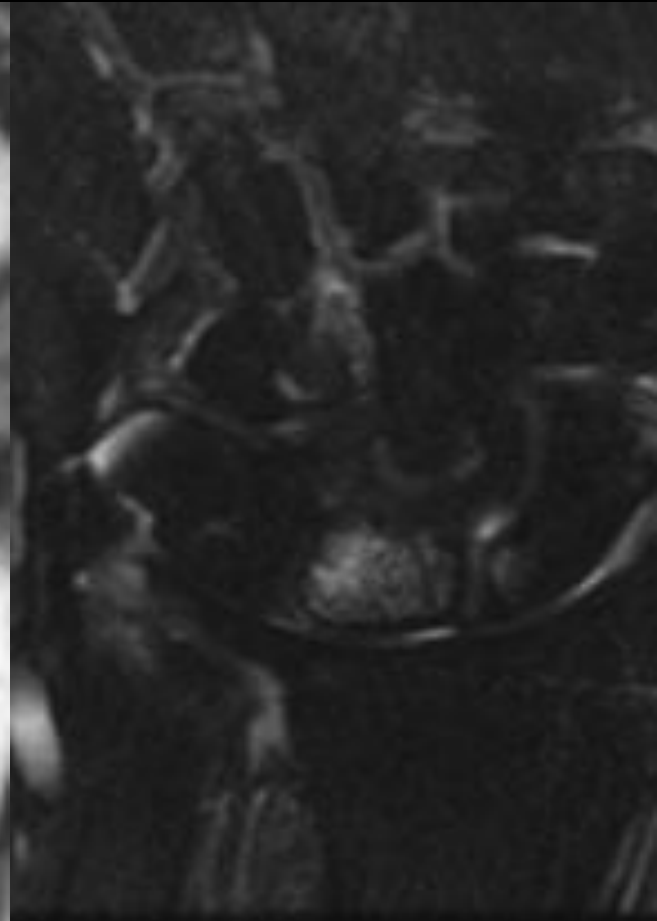
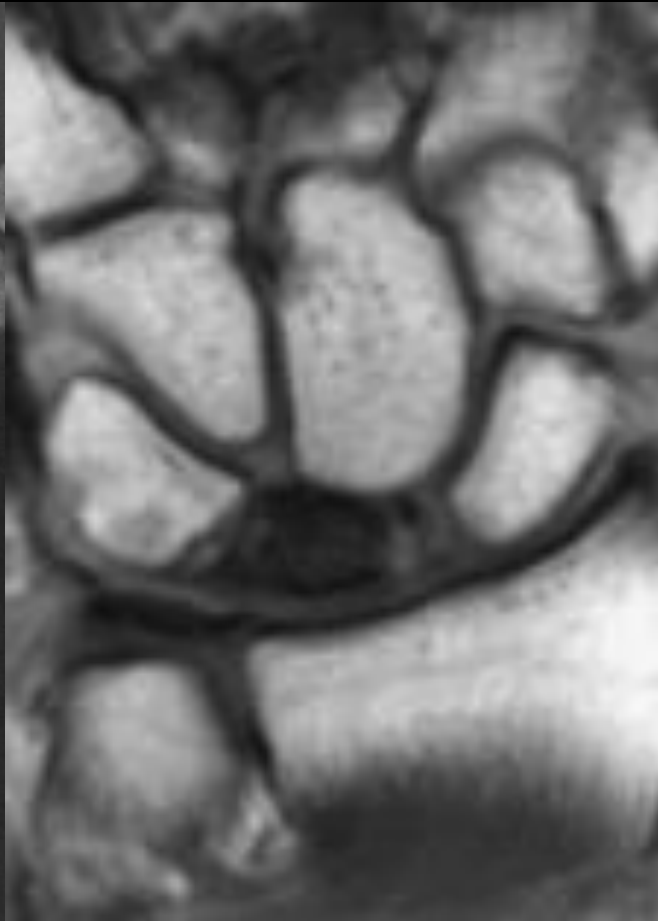
- Imaging
 - Largely radiographs
 - CT:
 - Coronal fracture
 - Typically upgrades of radiographs
 - MRI:
 - Stage I: Radiographically occult
 - Stage IV: Assess cartilage

Stage I – normal radiograph, abnormal MRI



Stage II - Sclerotic lunate

+/- mild loss of height radial side of lunate



Stage III - Lunate collapse in coronal plane



Stage III - Lunate collapse in coronal plane



Stage III - Lunate collapse in coronal plane



Kienbock Disease - Treatment

- Revascularization
- Address negative ulnar variance
 - Radial shortening osteotomy
- Proximal row carpectomy
- Wrist fusion
- Depends on stage and ulnar variance



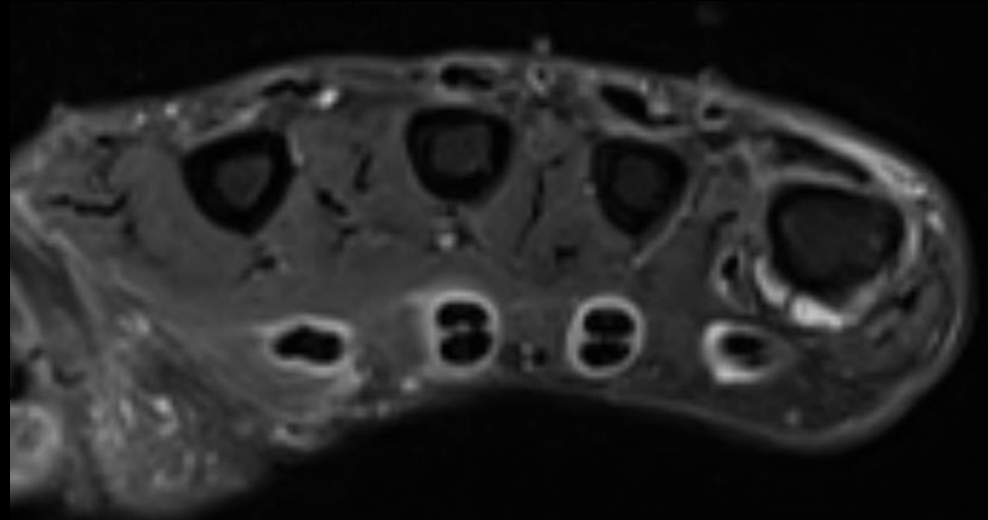
Hamatolunate Impaction

- Type II lunate
 - Anatomic variant
 - (25%-73%)
- Pain on ulnar deviation
- Chondral changes proximal hamate
- Arthroscopic burring proximal hamate

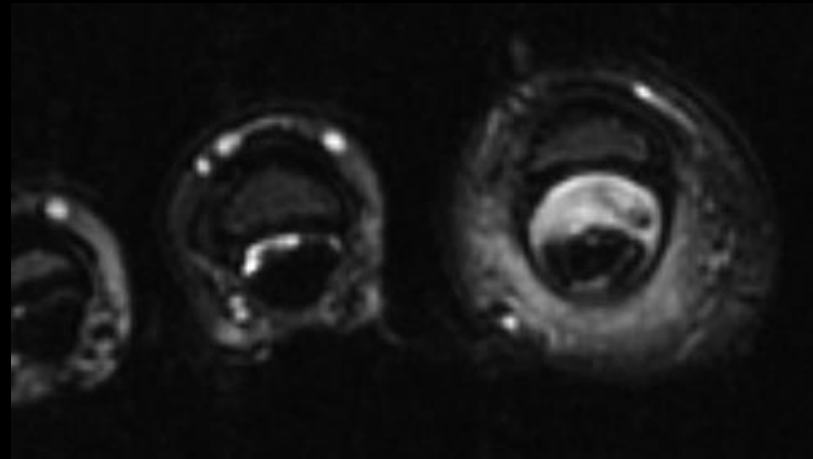


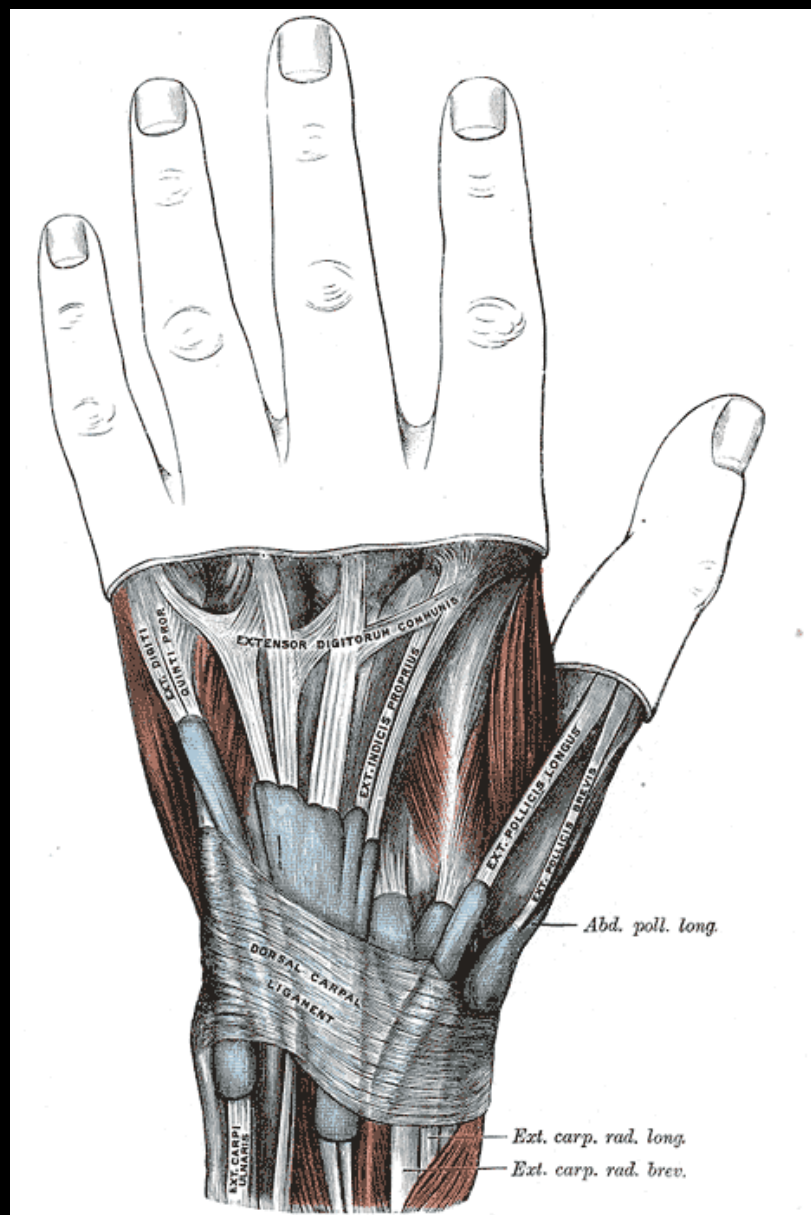
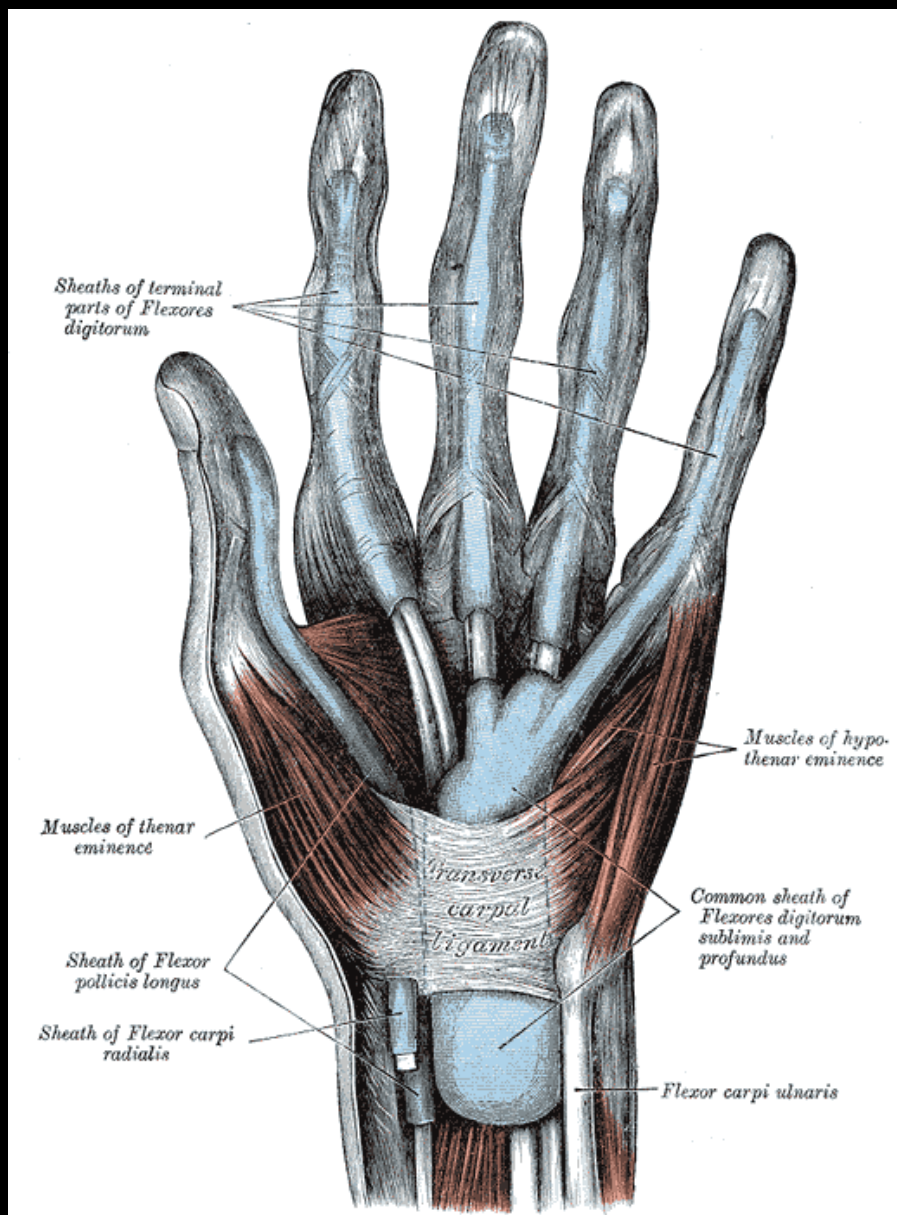
Tendon Injuries

- Tenosynovitis
- Tendinopathy
- Tears



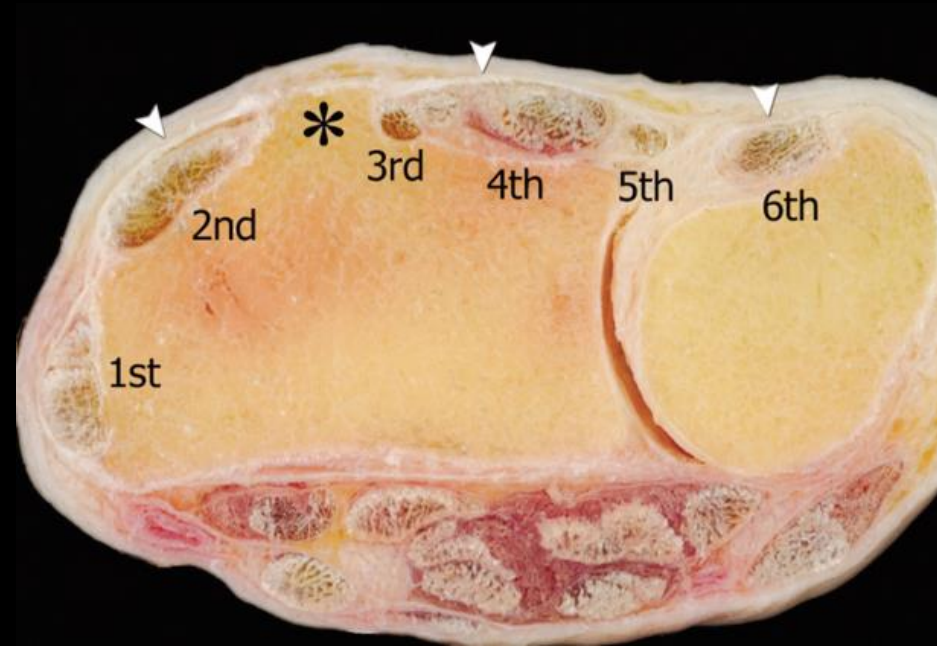
- Mechanical / repetitive trauma
- Inflammatory / infection
- Acute trauma





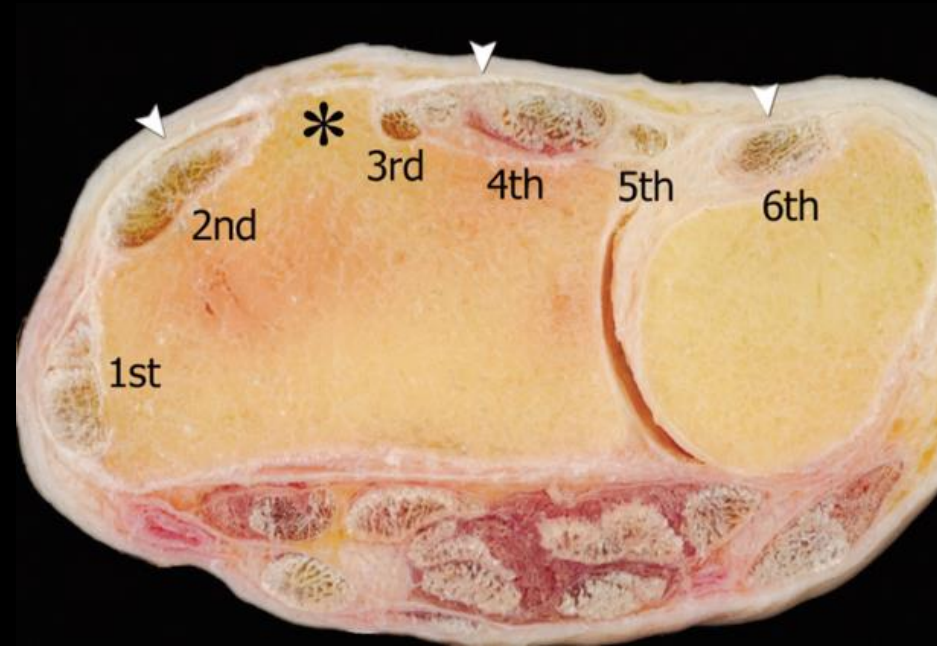
Extensor Compartments

- 1st
 - Abductor Poll Longus
 - Extensor Poll Brevis
- 2nd
 - Ext Carpi Rad Longus
 - Ext Carpi Rad Brevis
- 3rd
 - Ext Poll Longus
- 4th
 - Extensor Digitorum
 - Extensor Indicis
- 5th
 - Extensor Digiti Minimi
- 6th



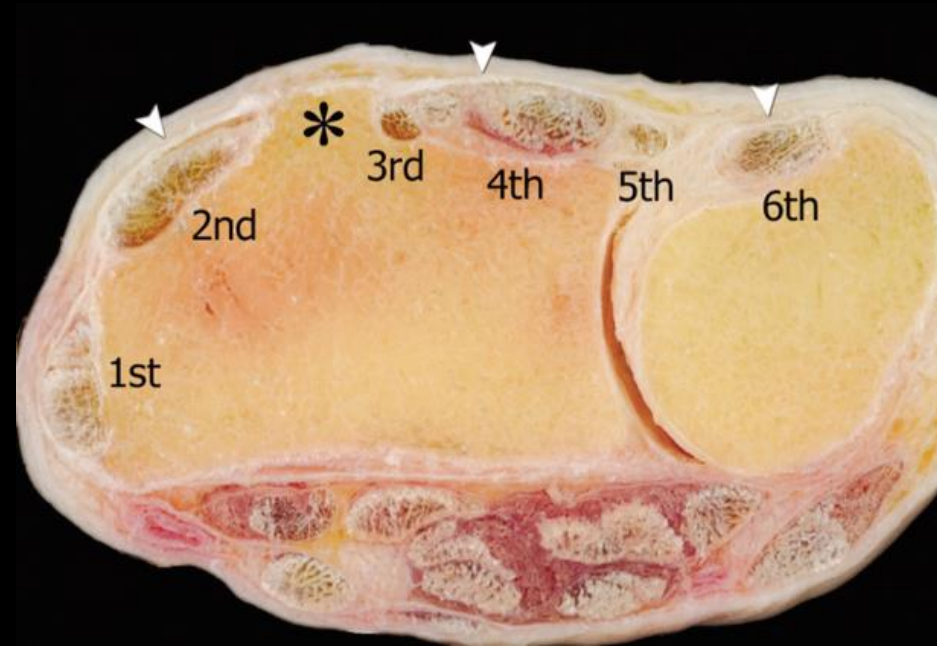
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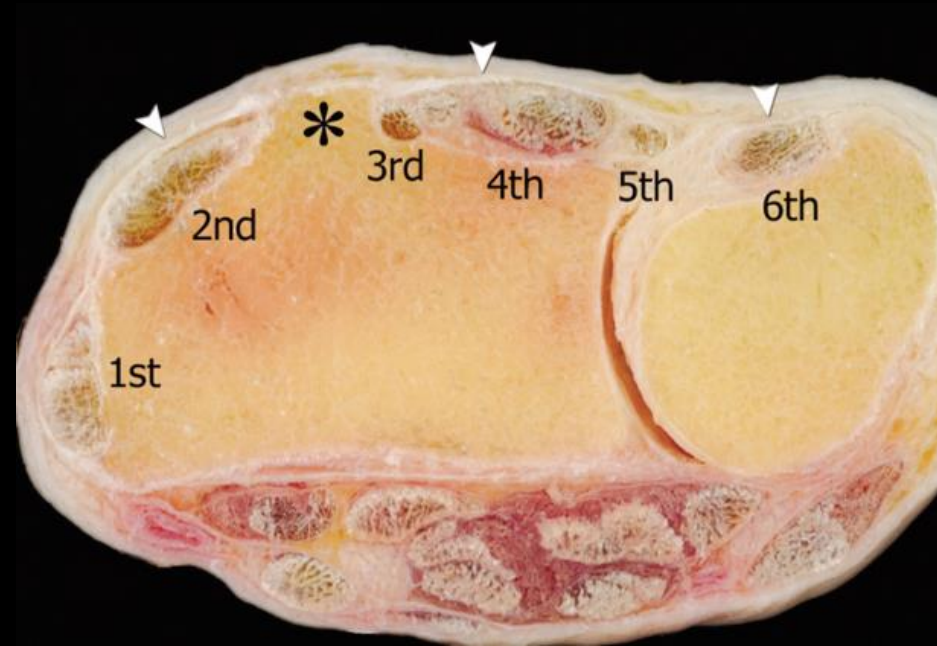
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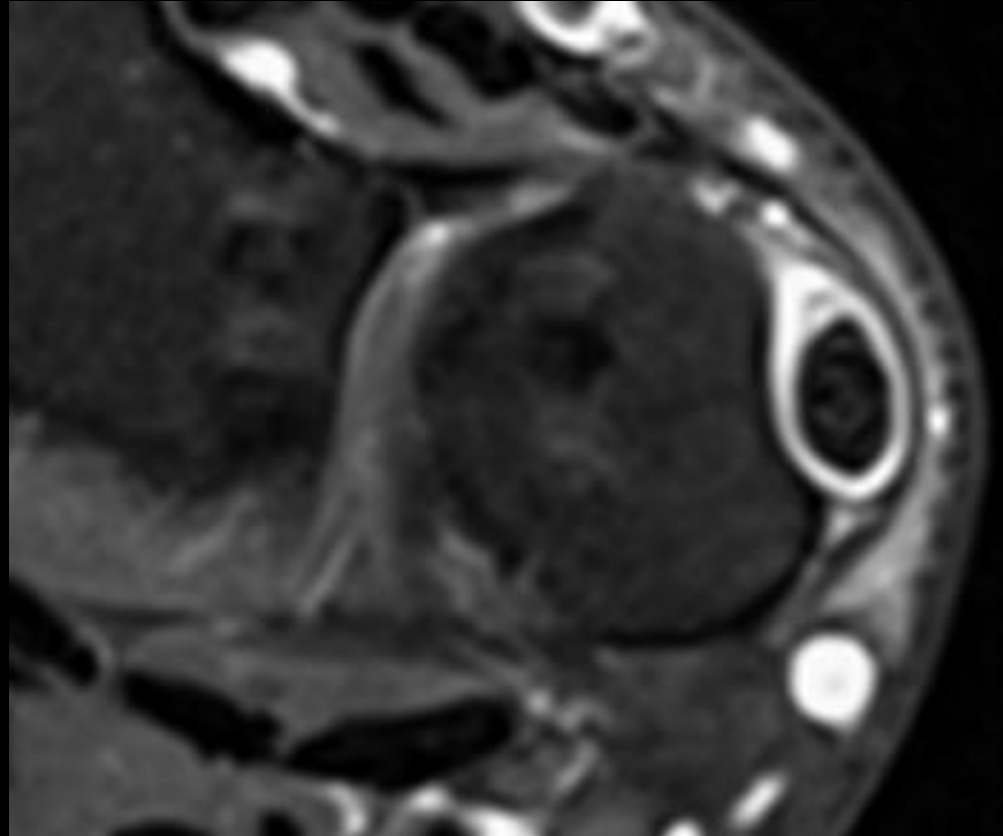
6th Extensor Carpi Ulnaris

- Maintained in ulnar groove
 - Osteofibrous tunnel
 - ECU Subsheath
 - Extensor retinaculum



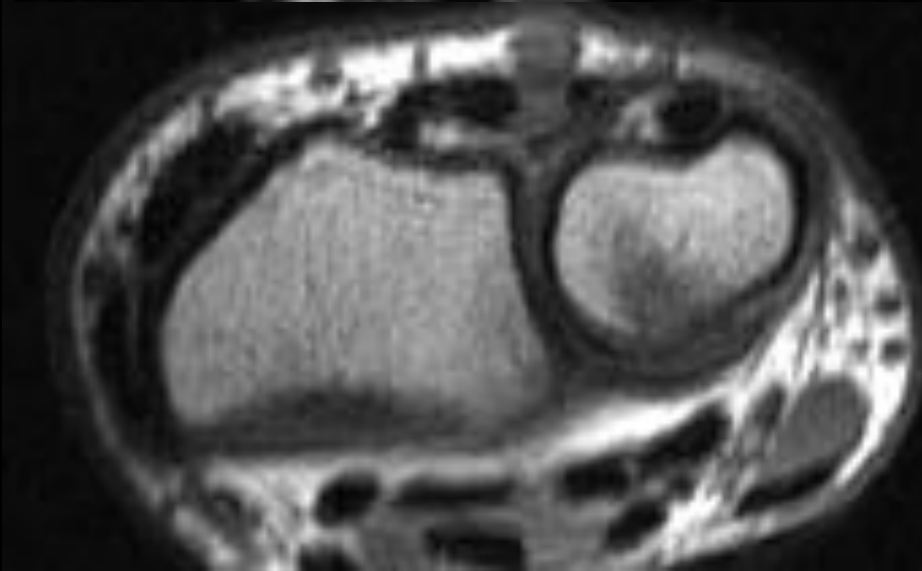
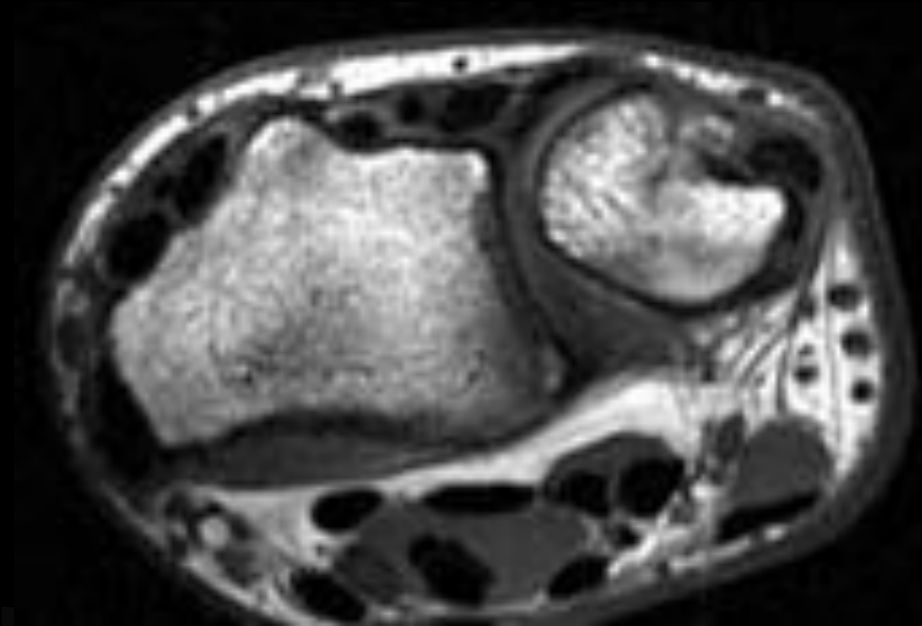
Extensor Carpi Ulnaris

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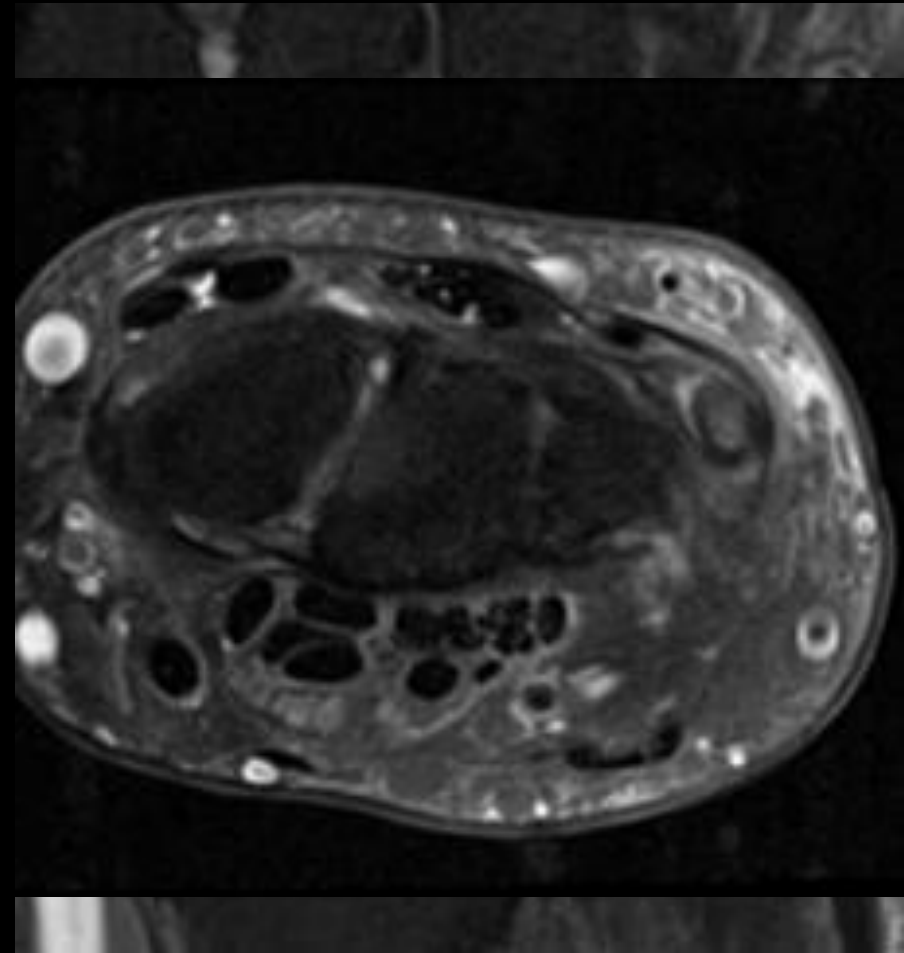
ECU Position

- Position dependent on wrist position:
 - Ulnar on pronation
 - Dorsal in neutral
 - Dorsal/radial on supination



ECU Disorders

- Etiology
 - Chronic inflammatory process
 - Chronic repetitive injury
 - Acute trauma



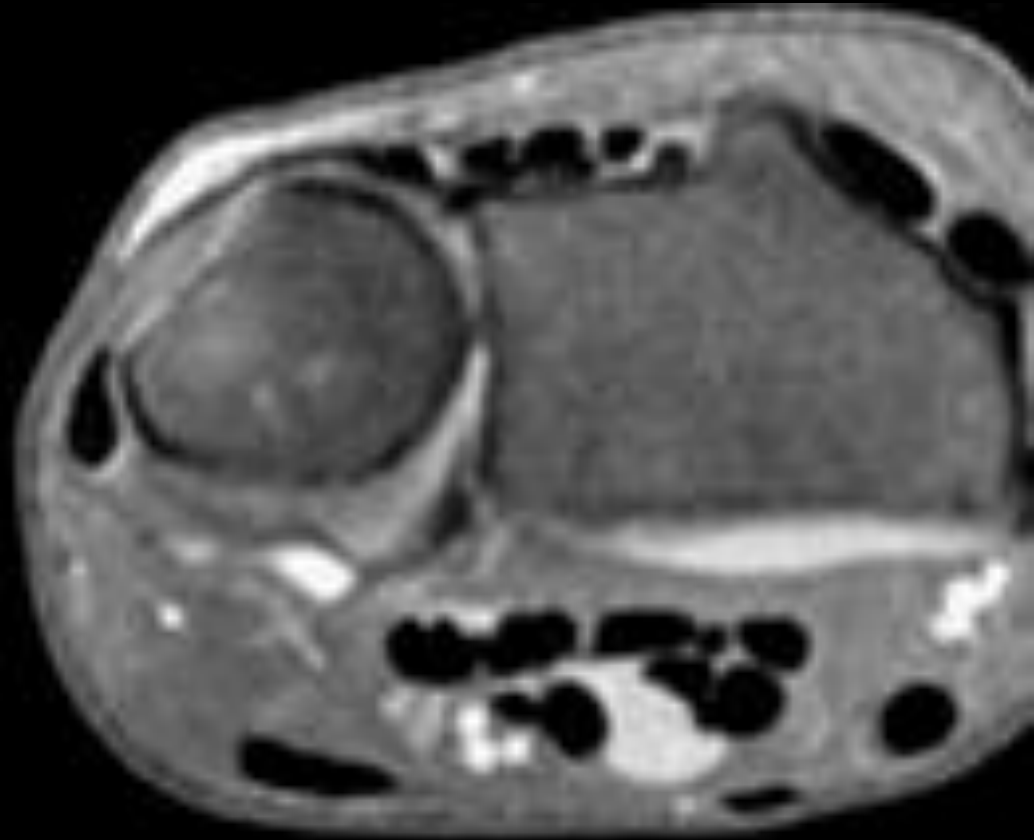
ECU Dislocation

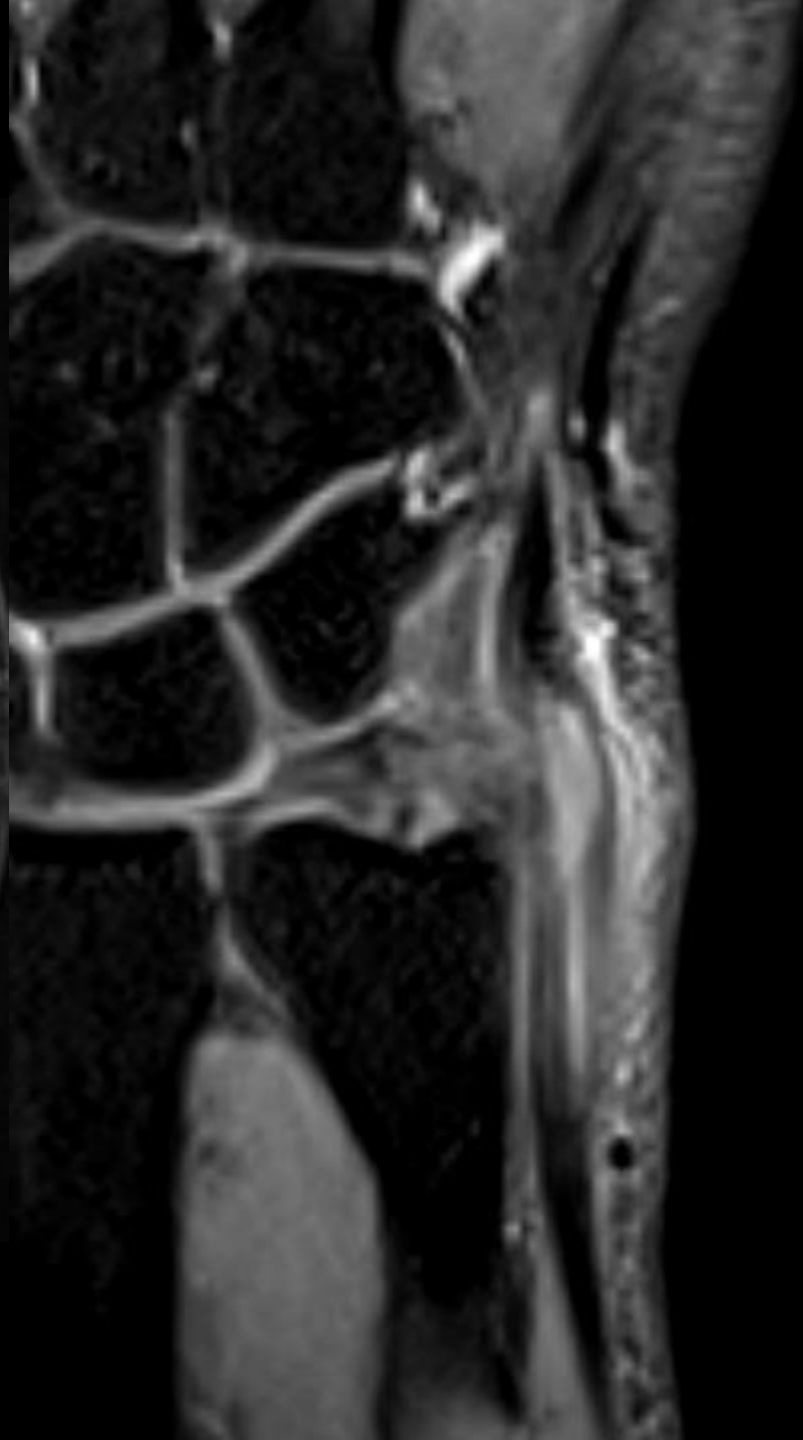
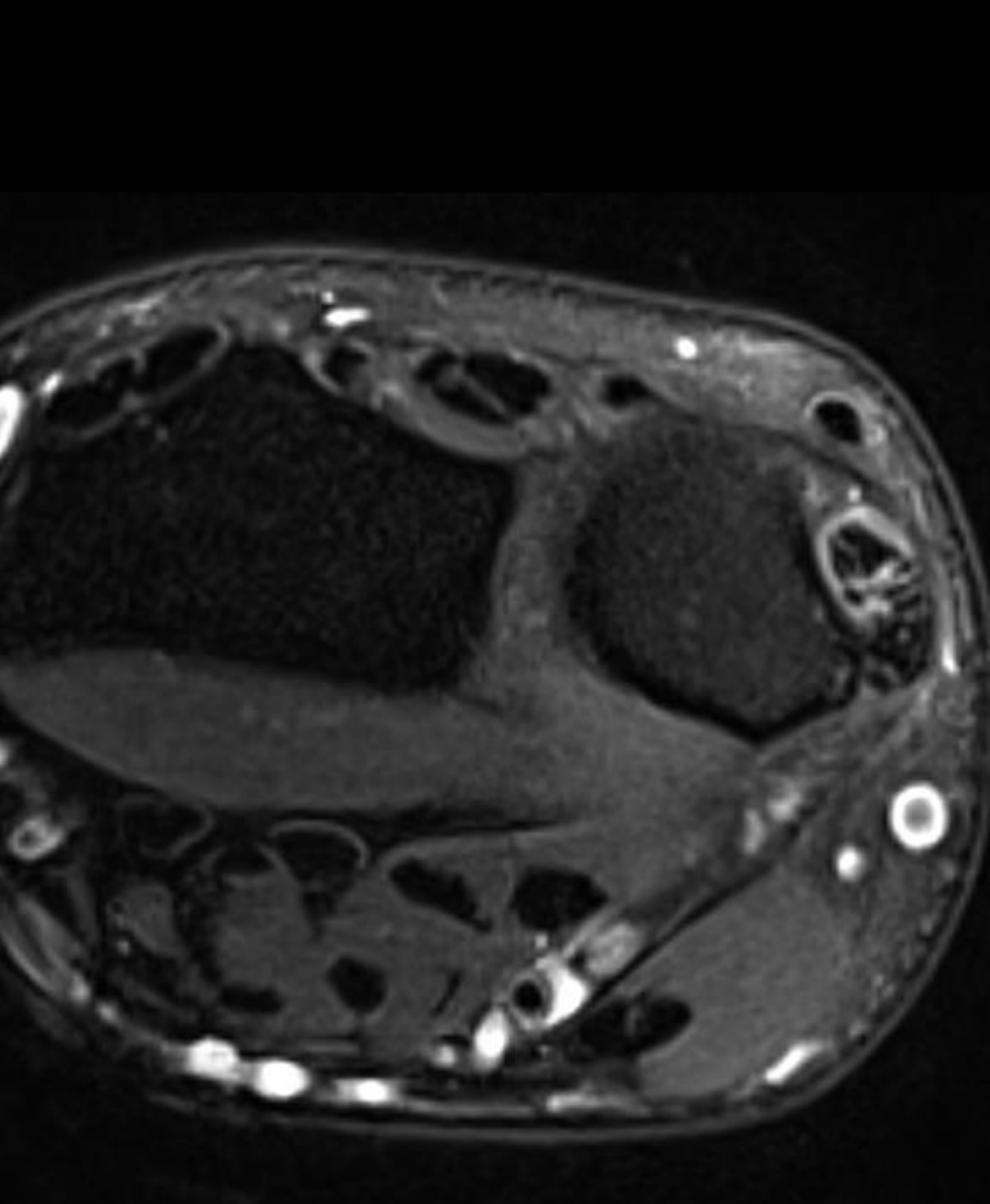
- Mechanism
 - Forced supination
 - Ulnar deviation
 - Palmar flexion
 - Increase angle to 5th MC
 - Increase traction on ECU
- Clicking / snapping
- Most common sports
 - Golf and Tennis

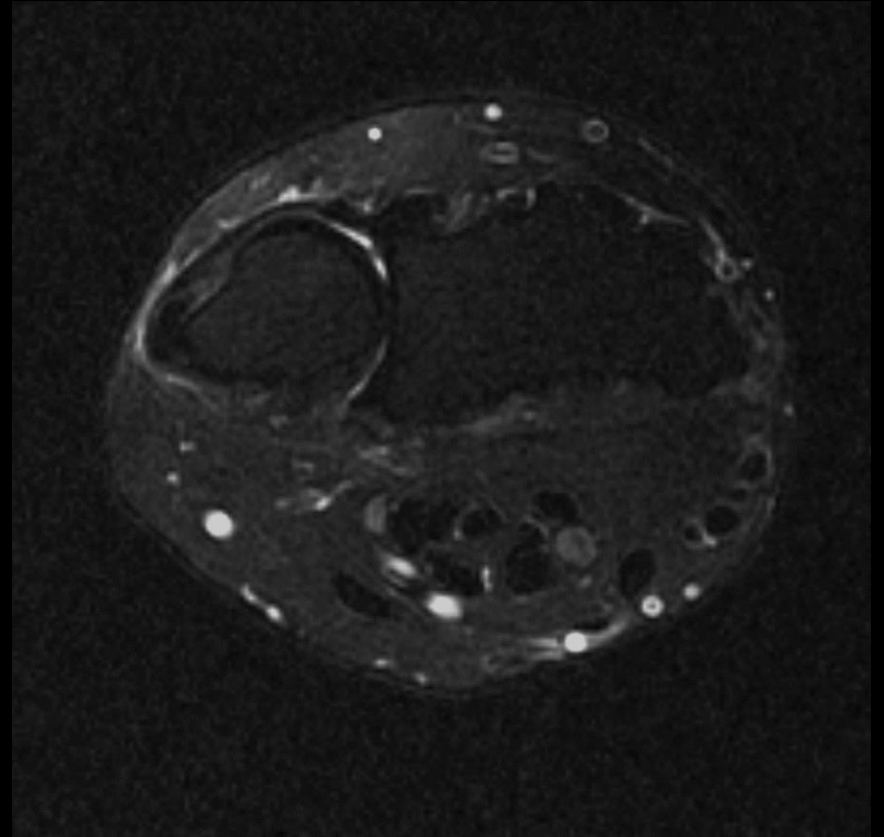
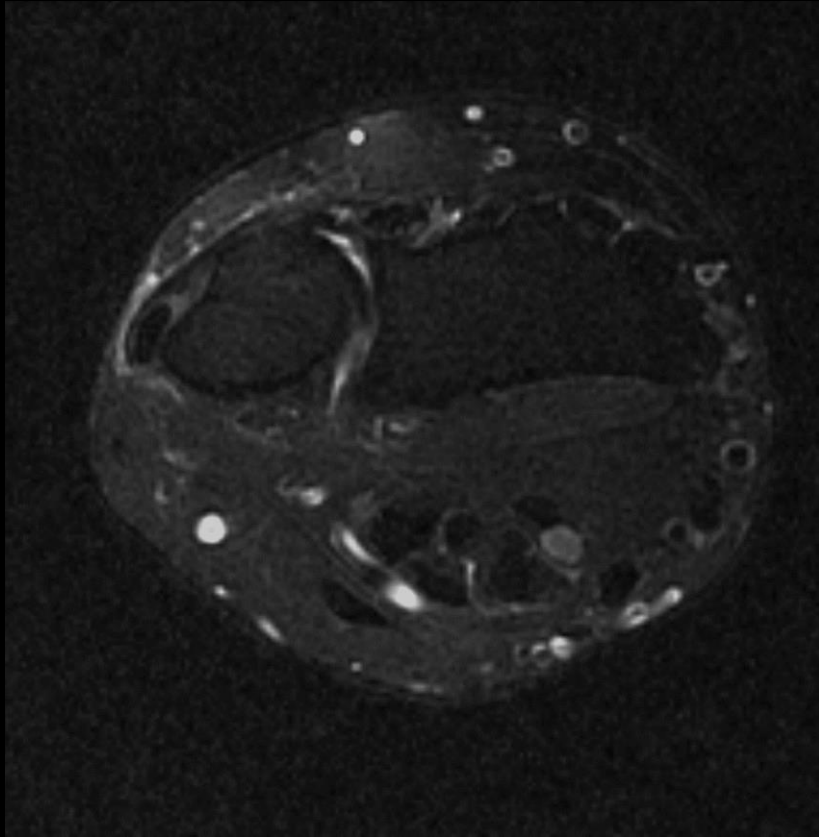


ECU Dislocation

- Subsheath injury
 - Stripping
 - Tear
 - Detachment
- Radial or ulnar tears



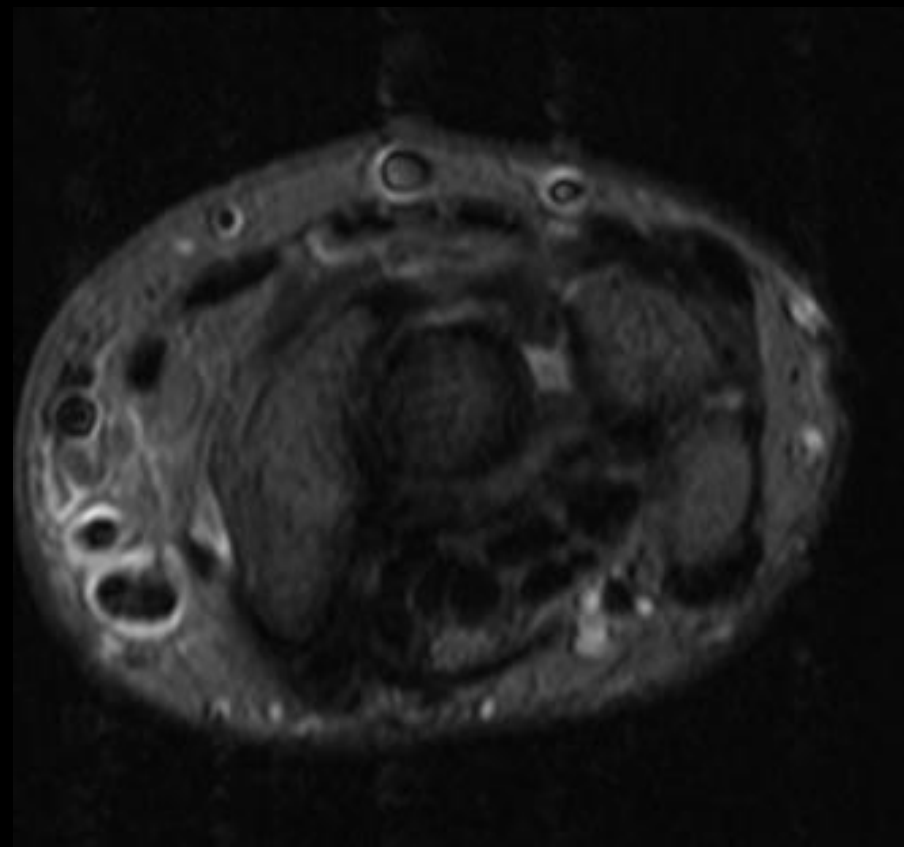
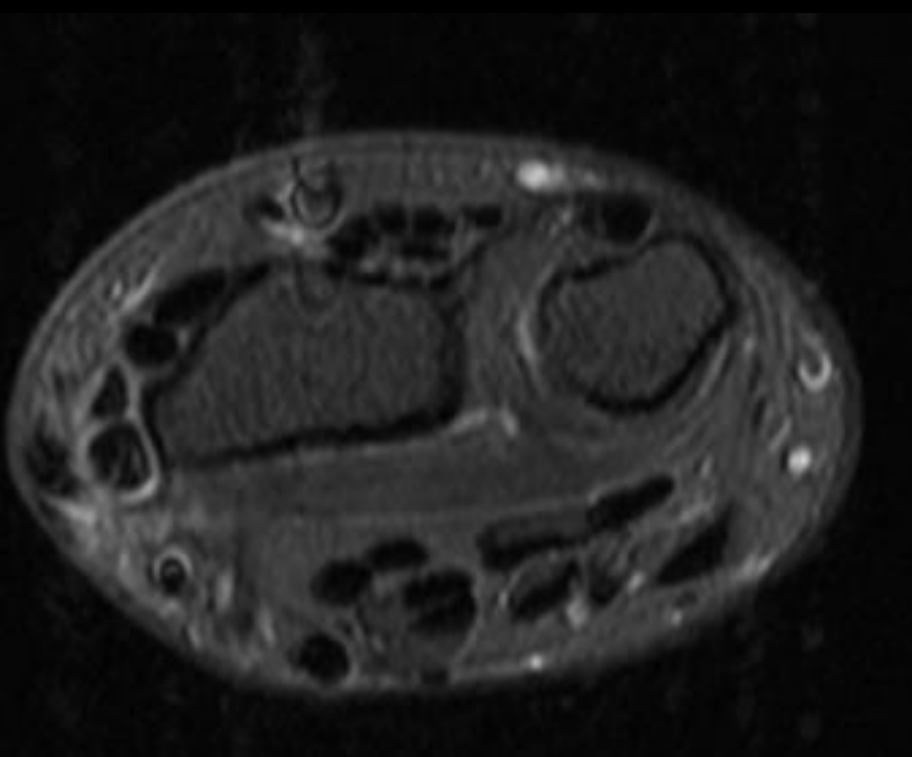




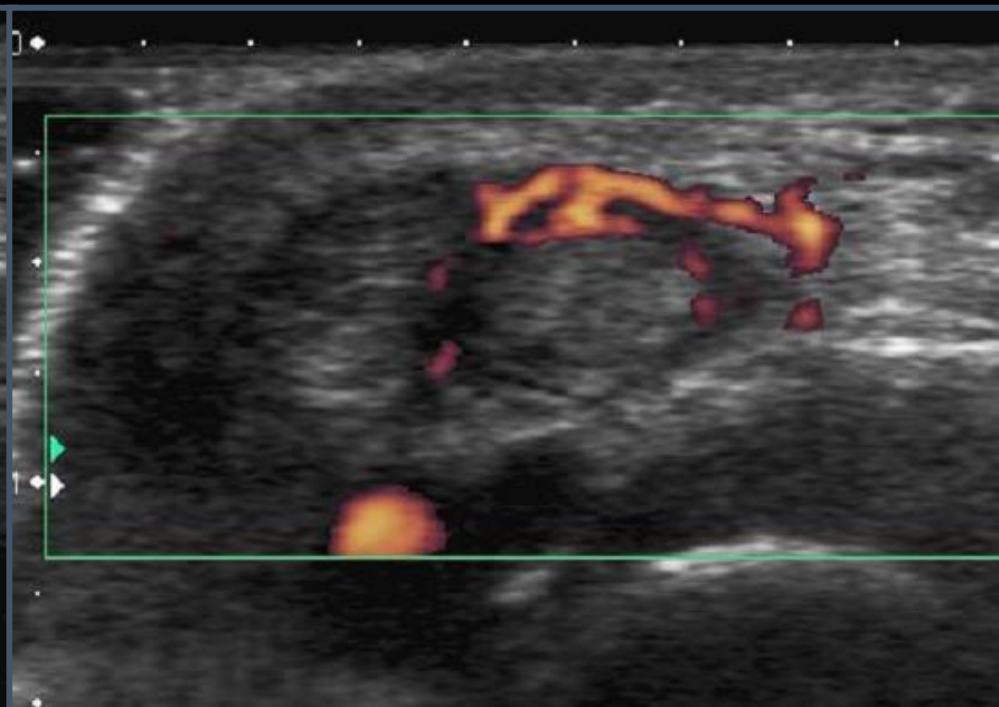
Subsheath Injury
-Subluxed ECU

De Quervain Tenosynovitis

- Overuse disorder
- Stenosing tenosynovitis 1st extensor compartment: APL and EPB
- Focal tenderness radial styloid
- Focal tendon sheath/retinacular thickening
- +/- Peritendinous fluid
- +/- Tendon changes



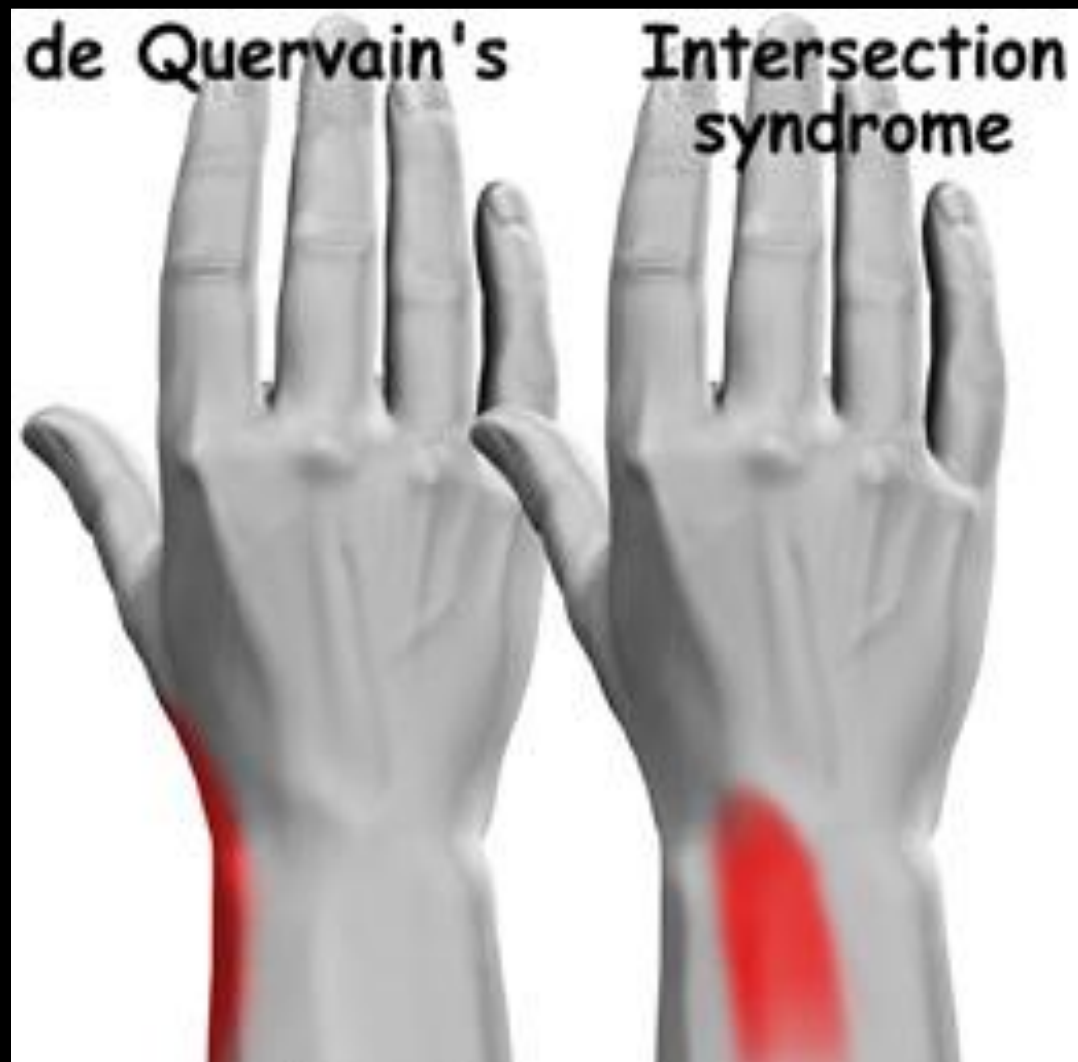




Intersection Syndrome

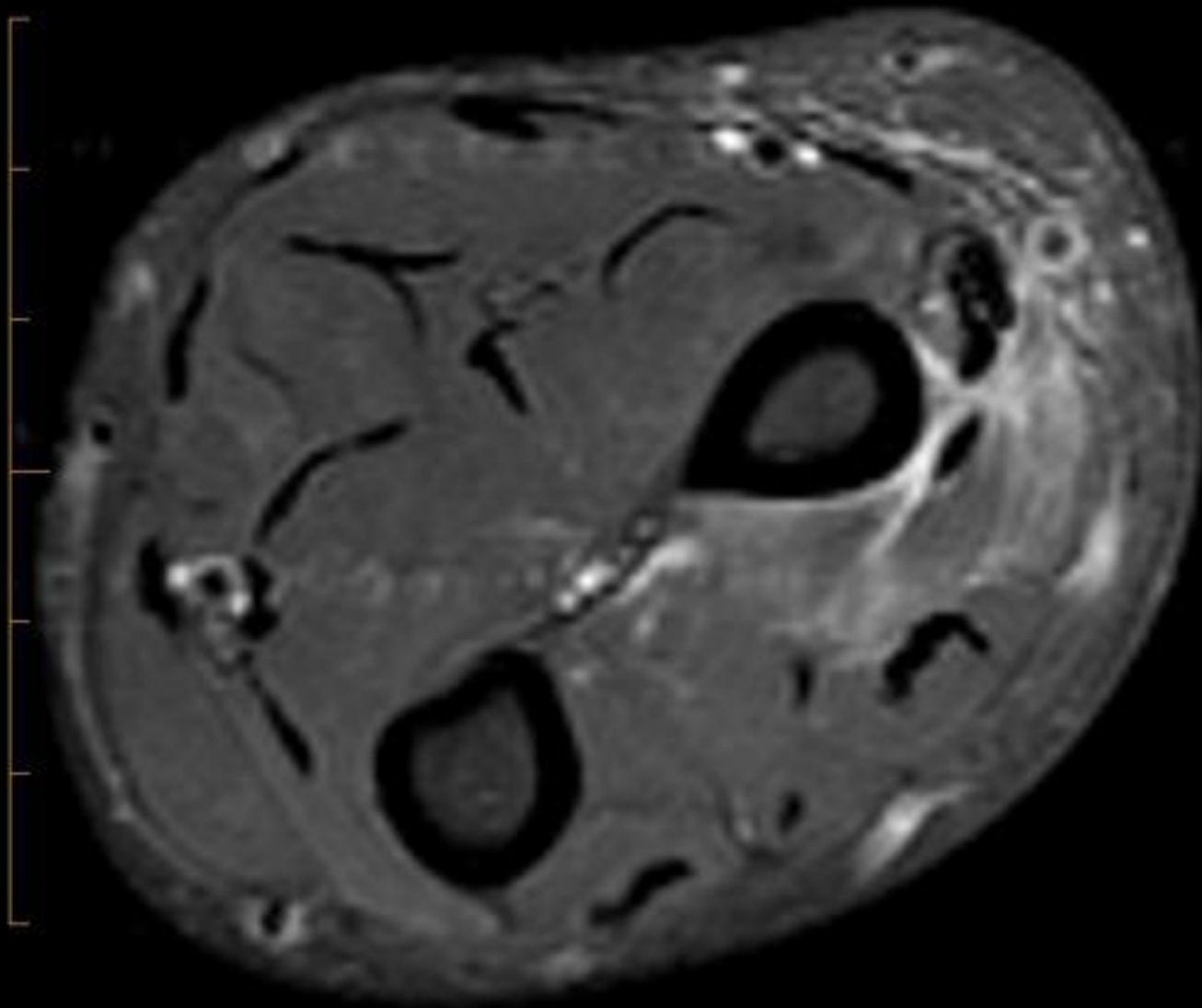
- Bugaboo forearm, oarsman wrist, cross-over syndrome
- Repeated flexion/extension
- Proximal Intersection:
 - Compartments 1 and 2
 - 3-5 cm proximal to Lister
- Distal Intersection
 - Compartments 2 and 3



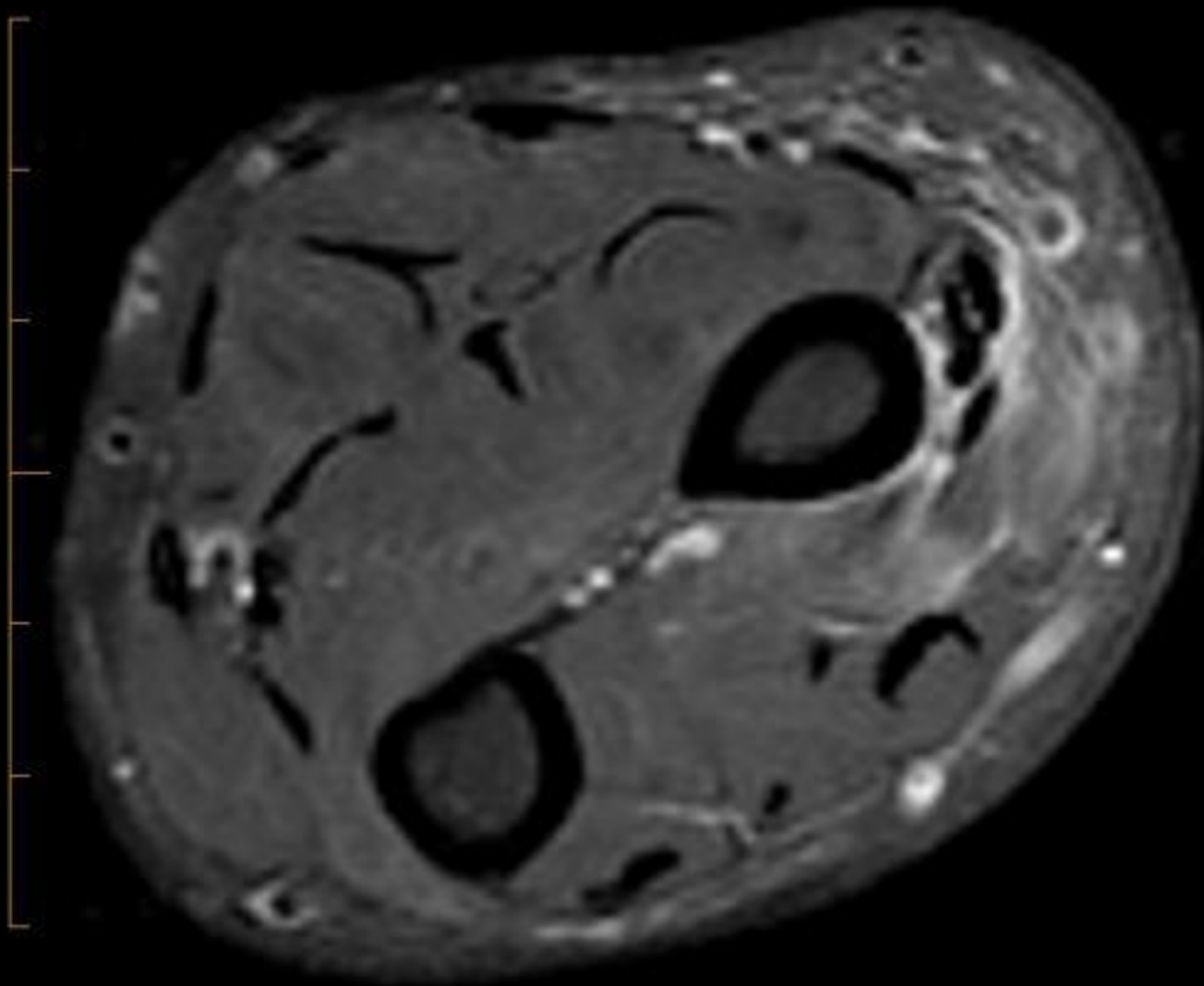


1st- abductor pollicis longus (APL) and extensor pollicis brevis (EPB) and 2nd - extensor carpi radialis longus (ECRL) and extensor carpi radialis brevis (ECRB)

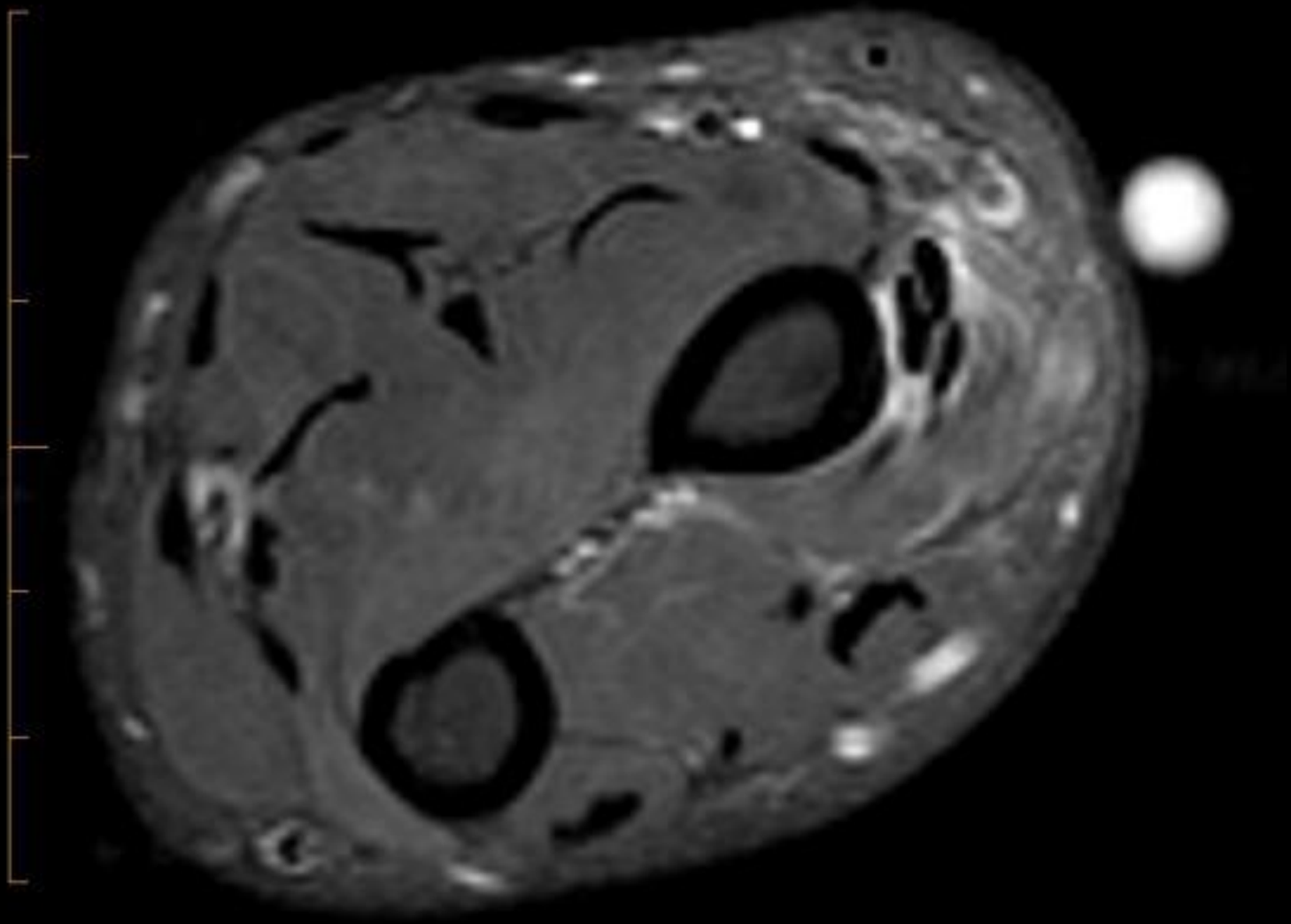
1st- APL and EPB crossing over 2nd – ECRL and ECRB



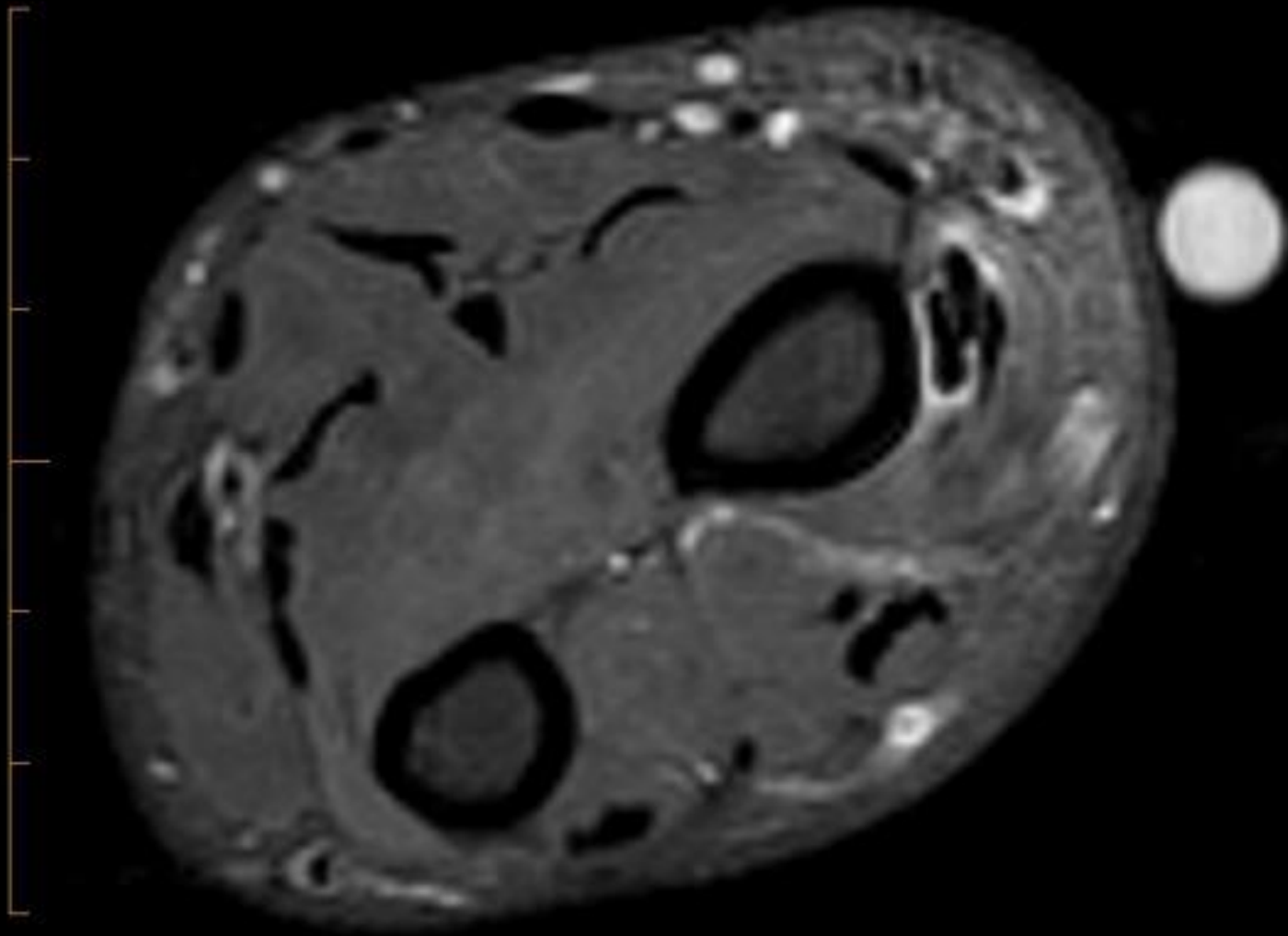
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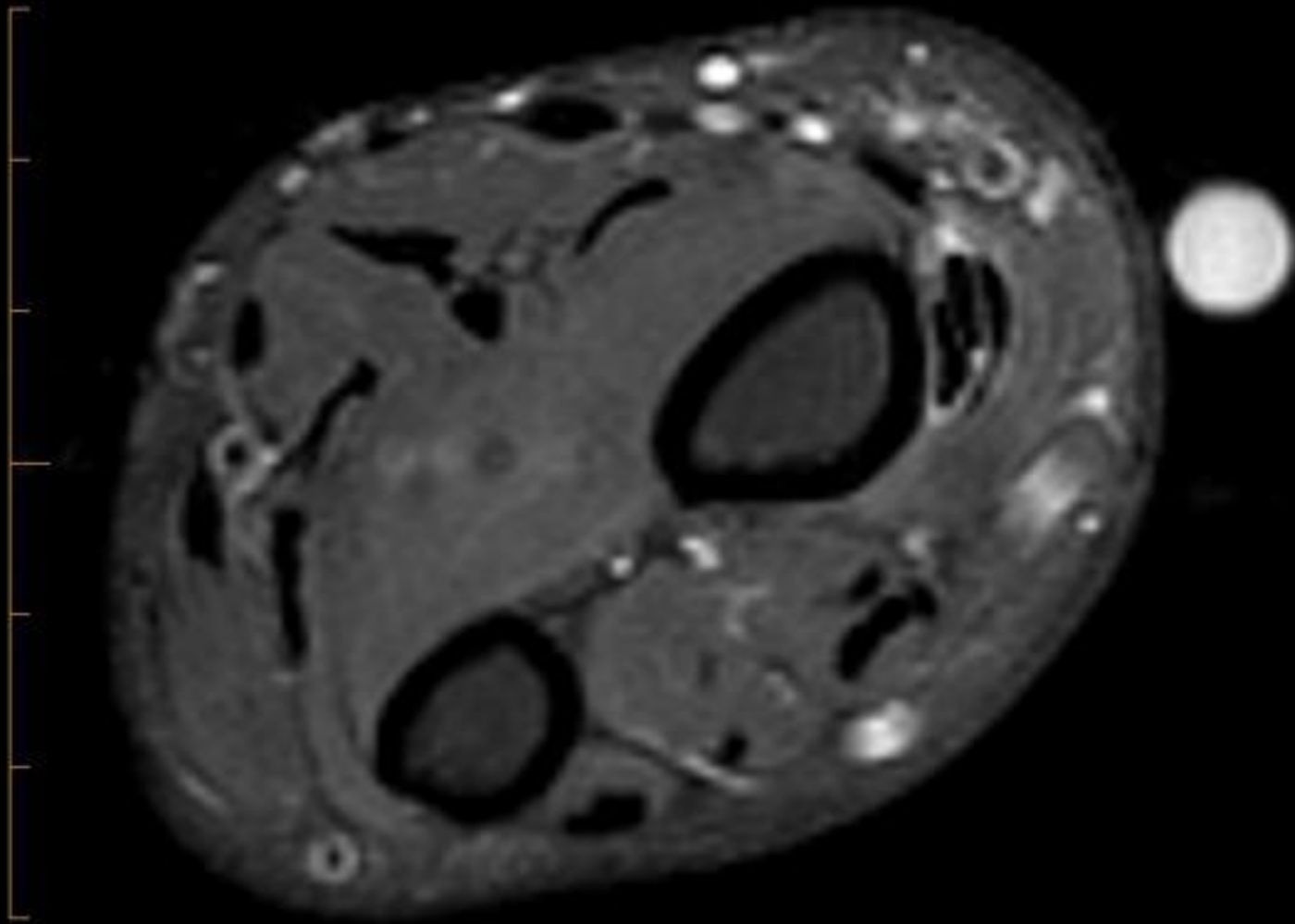
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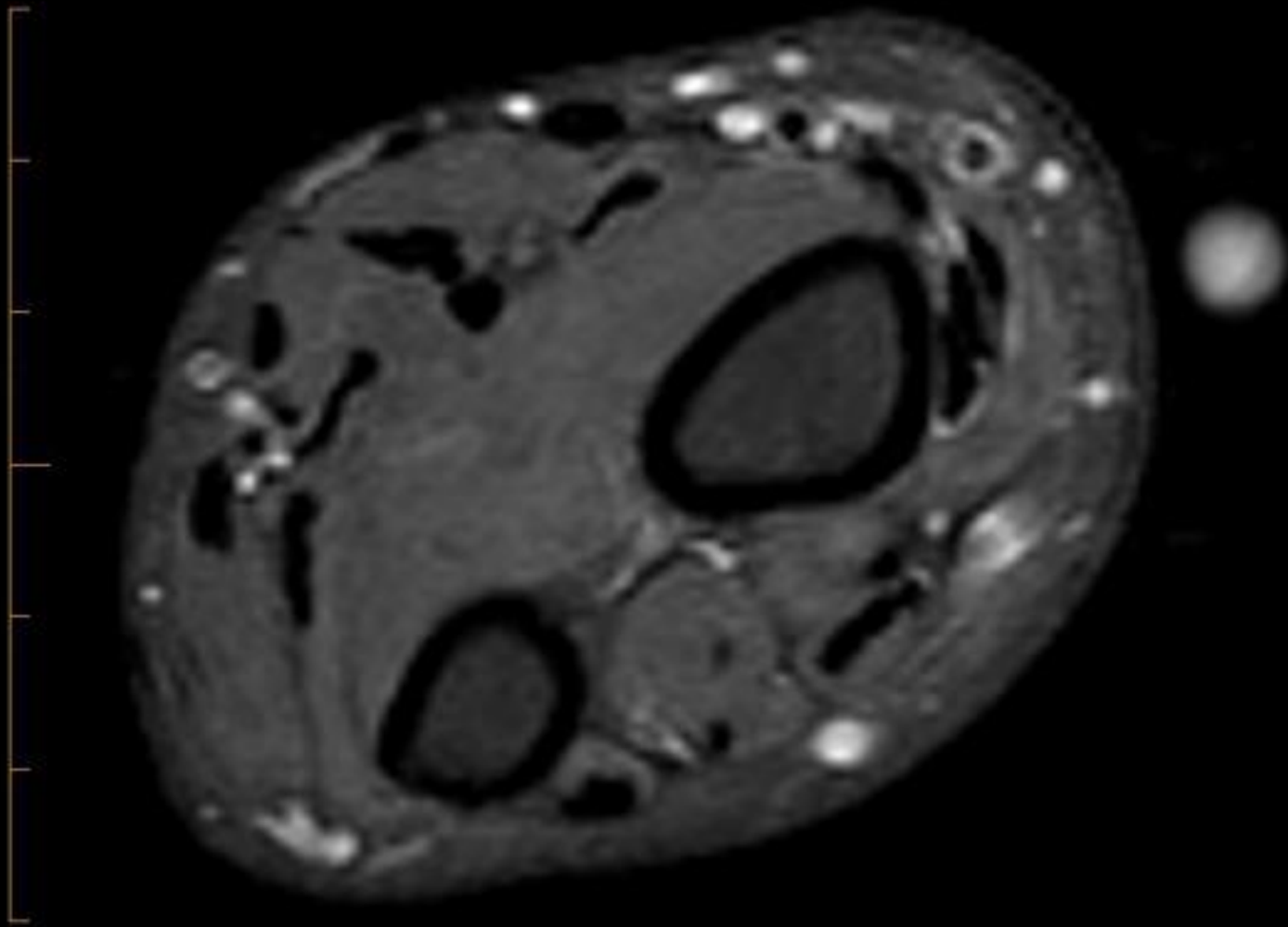
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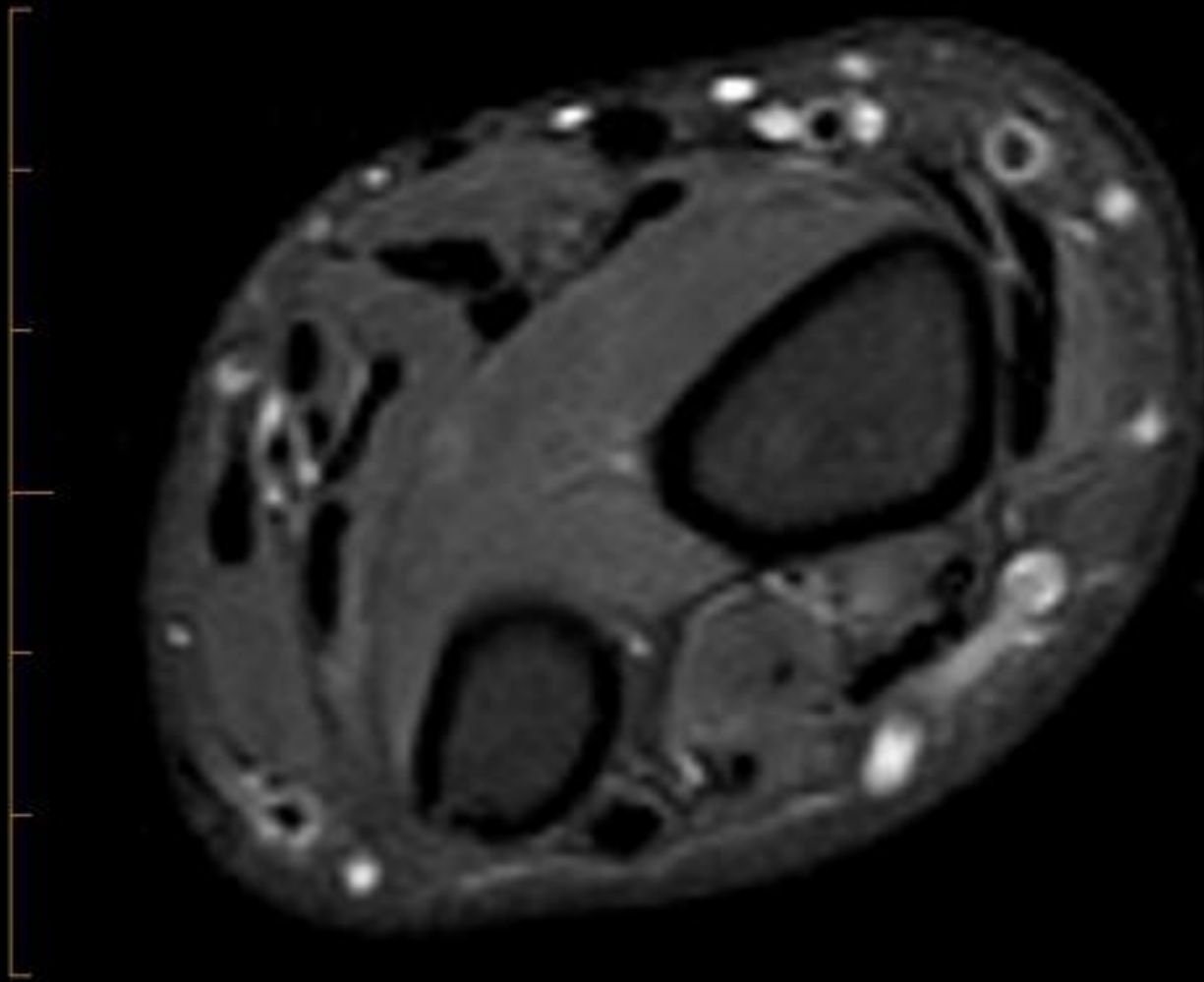
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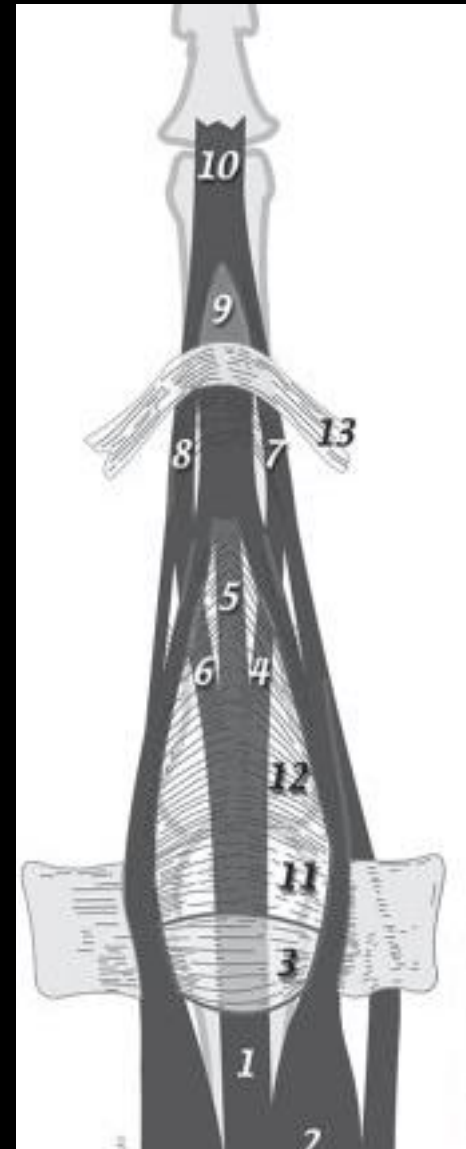


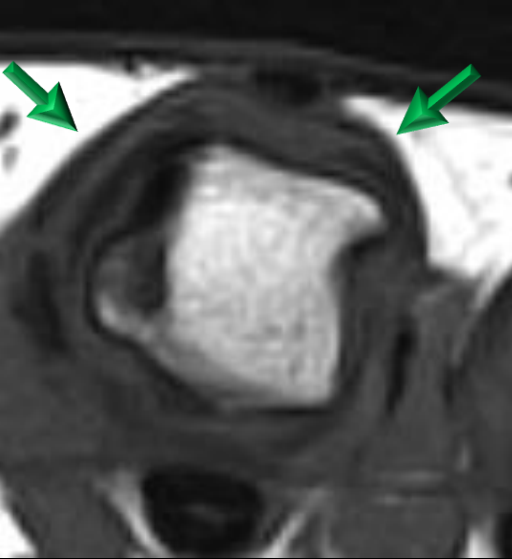
1st- APL and EPB crossing over 2nd – ECRL and ECRB



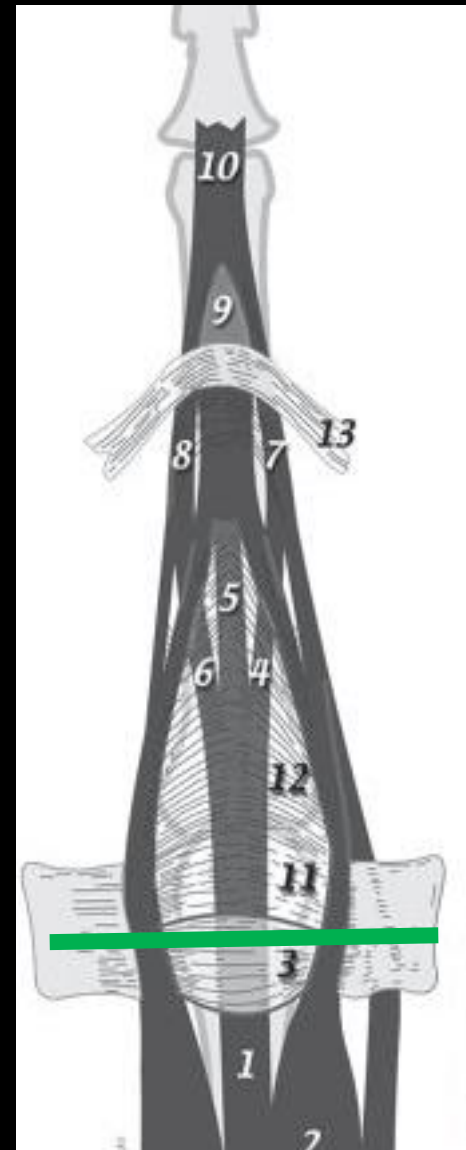
Finger Tendons - Anatomy

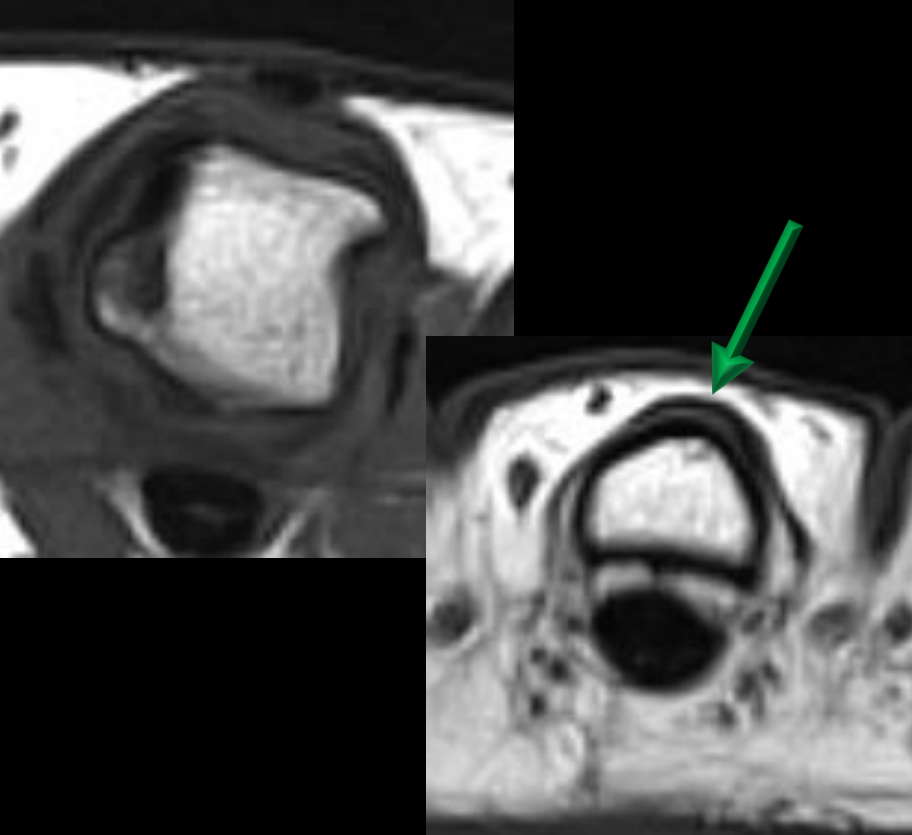
- Extensor digitorum
 - Stabilized by sagittal band MCP
- Central tendon
 - Insert middle phalanx
- Lateral bands
 - Joined by fibers from intrinsic
 - Conjoined tendons
 - Form terminal tendon
 - Insert distal phalanx



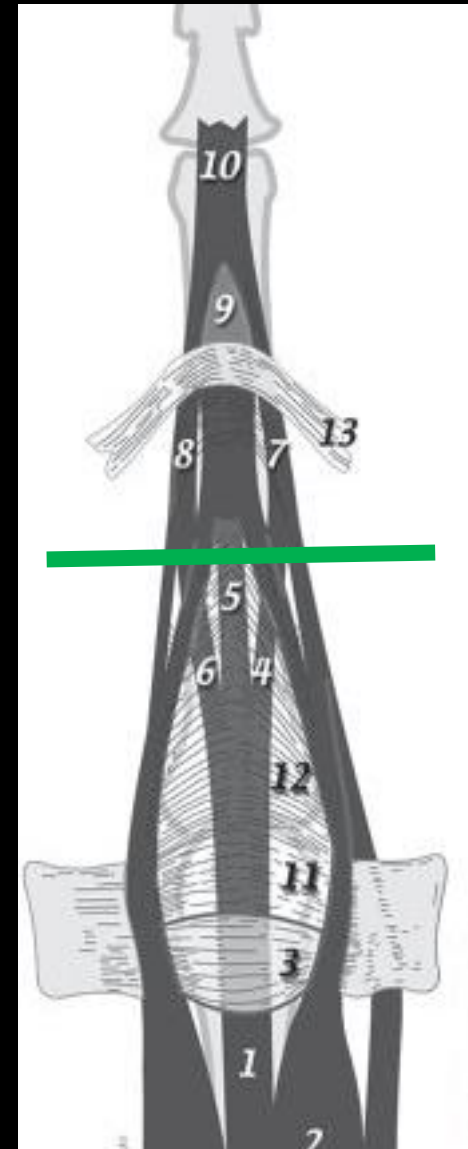


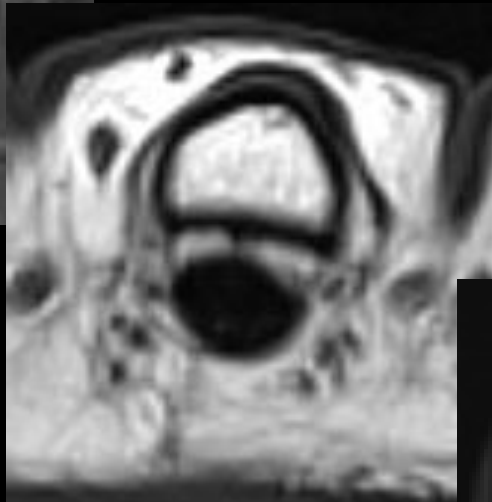
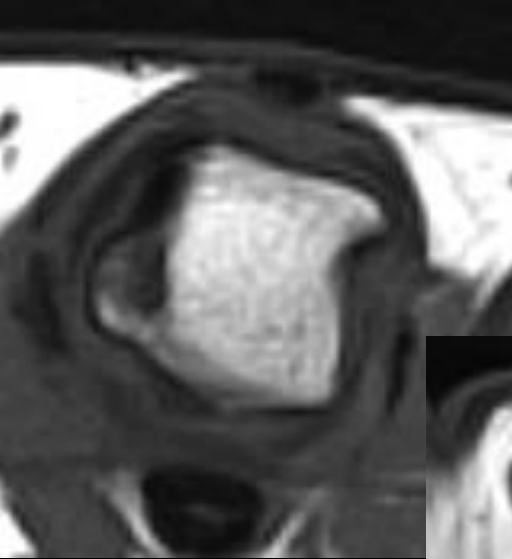
Sagittal bands
at MCP (3)



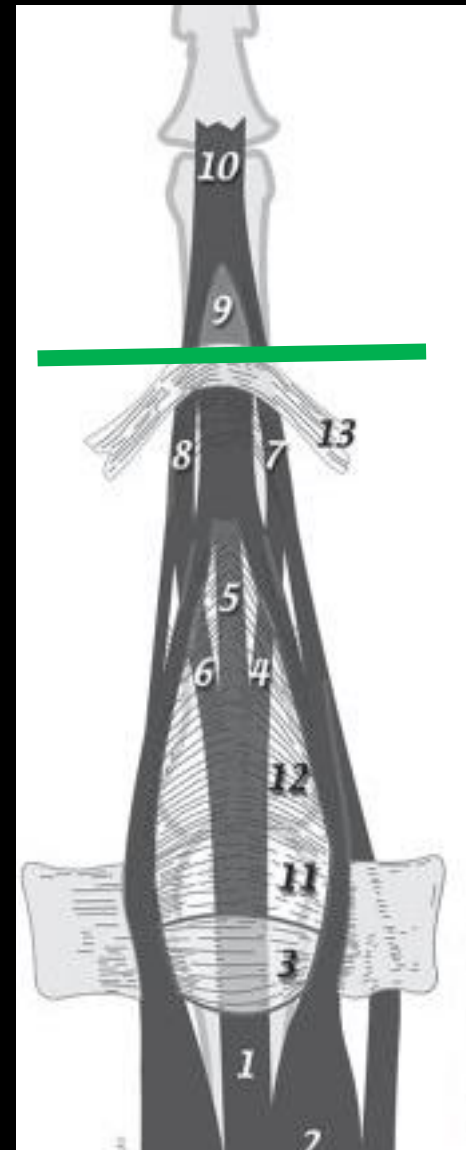


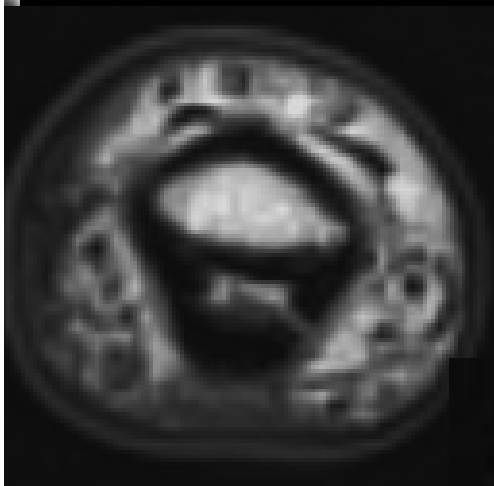
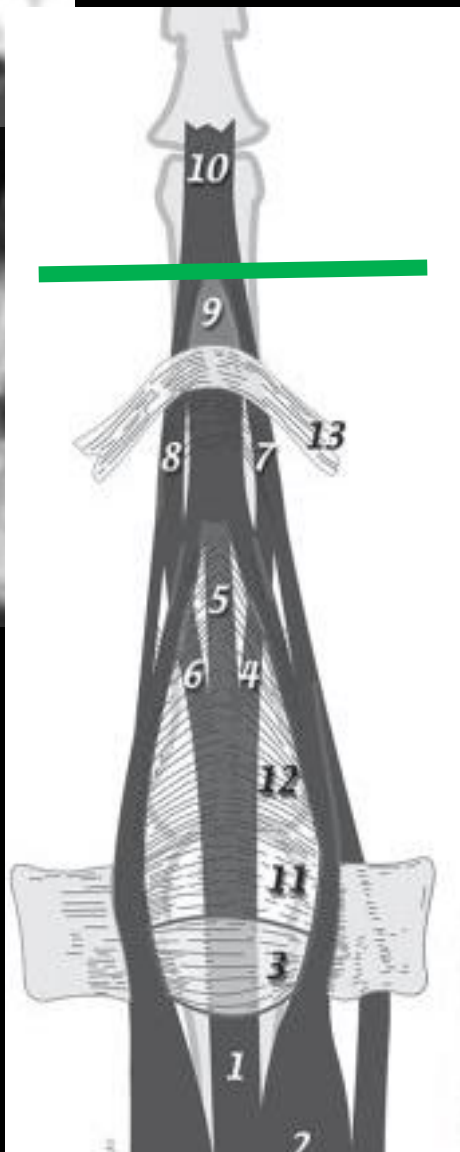
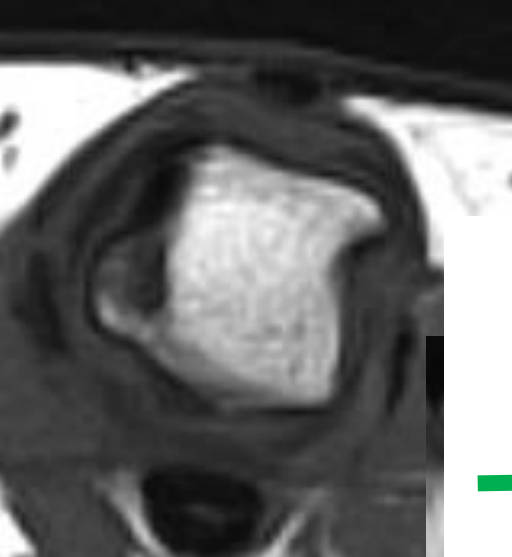
Central
Tendon (5)





Conjoined
Tendons (7,8)

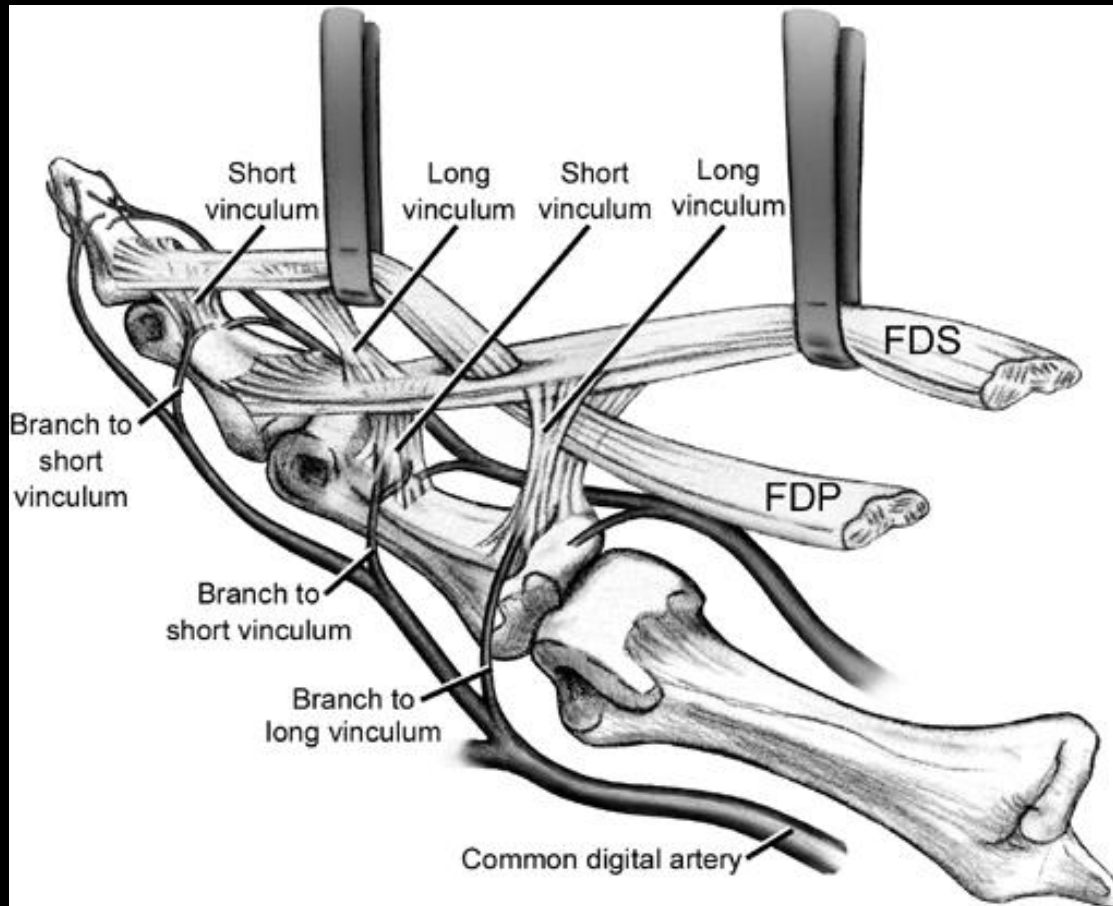


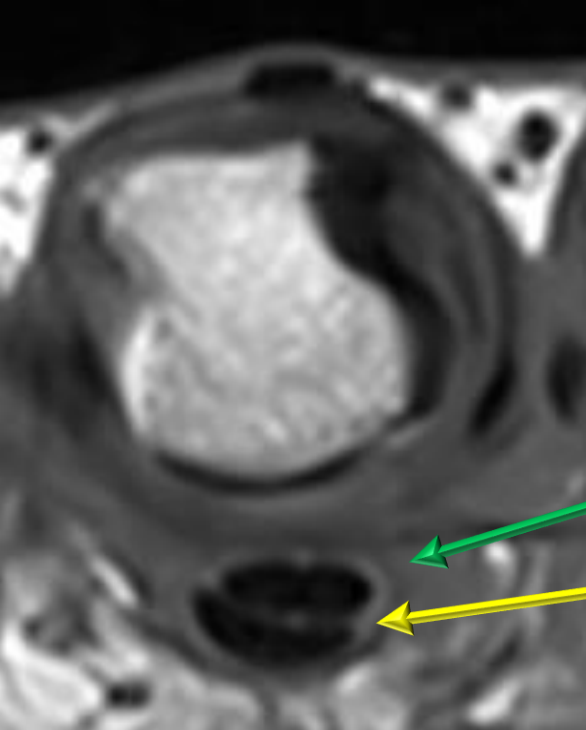


Terminal
Tendon (10)



Finger Tendons - Anatomy

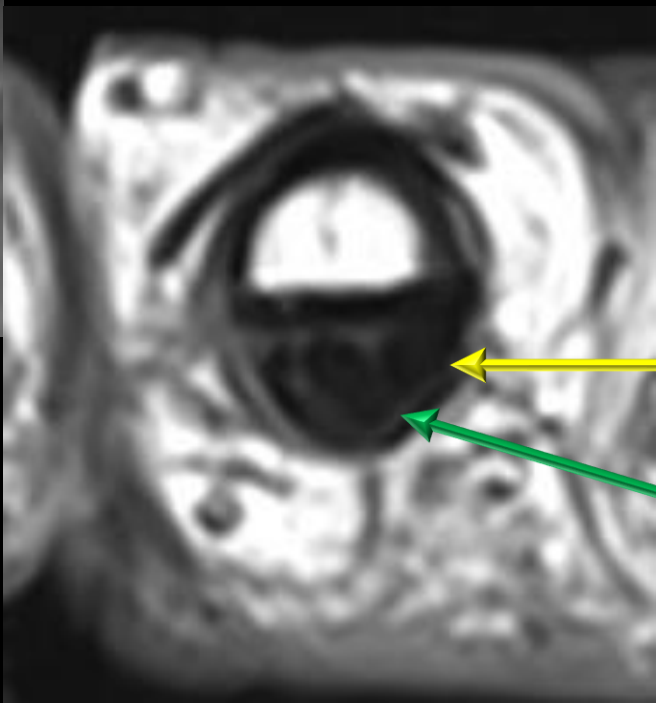
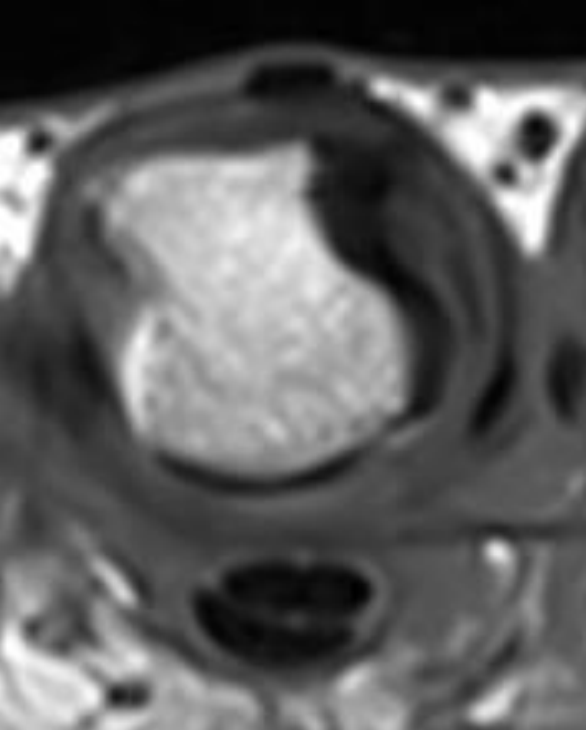




FDP

FDS

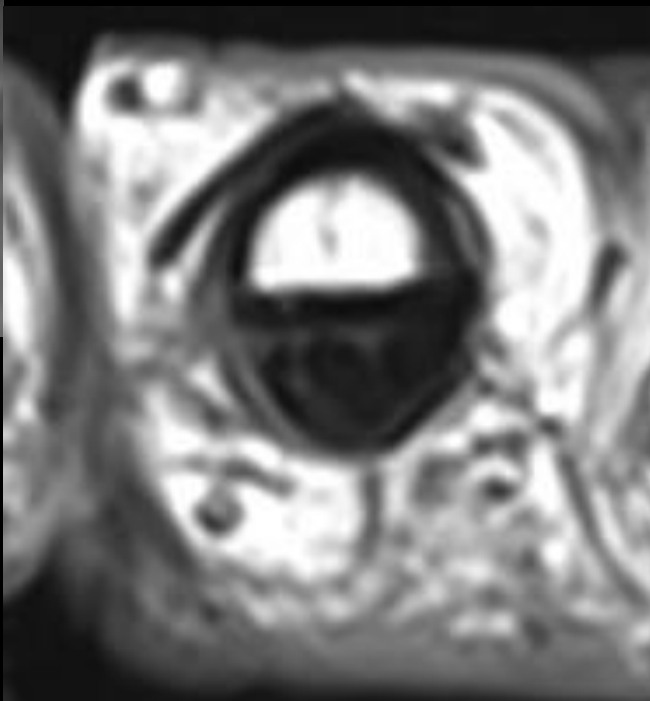
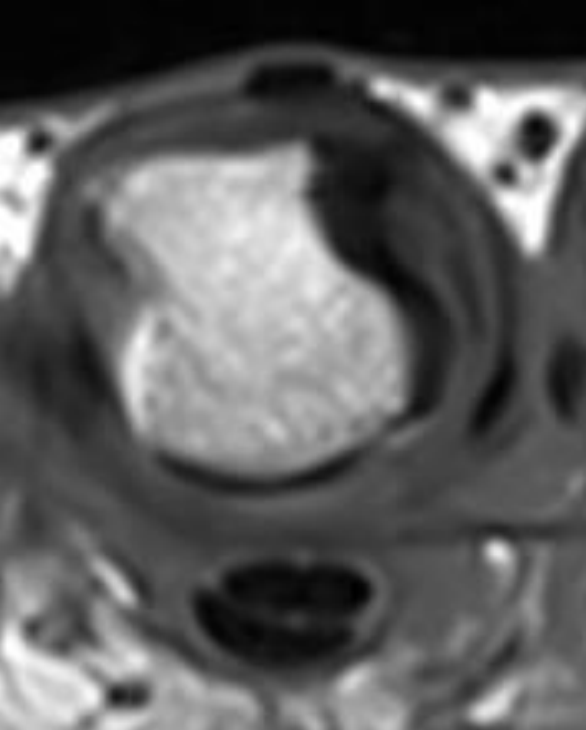
MCP



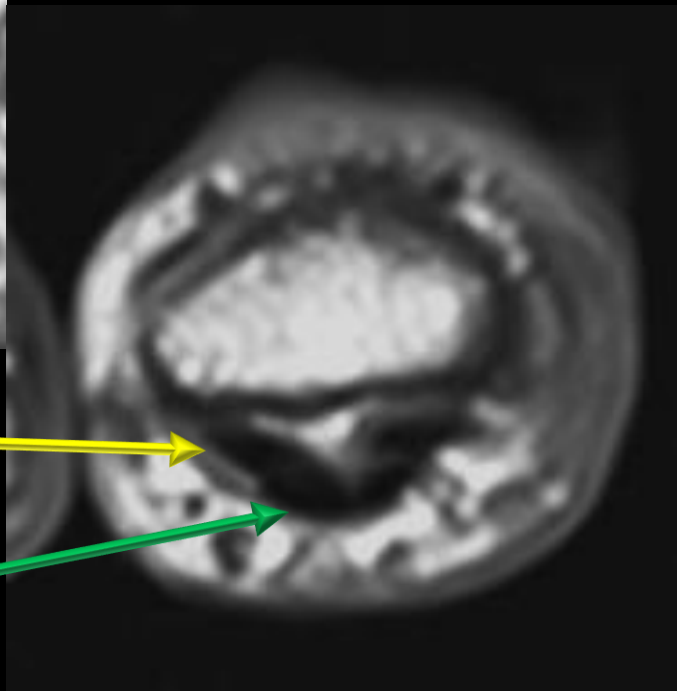
FDS

FDP

Prox-Phal



Mid-Phal

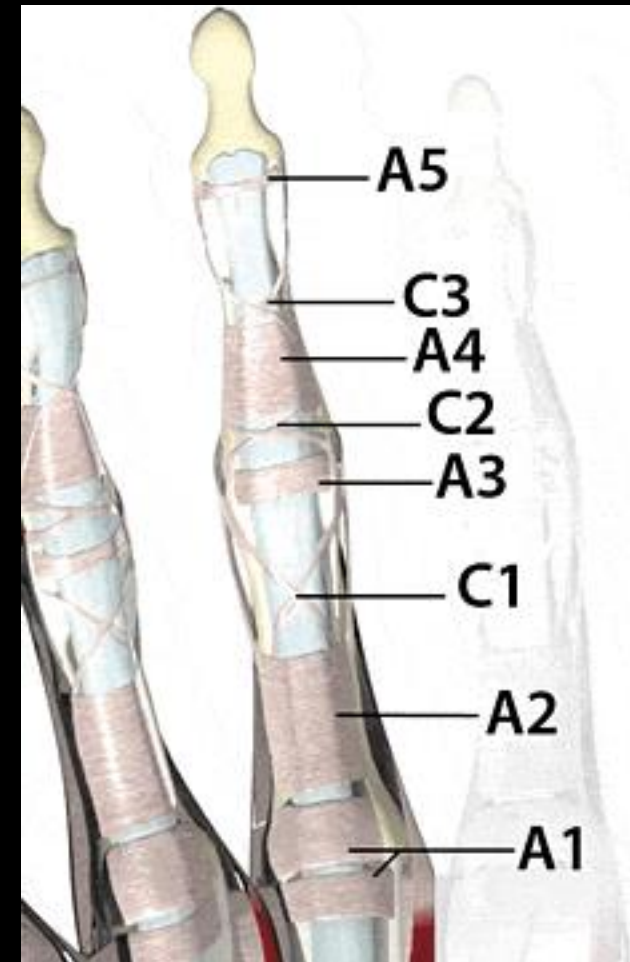


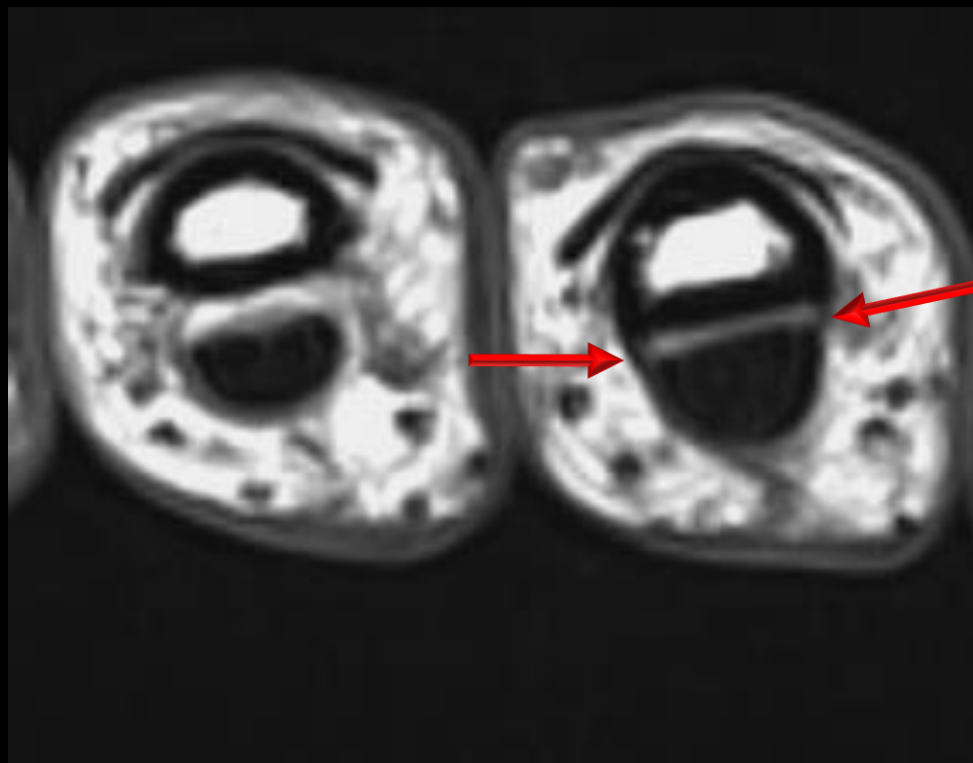
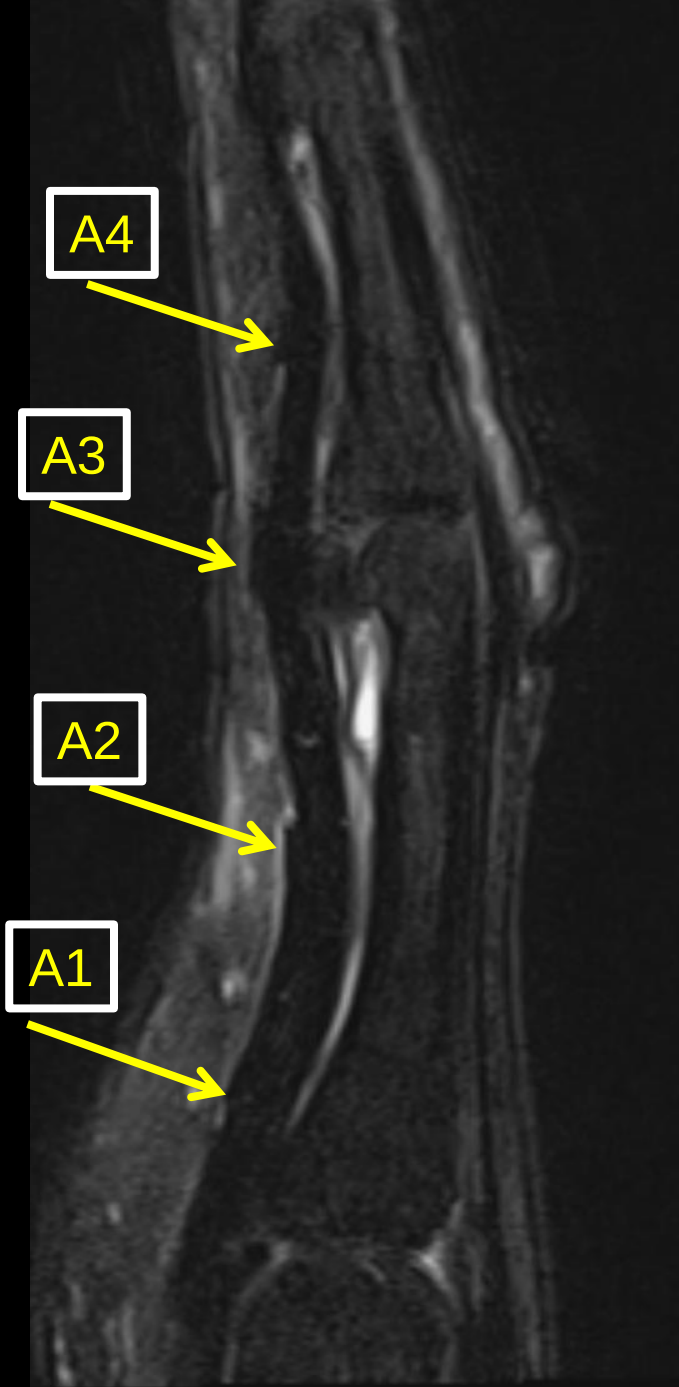
FDS

FDP

Pulley Injuries

- Pulley anatomy
 - 5 annular
 - 3 cruciate
 - Fibro-osseous tunnel
 - Stabilize tendon at flexion



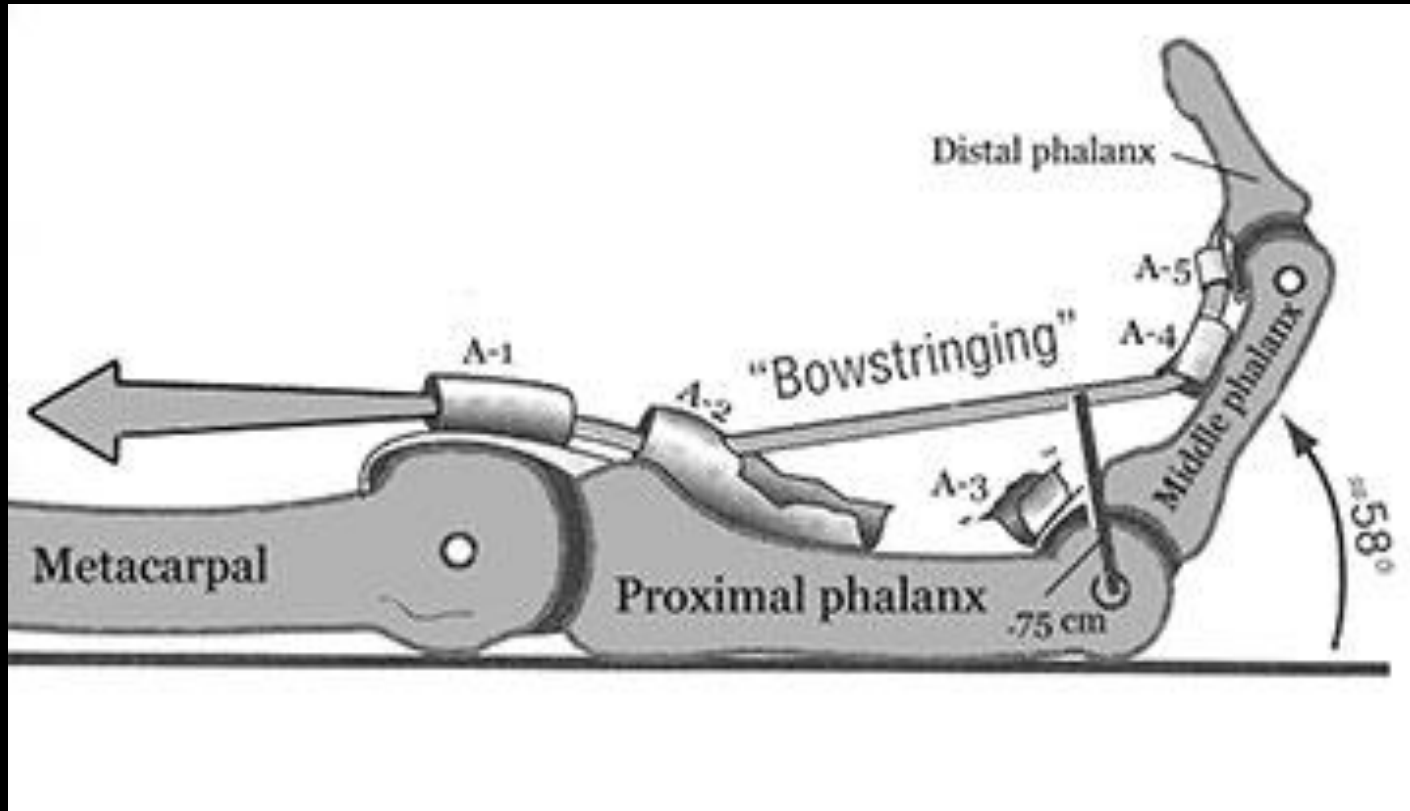


Pulley Injuries

- Rock climbing
 - Crimp position
 - Extended DIP
 - Flexed PIP
 - Extended MCP
 - Hanging finger position
 - Flexed DIP, PIP, MCP
- Middle and ring
- Typically distal A2
 - Then A3, A4
 - A1 rare



Pulley Injuries

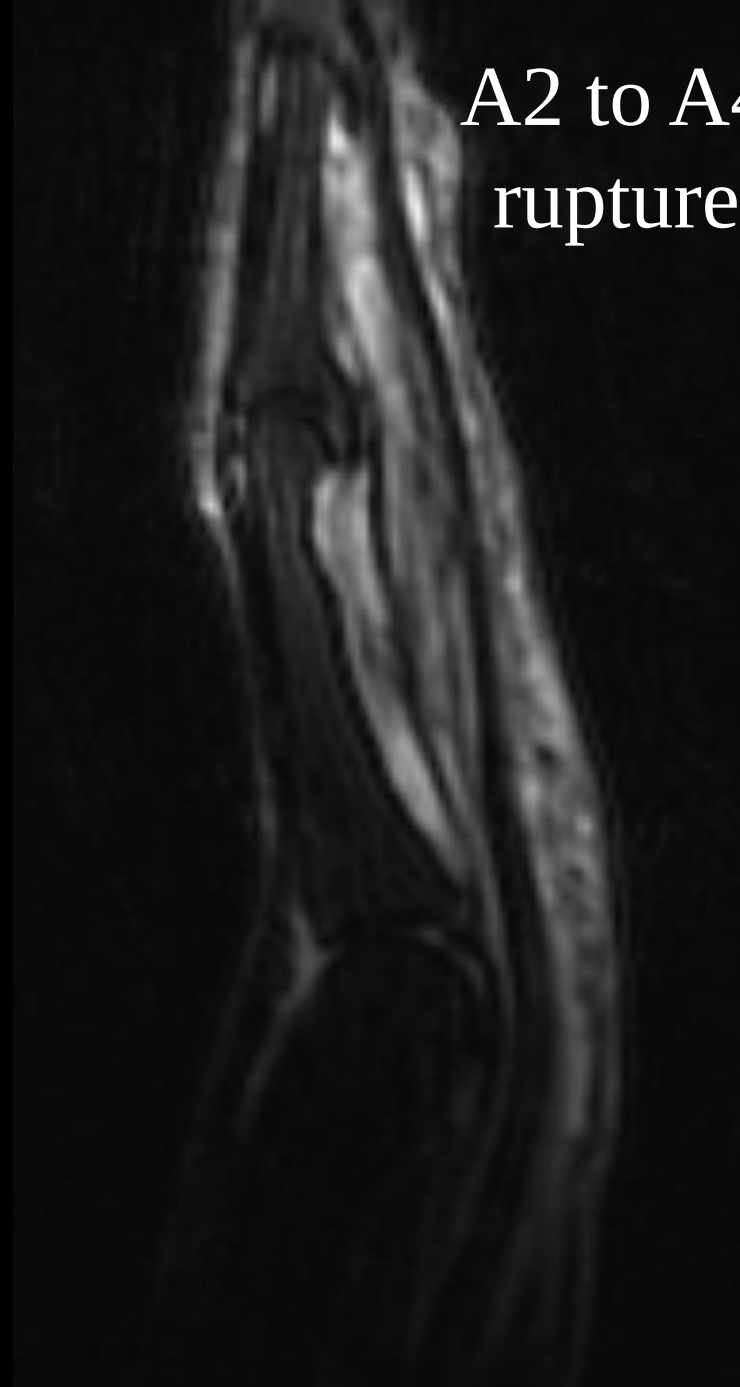
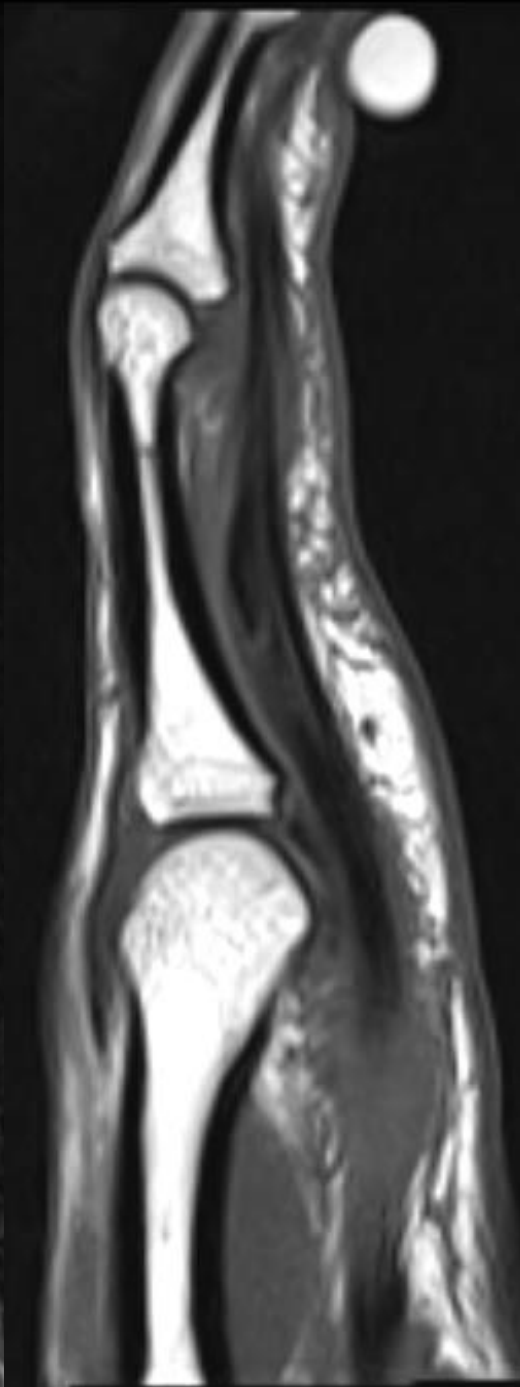
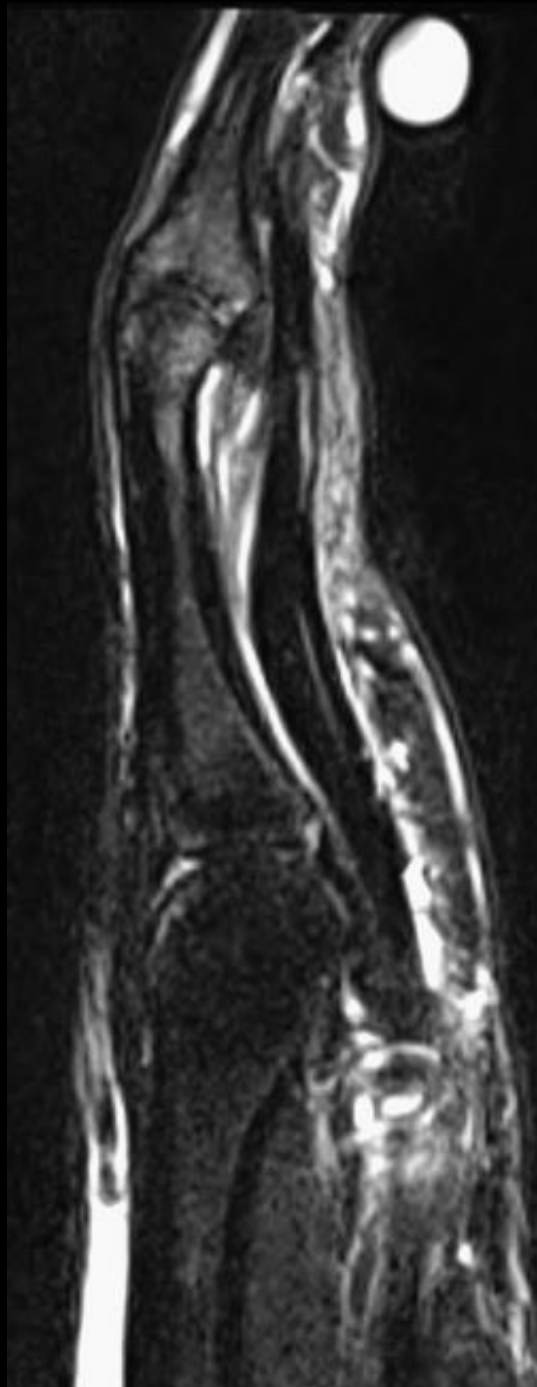


A2 and A3 Pulley Injury

Pulley Injuries

- Direct visualization pulley
- Bowstringing
 - Forced flexion
 - A2
 - Beyond base PP represent complete tear
- Gap tendon to bone
 - 2-5 mm isolated complete
 - 5-8 mm multiple pulleys

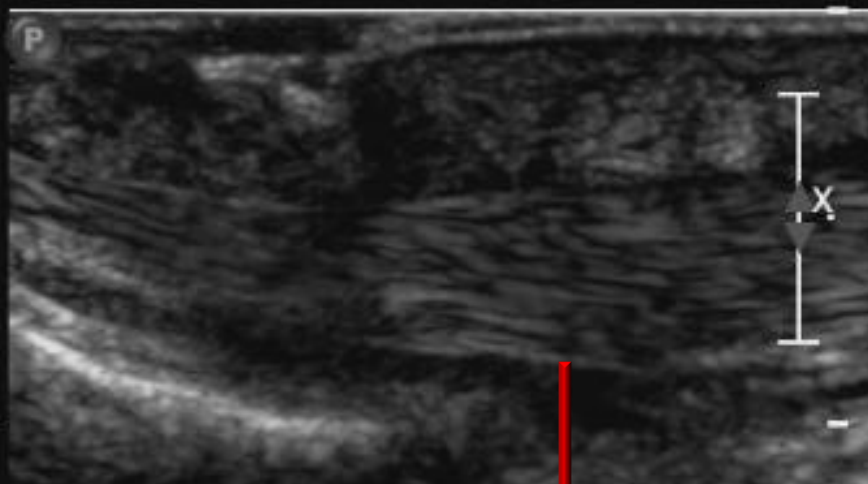
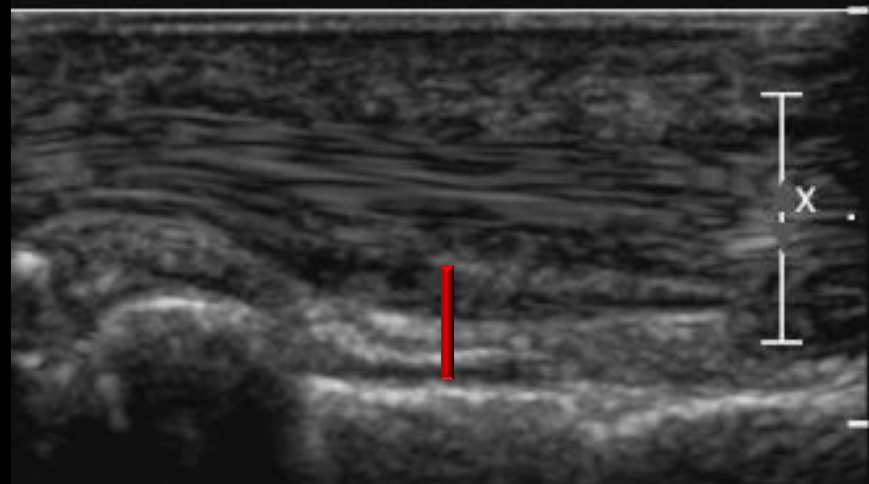




A2 to A4
rupture

EXT

FLEX



1.5

1.5

PIP

LEFT 4TH FINGER

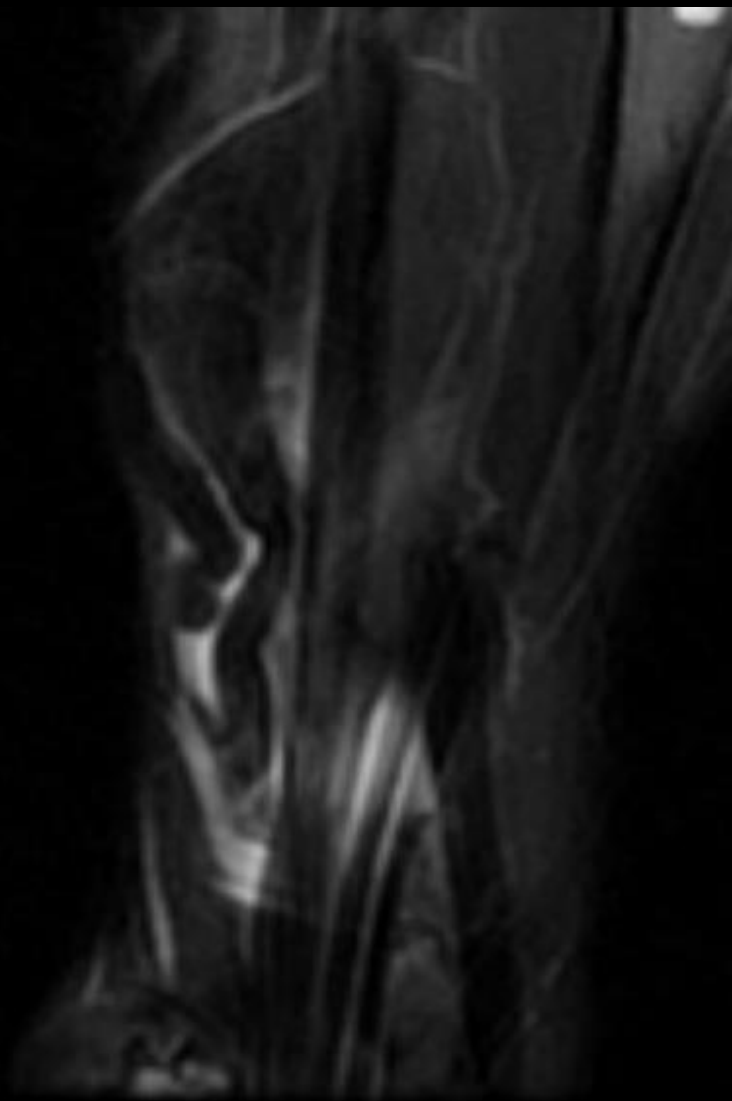
Tendon Injuries - Digits

- Open or closed treatment
- What the surgeon needs to know:
 - Complete or partial
 - Degree of retraction
 - Zone of injury
- MRI or US
 - US: Dynamic

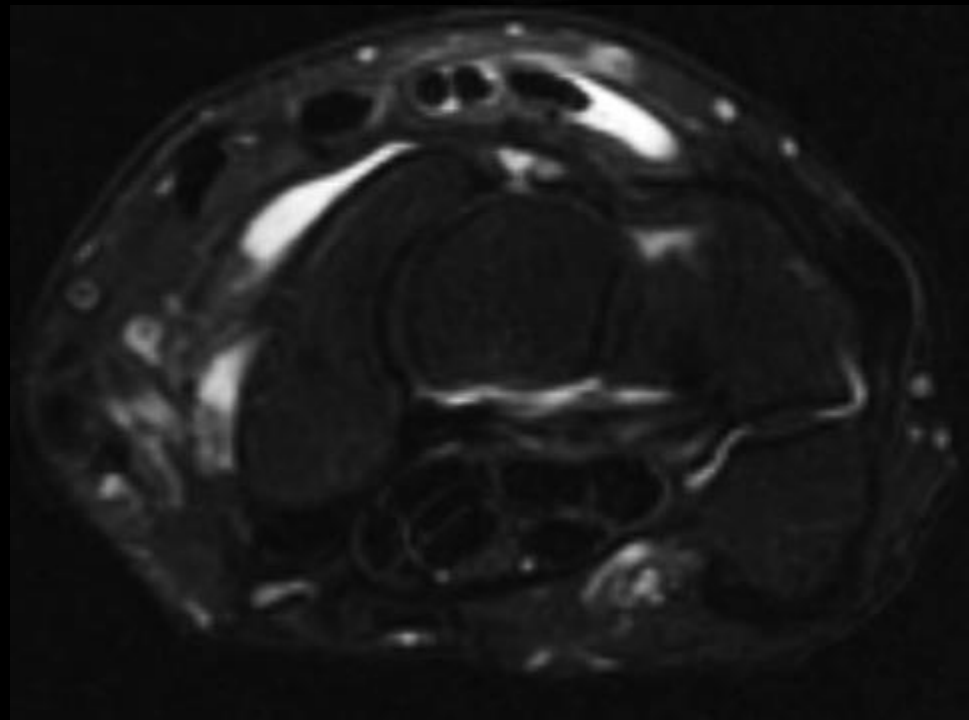
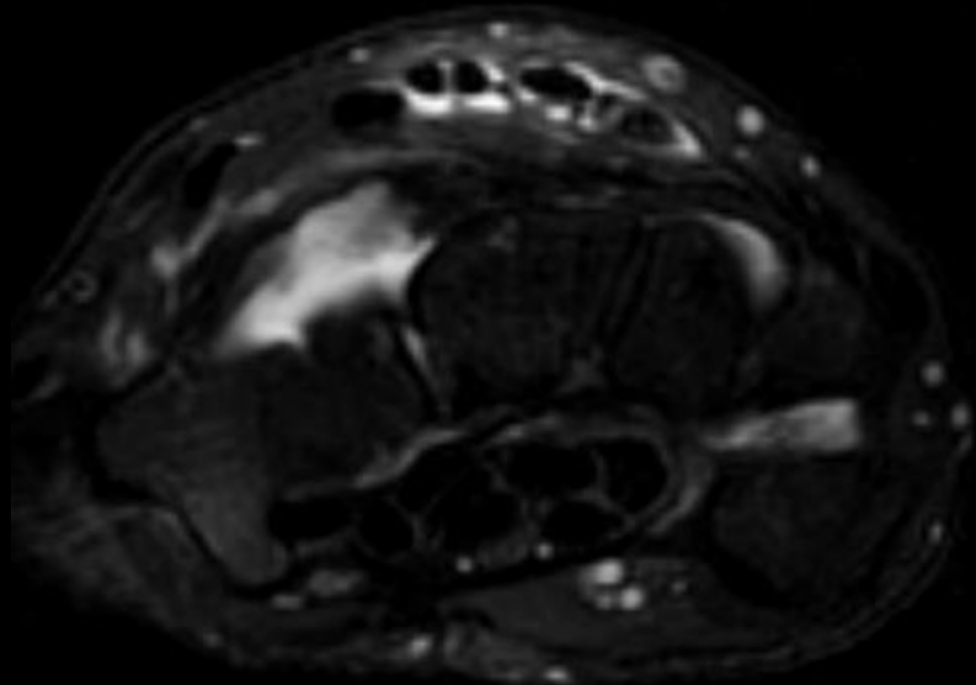
Extensor Tendon Injuries

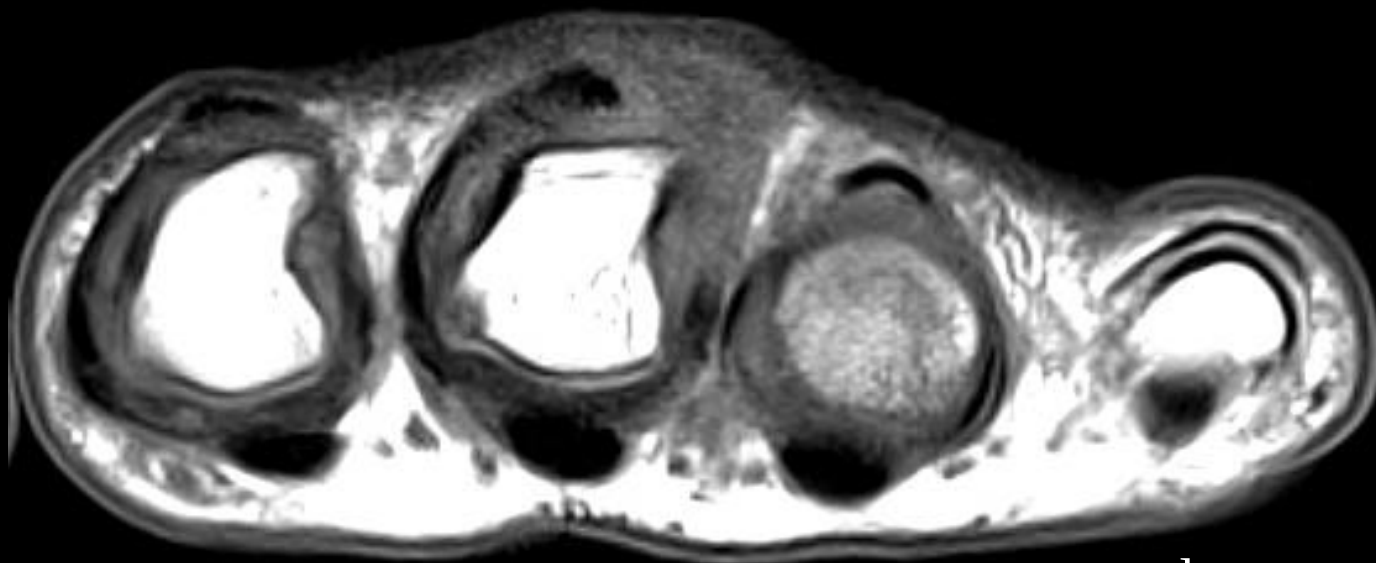
- Zone I: Mallet finger
- Zone III: Boutonniere
- Zone V: Sagittal band tear
- Zone VI: Neurovascular injury
- Zone VII: Retinacular injury



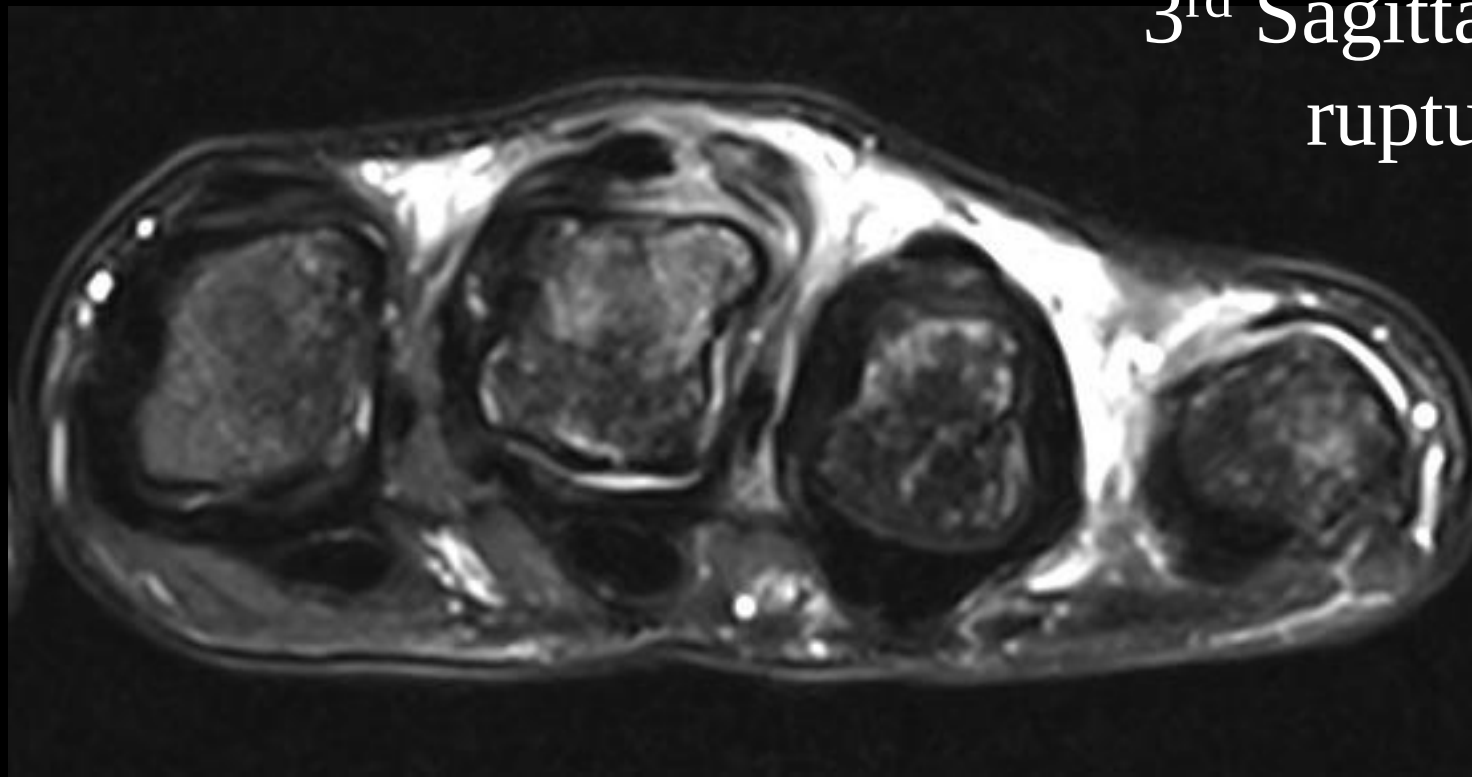


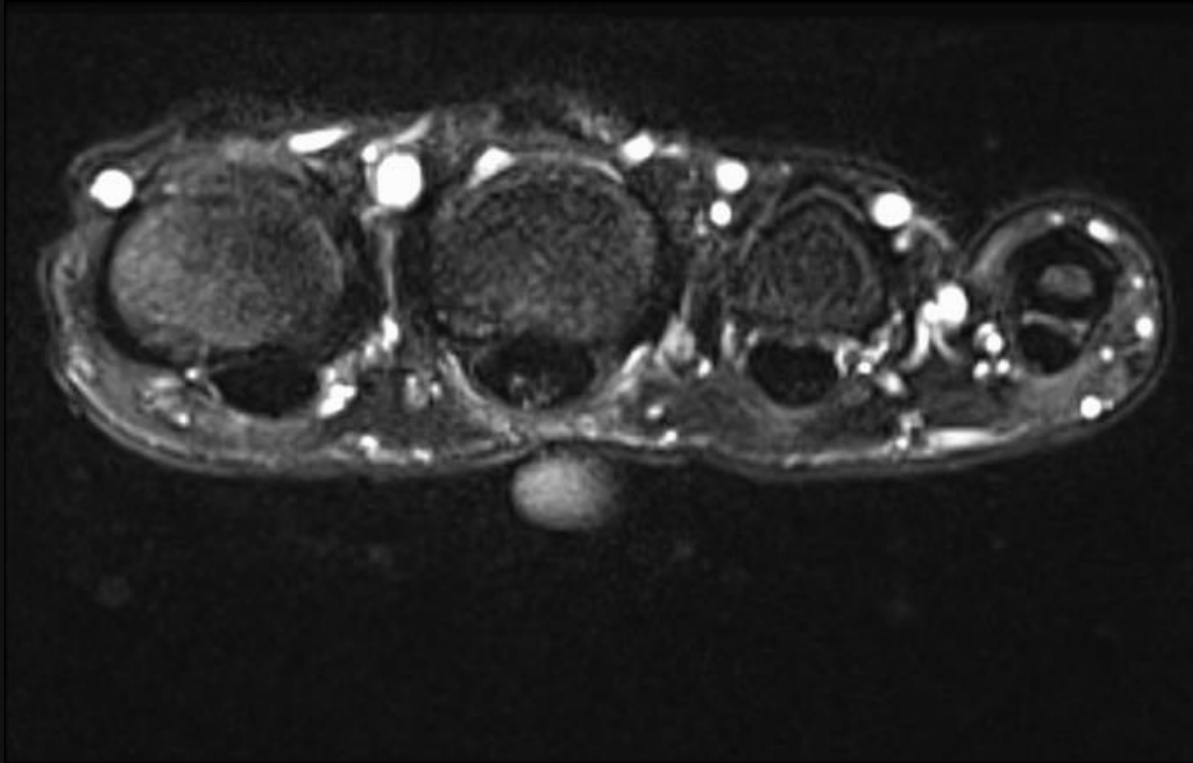
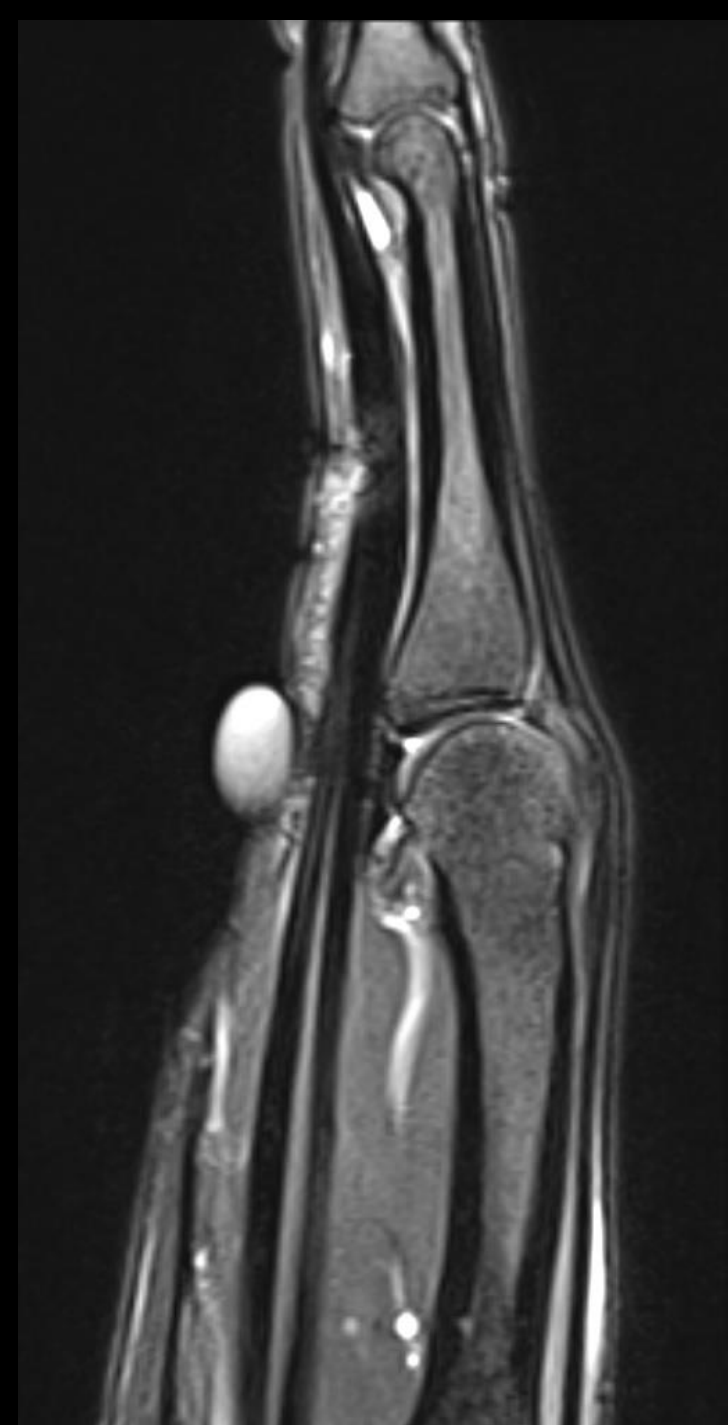
EDC 4th and 5th
rupture



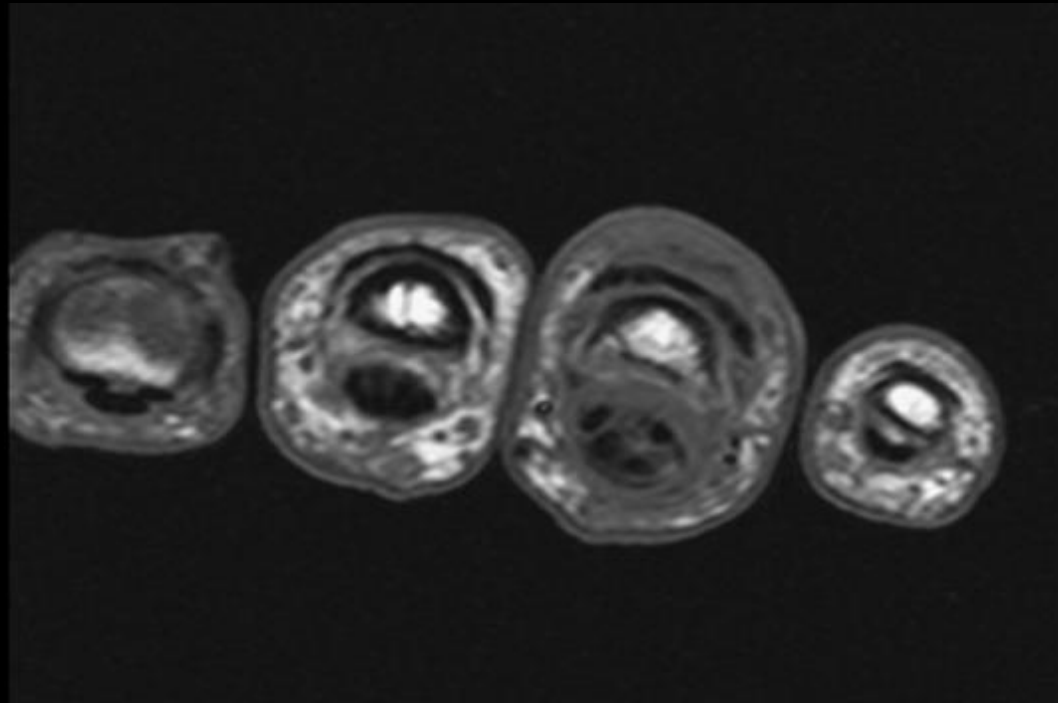
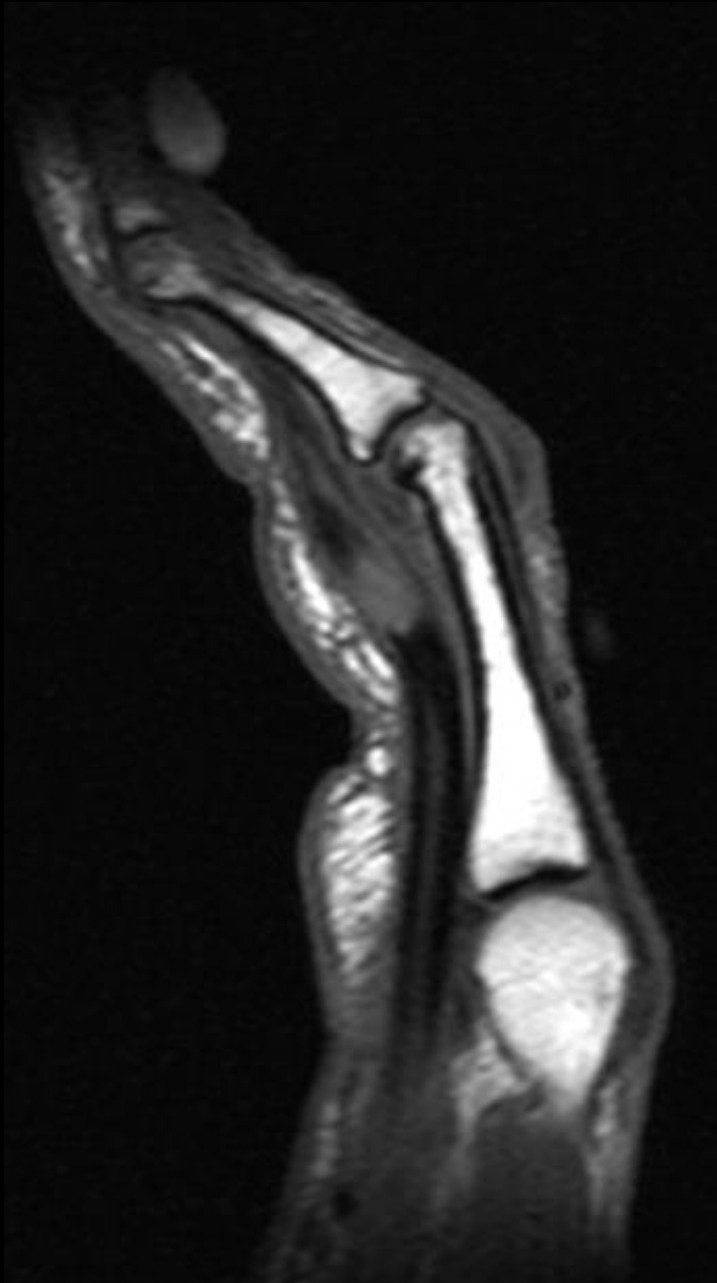


3rd Sagittal Band
rupture





3rd Partial FDS rupture



3rd Partial FDS & FDP rupture

Flexor Tendon Tears

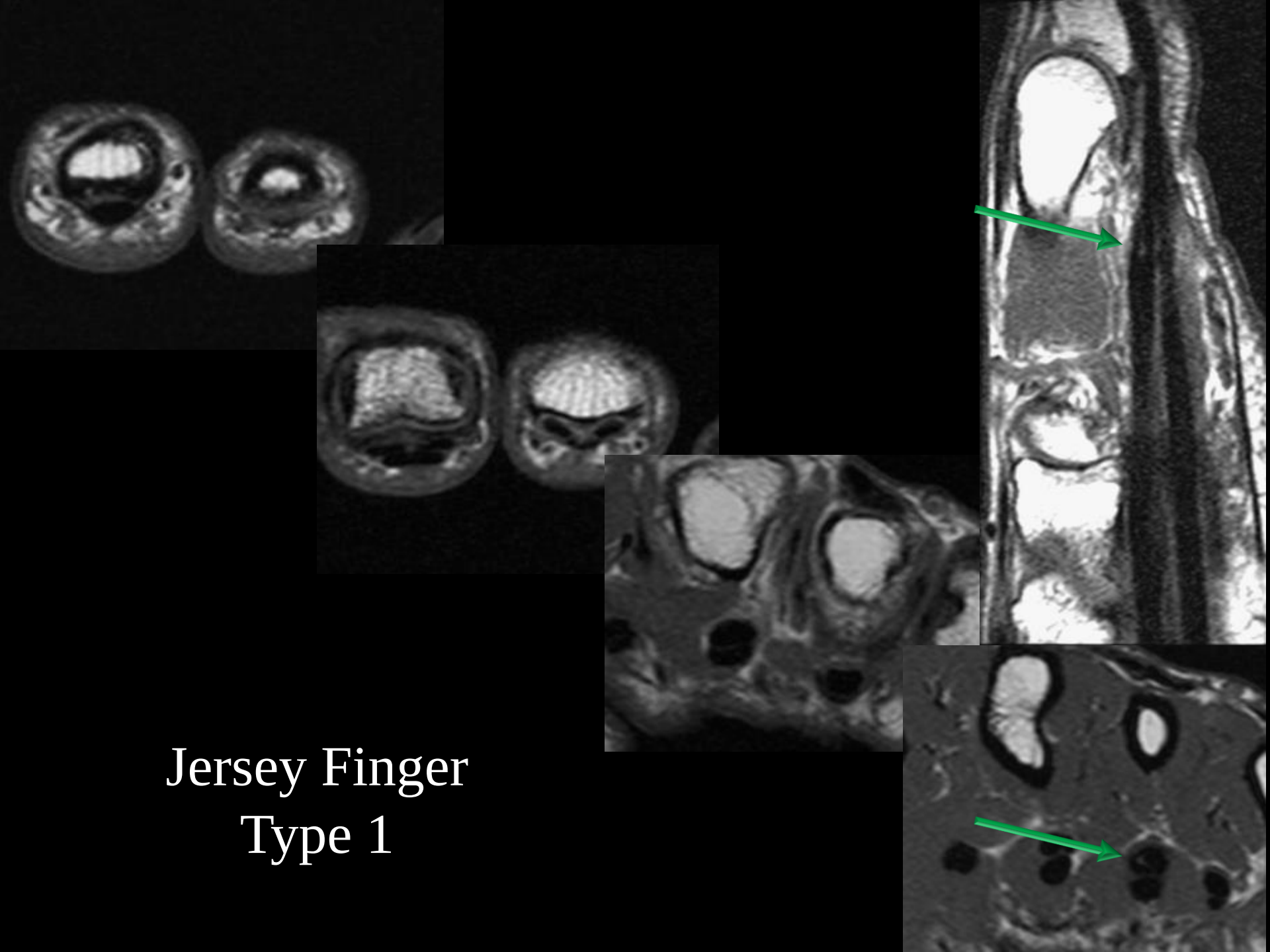
- FDP avulsions:
 - Jersey finger
 - Ring finger
 - Retract
 - A4 pulley (type III): larger fragment
 - A3 pulley / PIP (type II)
 - Palm (type I)



Flexor Tendon Tears

- FDP avulsions: treatment
 - Retract
 - A4 pulley (type III) - **ORIF**
 - A3 pulley / PIP (type II) – **within 6 weeks**
 - Palm (type I) – **within 10 days**





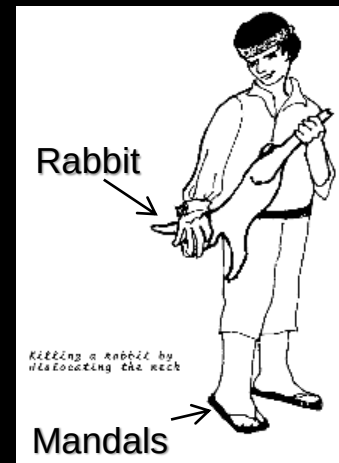
Jersey Finger
Type 1

Gamekeeper's Thumb

- Injury of the ulnar collateral ligament (UCL) of the thumb
 - Historically, chronic injury in Scottish gamekeepers
 - Frequently, due to acute MCP joint hyperabduction
 - **Skier's thumb**: up to 86% of thumb base injuries



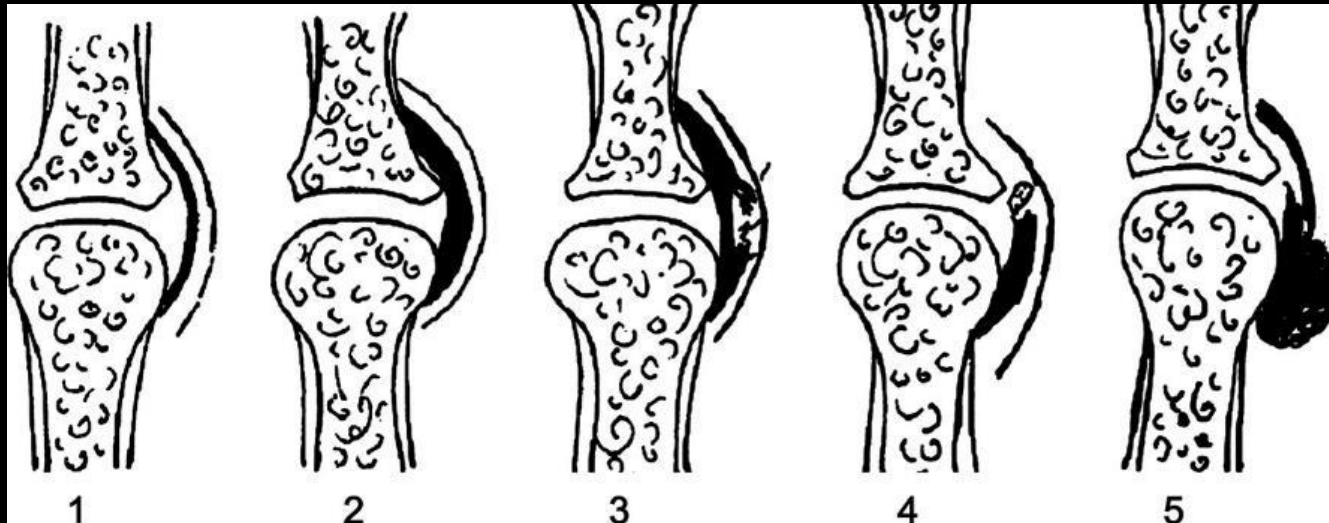
Acute Mechanism



Chronic Mechanism



Ulnar Collateral Ligament: thumb



1
Normal

2
Sprain

3
Partial
Tear

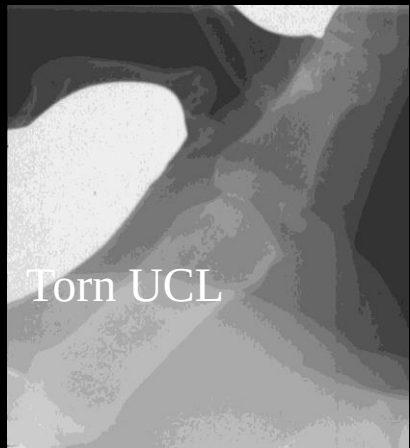
4
Nondisplaced
Complete Tear
(+ fracture)

5
Displaced
Complete Tear
(**Stener Lesion**)









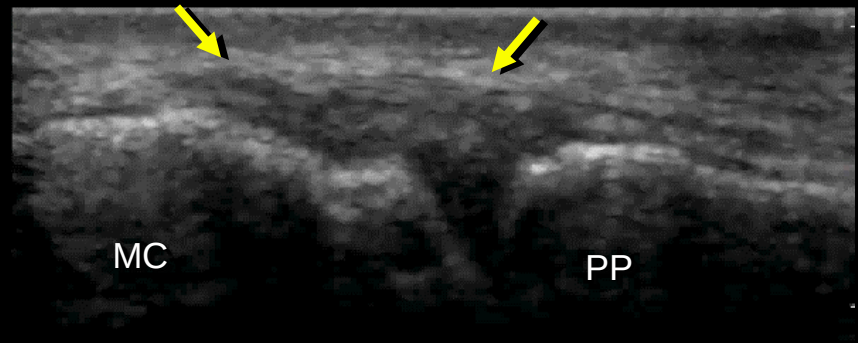
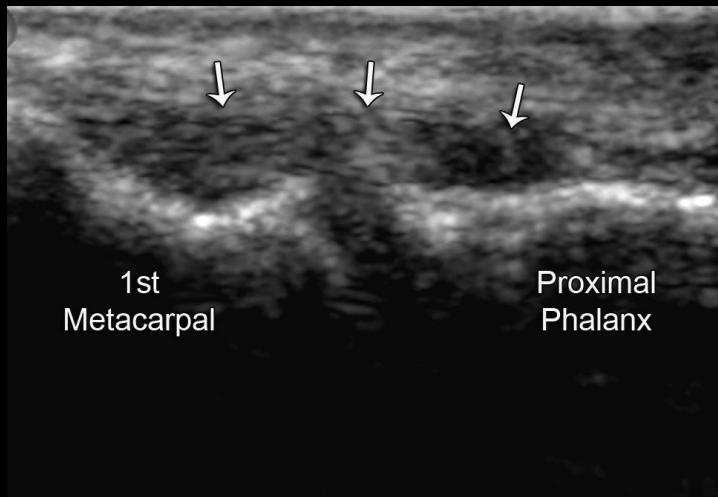
Stress Views



- Stener Lesion: MR imaging
- Interposition of adductor pollicis aponeurosis between torn UCL and base of proximal phalanx
- Surgical lesion



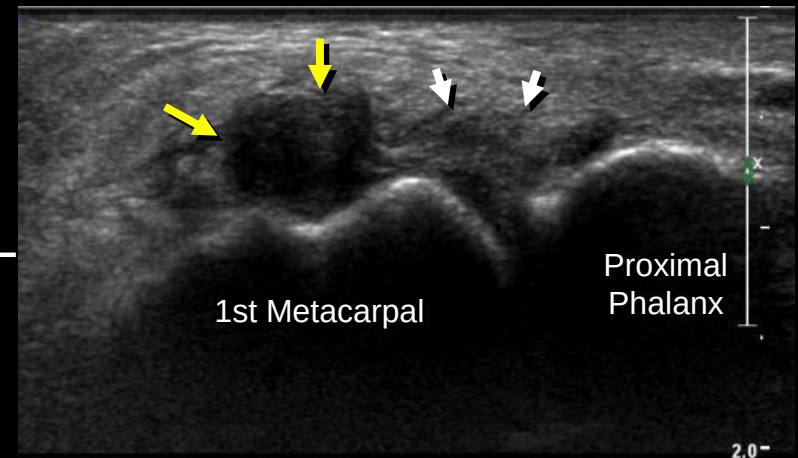
Ulnar Collateral Ligament: thumb



Note: sliding of adductor aponeurosis with isolated interphalangeal joint flexion

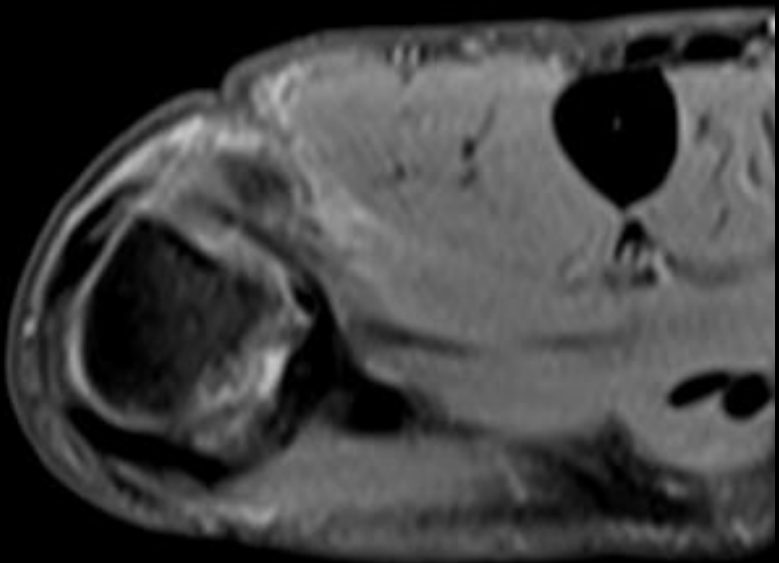
Stener Lesion

- Displaced proximal stump of UCL
 - Hypoechoic & round
 - Proximal to MCP joint
 - At proximal edge of adductor pollicis aponeurosis
- No tissue spanning MCP joint
- “Yo-yo on a string” sign
- Ultrasound: 100% accuracy*

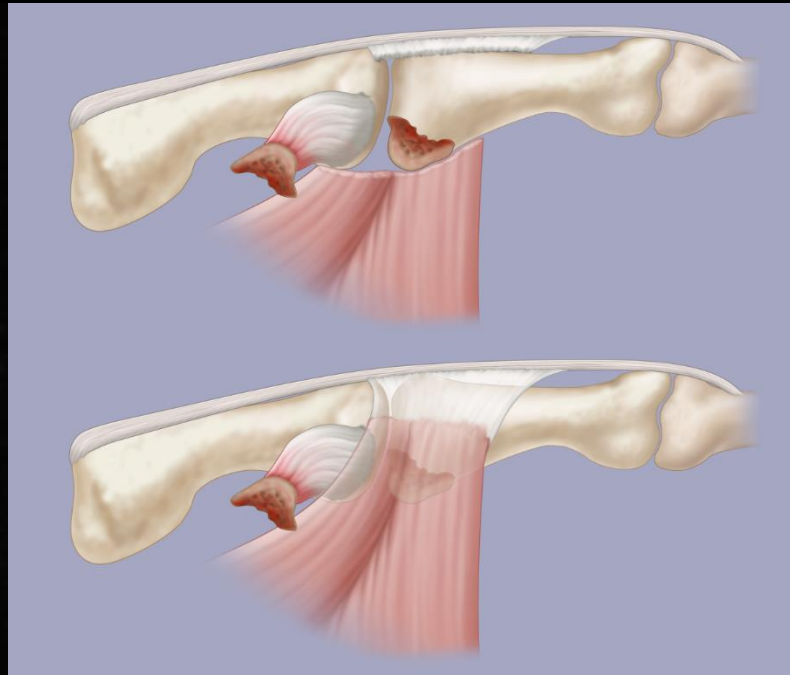


Yellow arrows:
Stener
White arrows:
aponeurosis



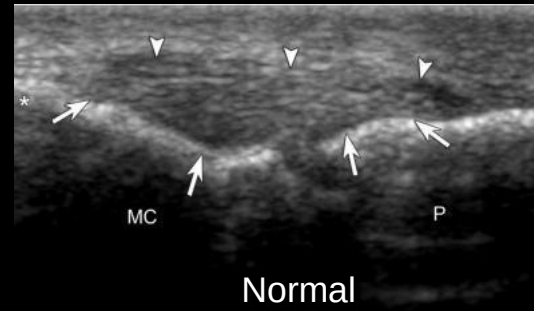
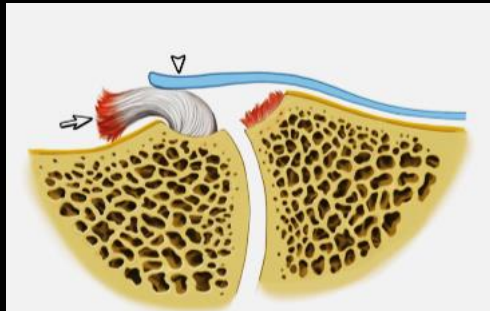
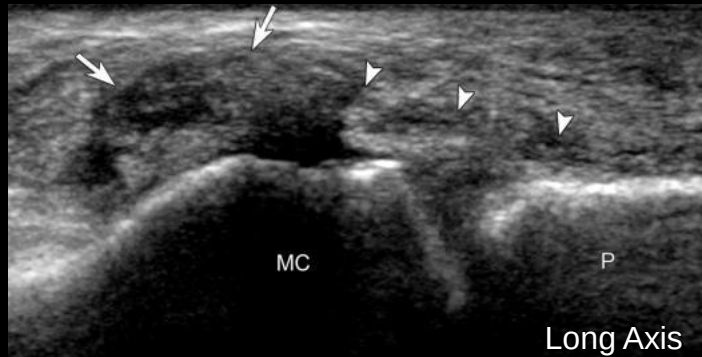


STENER LESION

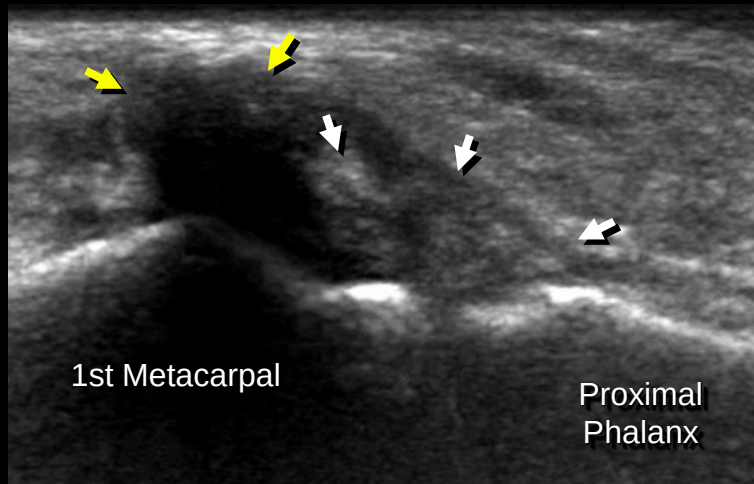


- UCL: retract and displaces superficial to the adductor aponeurosis
- Requires surgical repair: leads to instability and early arthrosis

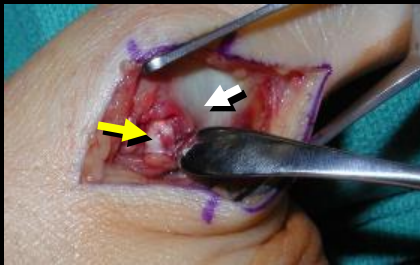
Stener Lesion



Stener Lesion: dynamic



White arrows = adductor aponeurosis
Yellow arrows = Stener lesion



Normal

r. Lucas

19-Aug-2006 10:54
Ac-023292141352631
Series: 12
01.09.1990
M

Murphey, Lucas
19-Aug-2006 10:54



ID:839062

Murphey, Lucas
ID:839062
01.09.1990
M



CONCLUSION

- Occult fractures
- AVN
 - Scaphoid: MRI T1 +/- Gadolinium
 - Early stages, chondral change, fracture
- Tendon injuries
 - MRI or US
 - Complex anatomy
 - Axials most useful
- UCL injury thumb
 - MRI or US
 - Look for retraction (Stener)