Wrist Extensor Retinaculum and Dorsal Compartments

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Outline

- Background
- Research project - Purpose, Materials/Methods
- Anatomy of the extensor retinaculum of the wrist
  - Radial and ulnar attachments
- 6 Dorsal wrist compartments
  - 1st compartment
    - deQuervain's tenosynovitis
    - Subcompartmentalization
    - Video - Sectioning Step 1
  - 2nd compartment
    - Carpal boss
    - Video - Sectioning Step 2
  - 3rd compartment
    - Intersection syndrome (proximal and distal)
    - Video - Sectioning Step 3
  - 4th compartment
    - Accessory muscles
    - Dorsal wrist impingement
    - Research project - Results
    - Video - Sectioning Step 4
  - 5th compartment
    - Extensor retinacular tear
    - Video - Sectioning Step 5
  - 6th compartment
    - Subsheath tear
    - Erosion of 6th compartment
    - Video - Sectioning Step 6
- Multicompartment tenosynovitis
- Summary

Wrist Extensor Retinaculum

- Complex system which maintains extensor tendon anatomy and function by preventing bowstringing
- Specialized fascia which circumferentially extends around the radius and ulna
  - Originates as an extension of the forearm fascia
    - Superficial
    - Deep
      - Thickens distally to become the distal annular ligament
      - Contributes to the extensor retinaculum
- Retinaculum is further divided
  - Superficial or supratendinous retinaculum
  - Deep or infratendinous retinaculum
- Attached to the radius by multiple septa which have been used as harvest sites for autogenous ligament reconstruction

Extensor Retinaculum Project

- Purpose
  - Demonstrate extensor retinaculum anatomy utlizing MR, ultrasound, tenography and gross anatomic section
  - Morphologic changes before and after wrist dorsiflexion
  - Correlate changes with dorsal wrist impingement

Extensor Retinaculum Project

- Materials/Methods
  - 10 wrists (7 male, 3 female)
    - Ages 53-91, average 77.5
  - MR imaging
    - Samples thawed for 24 hours prior to imaging
    - Imaging in various positions (neutral, supination, pronation, dorsiflexion)
      - T1: TR: 500, TE: 14, matrix: 384x288, FOV: 7x5.25, thick: 2.0 mm, interslice gap 0.6 mm, NEX: 6, BW: 19.23
      - PD FSE: TR: 1800, TE: 6, matrix: 512x320, FOV: 8x5.6, thick: 2.0 mm, interslice gap 0.4 mm, NEX: 6, BW: 19.23, ETL: 3
    - Acquired in axial, sagittal planes

Extensor Retinaculum Project

- Materials/Methods
  - Tenography
    - Samples thawed at least 24 hours prior to injection
    - Utilized ultrasound to inject 1: 200 solution of dilute gadolinium (Magnevist/Omnipaque 350 with gelatin)
    - 20 gauge needle used to inject mixture into the 4th and 6th extensor compartments
  - MR imaging after ultrasound guided tenography
    - Imaging in various positions (neutral, supination, pronation, dorsiflexion)
    - PD FSE: TR: 1800, TE: 6, matrix: 512x320, FOV: 8x5.6, thick: 2.0 mm, interslice gap 0.4 mm, NEX: 6, BW: 19.23, ETL: 3
    - Post injection T1 FS: TR: 500, TE: 14, matrix: 384x288, FOV: 7x5.25, thick: 2.0 mm, interslice gap 0.6 mm, NEX: 2, BW: 3.01
    - Acquired in axial, sagittal planes

Extensor Retinaculum Project

- Materials/Methods
  - Sectioning
    - 5 sagittal
      - 3 samples in neutral position
      - 2 samples in dorsiflexion
    - 5 axial
      - 1 samples in neutral position
      - 2 samples in supination
      - 2 samples in dorsiflexion

Supratendinous Extensor Retinaculum

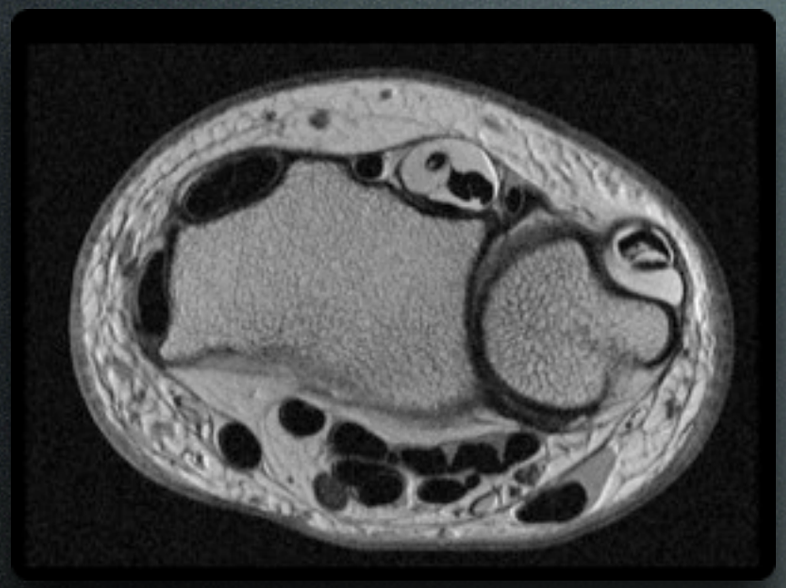
- Begins 2-3 cm proximal to the radiocarpal joint
- Distal retinaculum is thicker than the proximal portion
- Ends at the carpometacarpal joint

Rohen/Yokochi. Color Atlas of Anatomy. 3rd Ed.

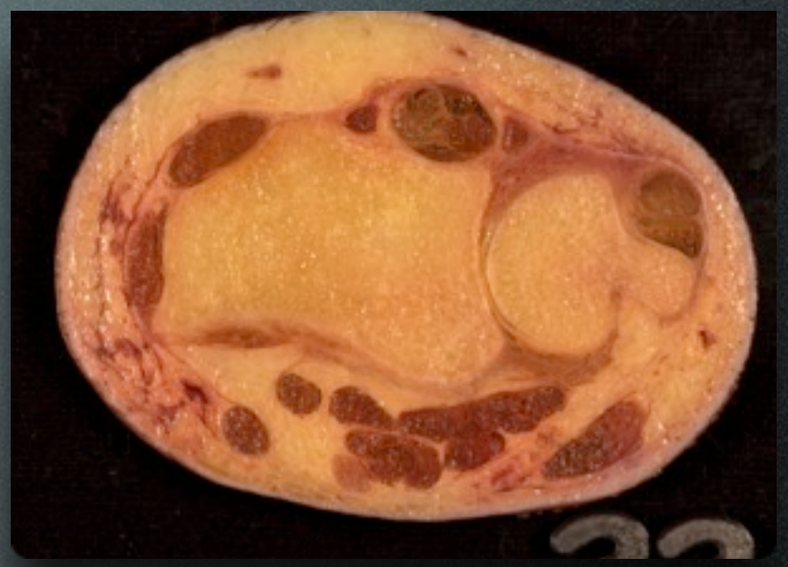
Radial attachment site

- Proximal portion extends around the radius to invest the flexor carpi radialis tendon and blend with the palmar antebrachial fascia
- Central fibers insert onto the radius forming the septa for the 1st dorsal compartment
- Distal fibers blend with fascia overlying the thenar eminence

Axial PD



Axial PD



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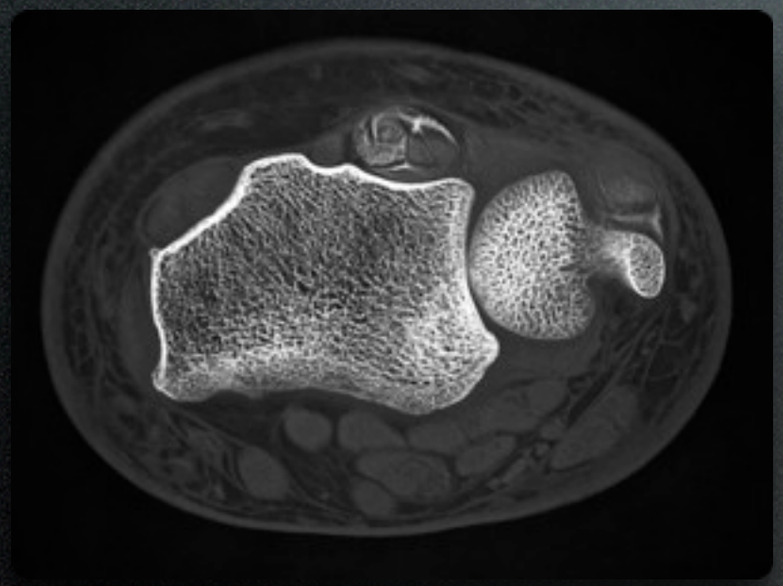

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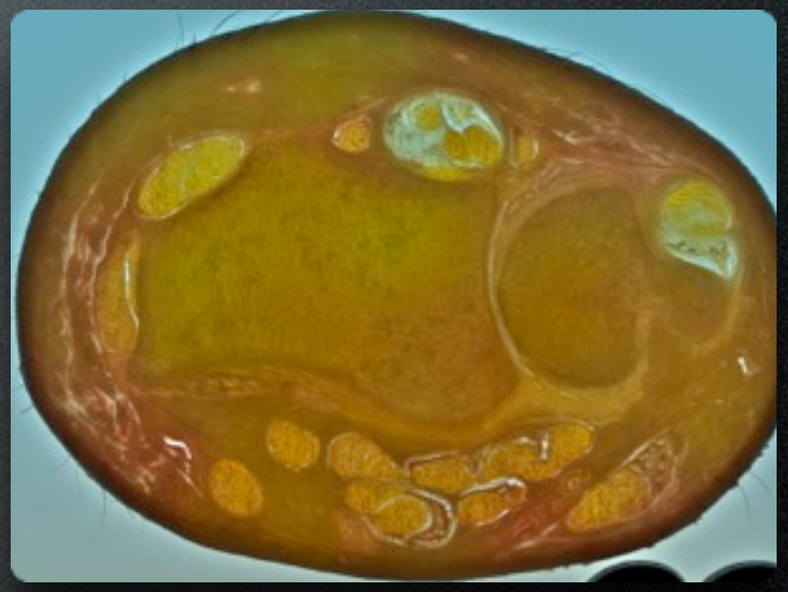
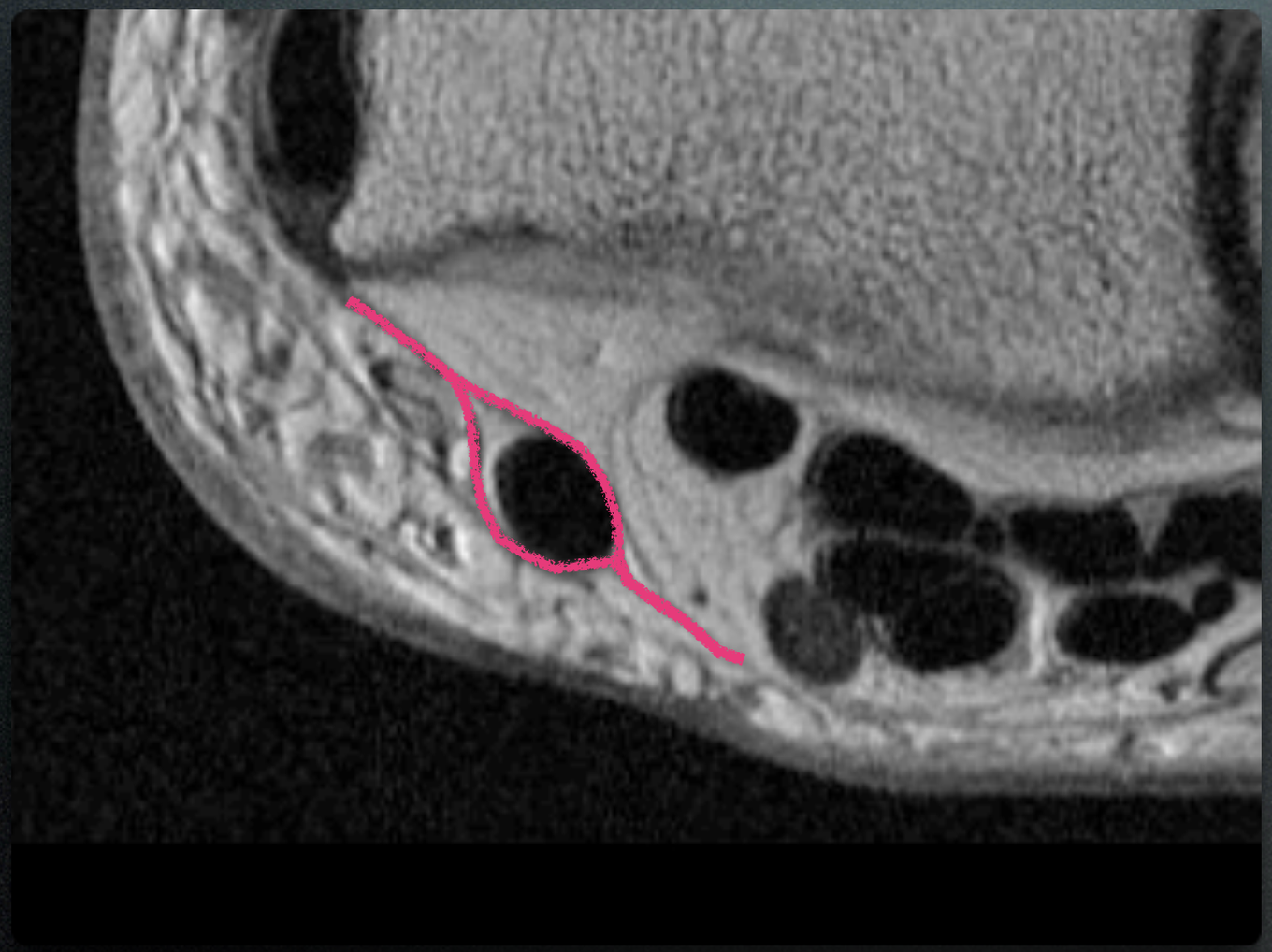
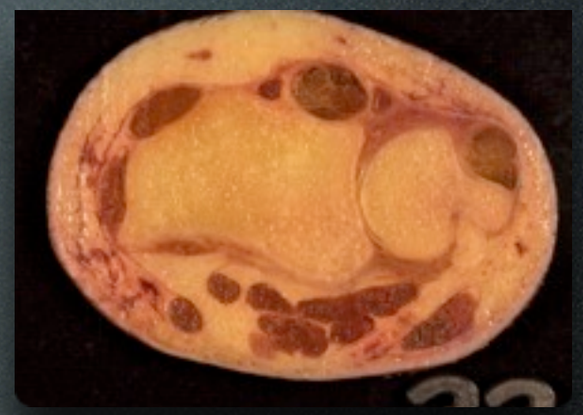
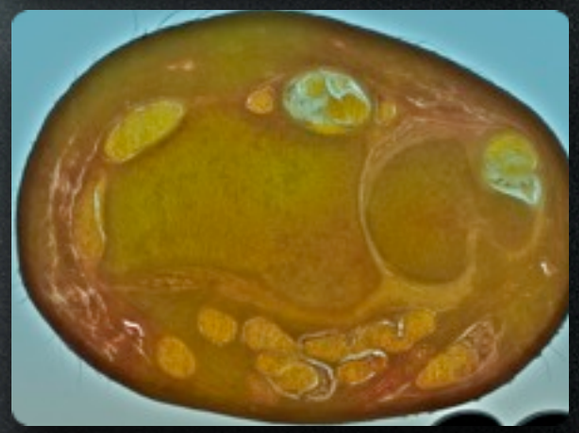


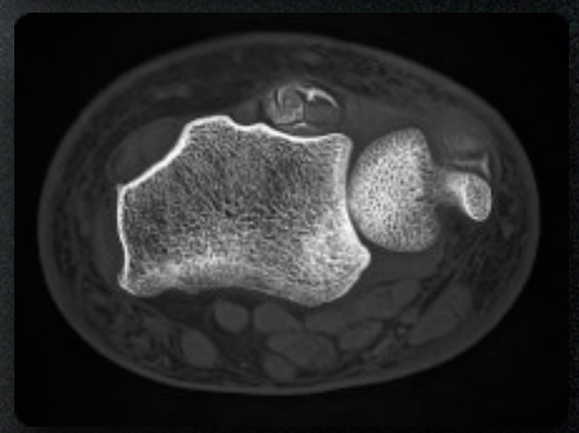
Photo

Proximal radial attachment site

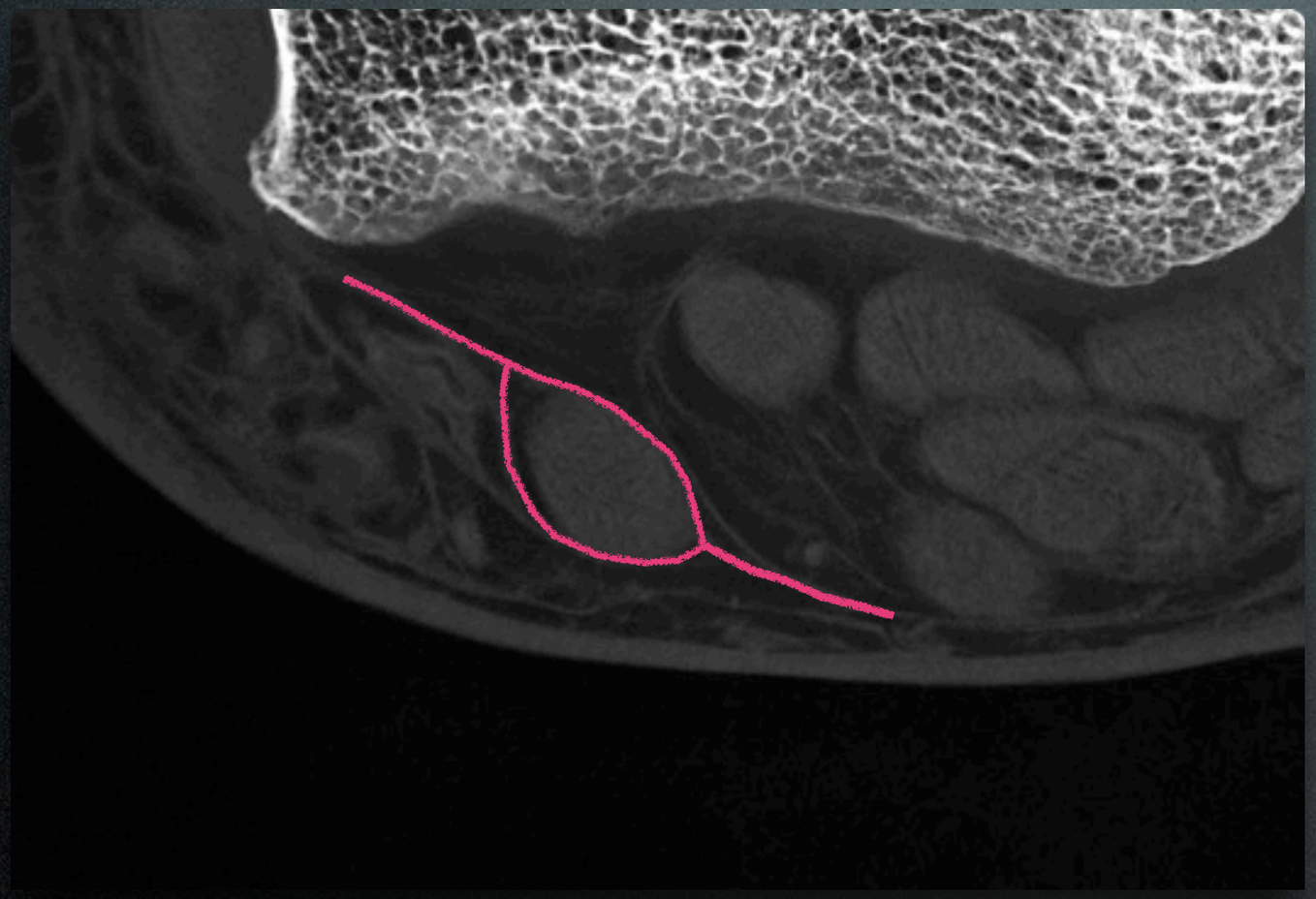


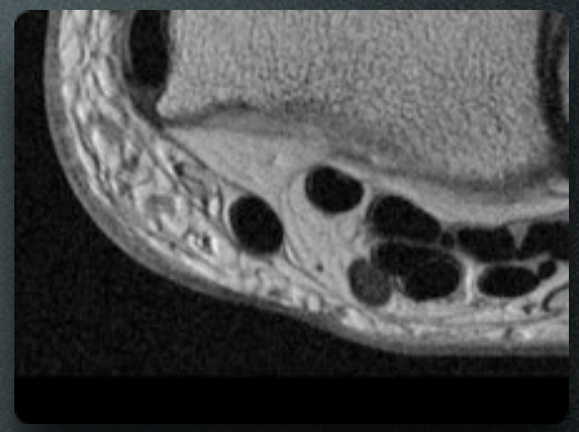


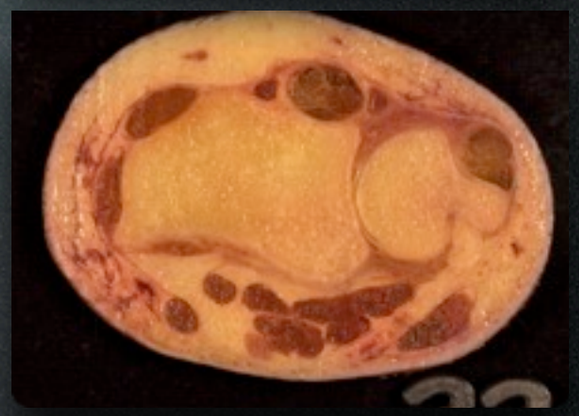


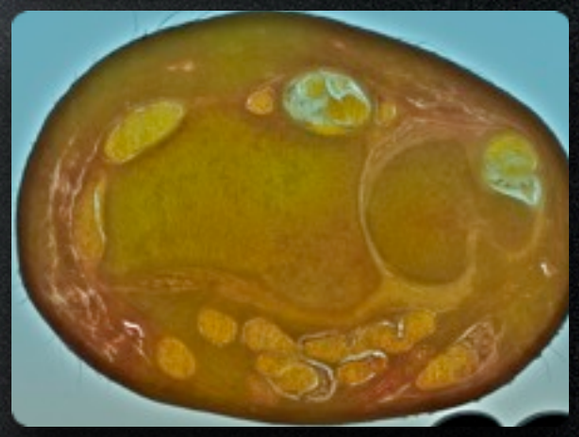


Proximal radial attachment site









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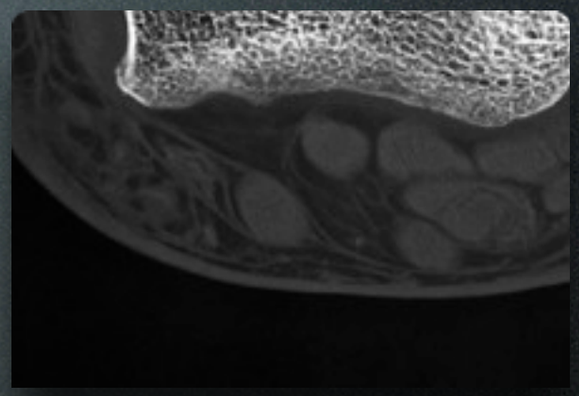

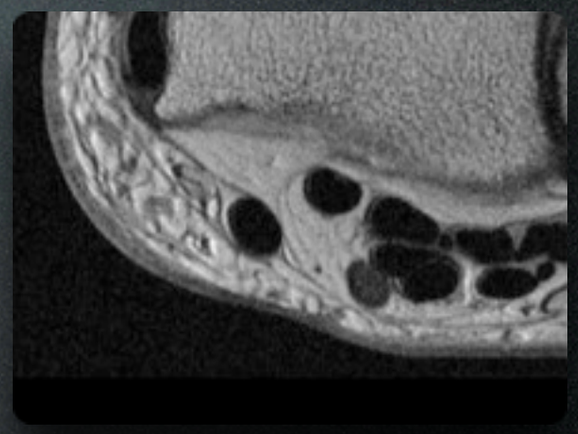

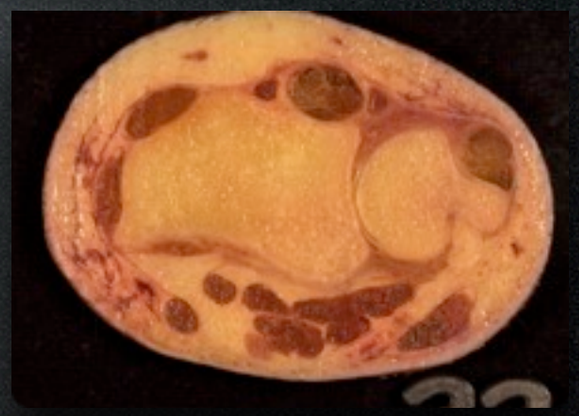

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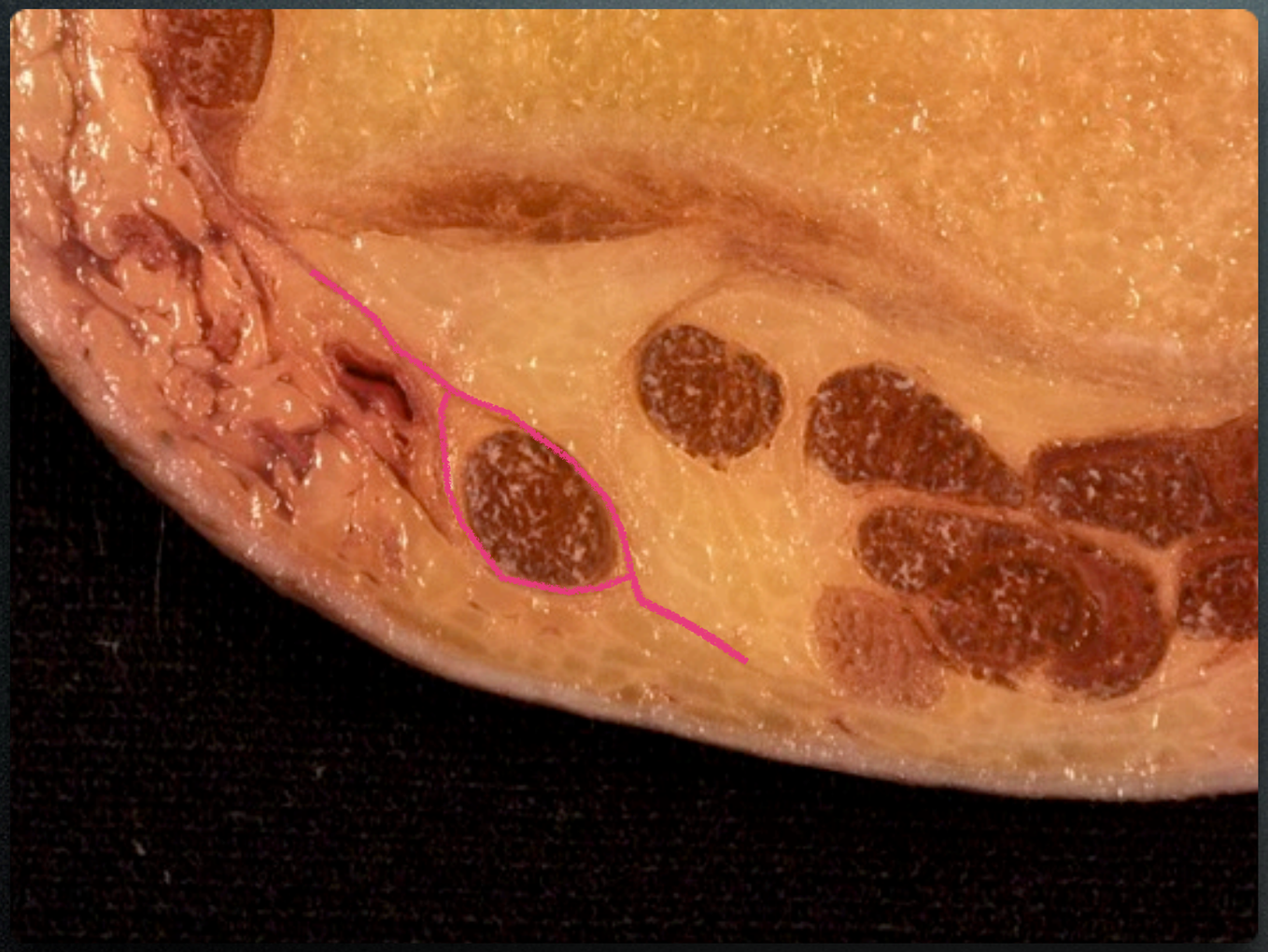

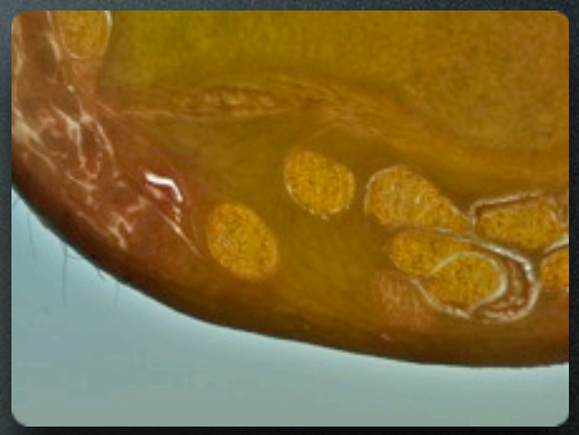

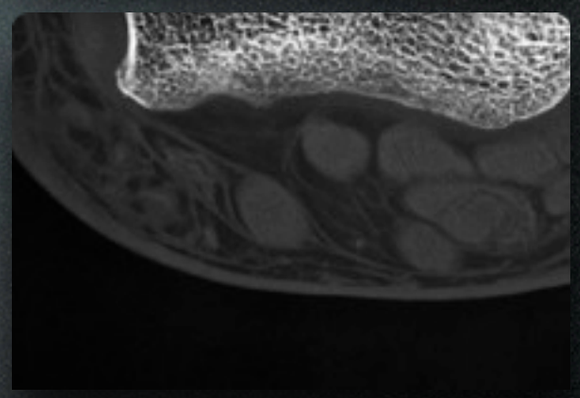

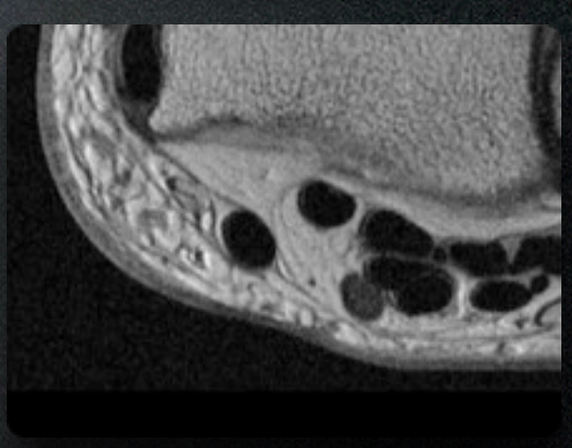

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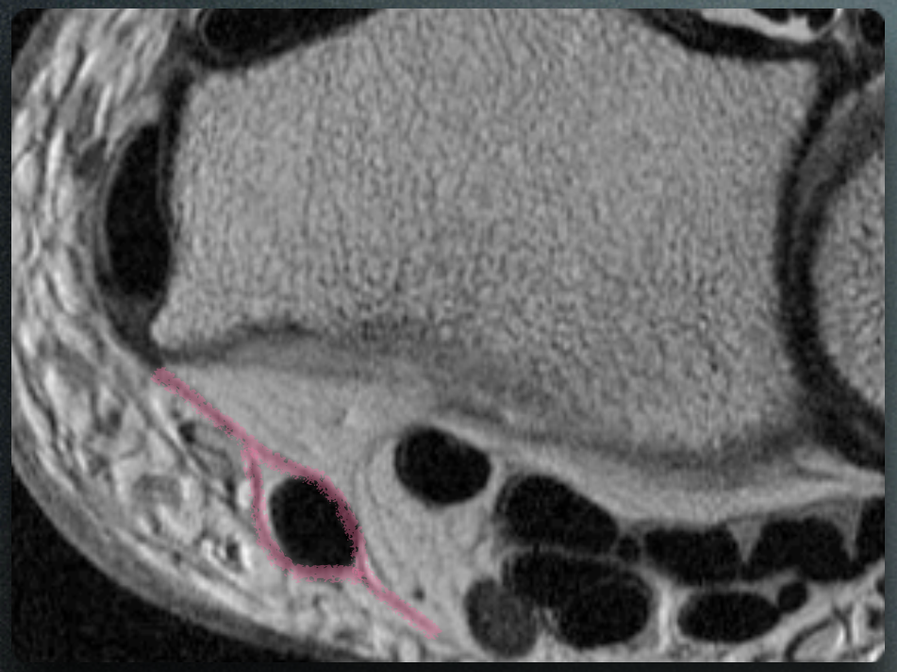
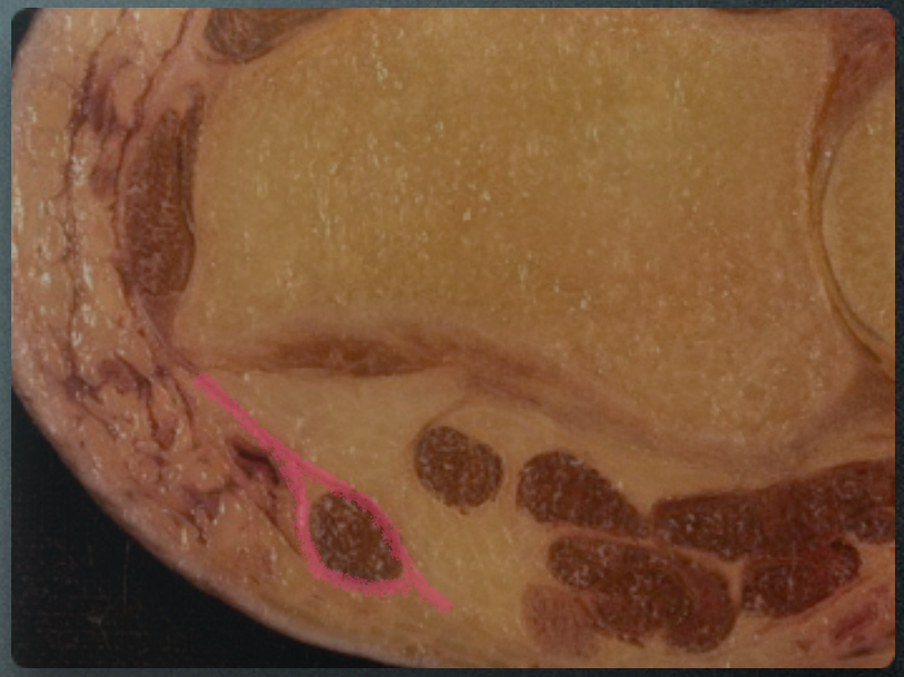
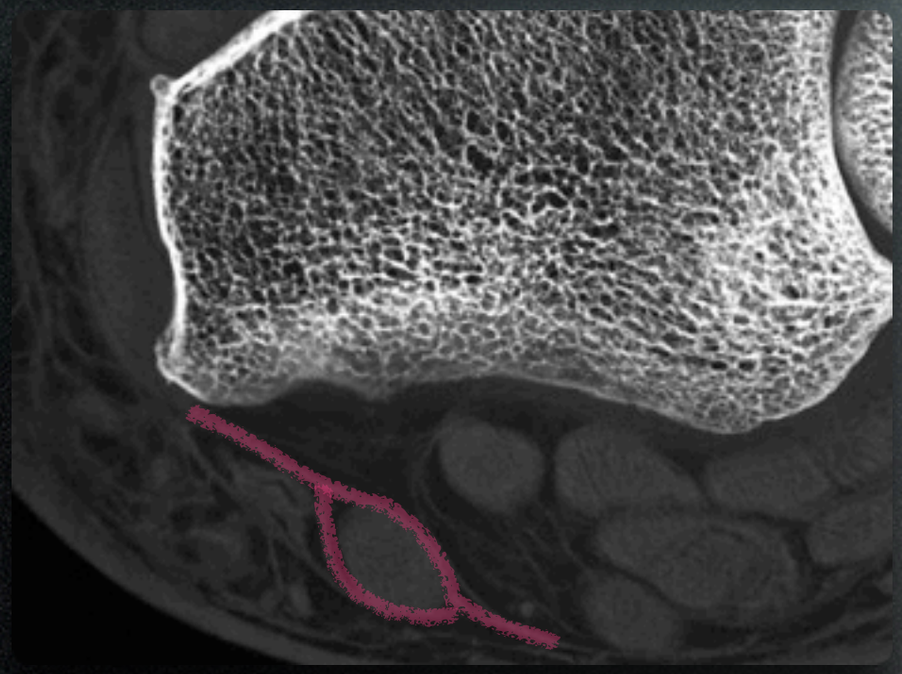
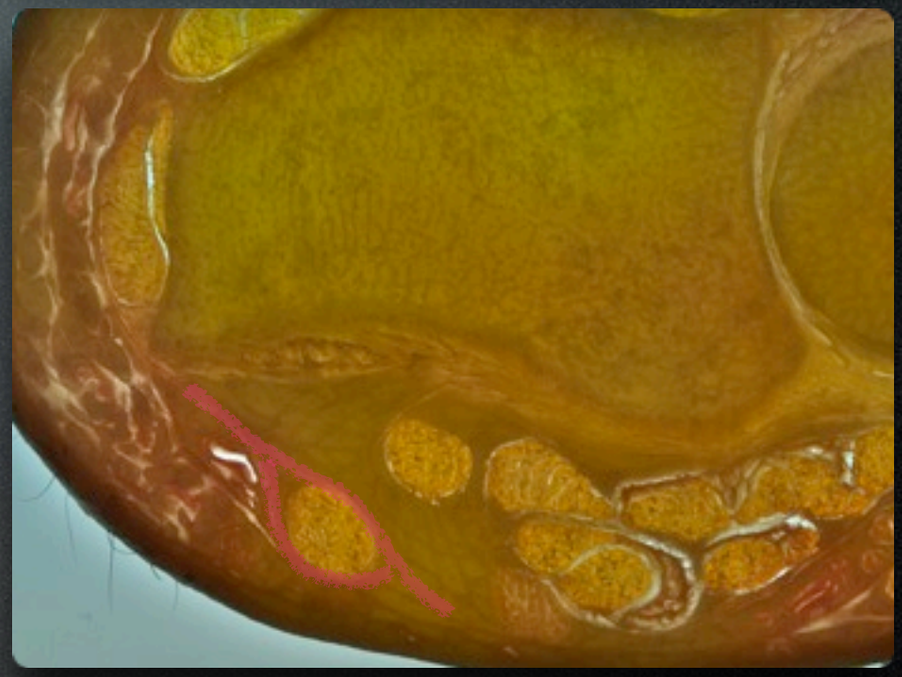








Proximal Radial attachment site: Invests around the flexor carpi radialis tendon to coalesce with palmar antebrachial fascia

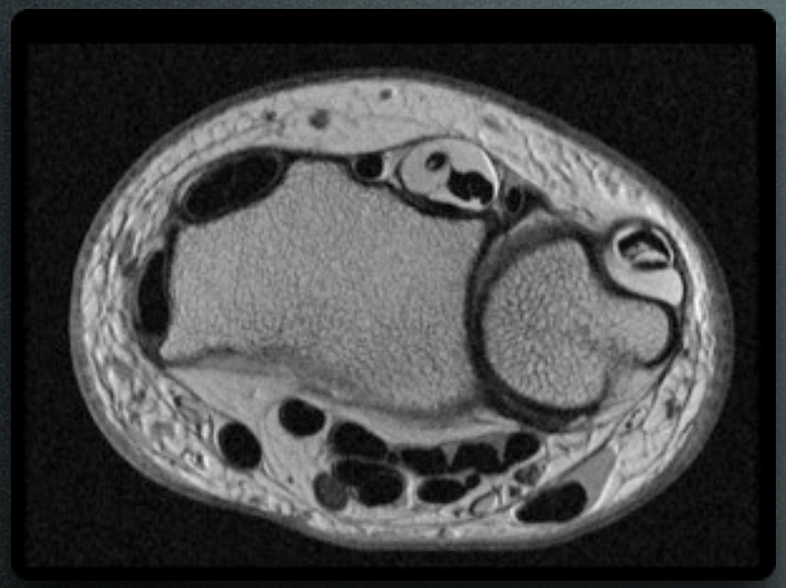
Radial attachment site

- Proximal portion extends around the radius to invest the flexor carpi radialis tendon and blend with the palmar antebrachial fascia

- Central fibers insert onto the radius forming the septa for the 1st dorsal compartment

- Distal fibers blend with fascia overlying the thenar eminence

Axial PD



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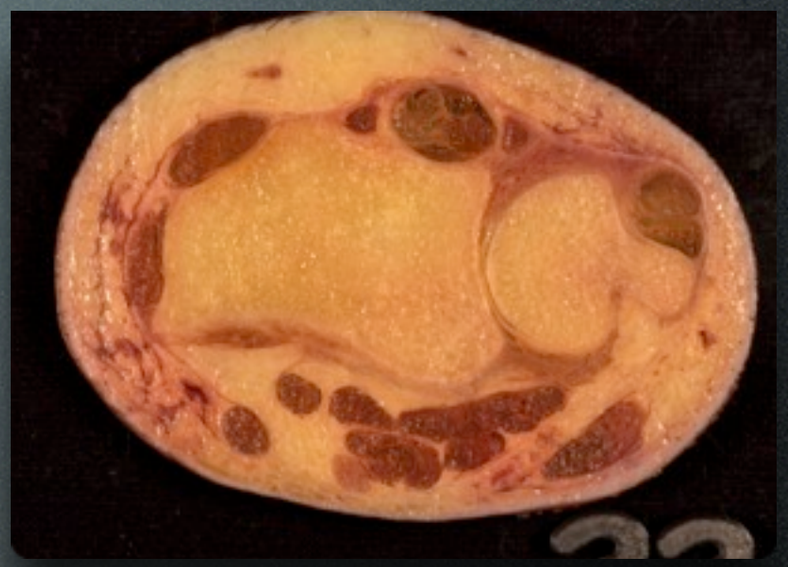
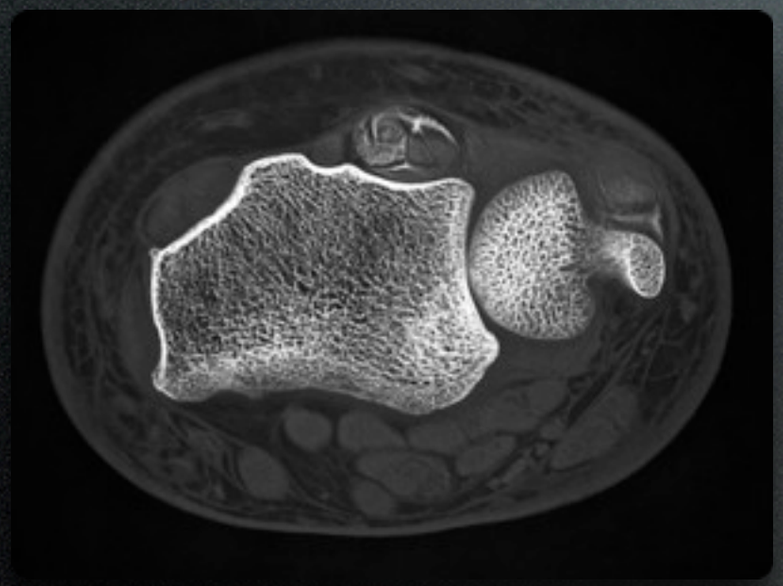
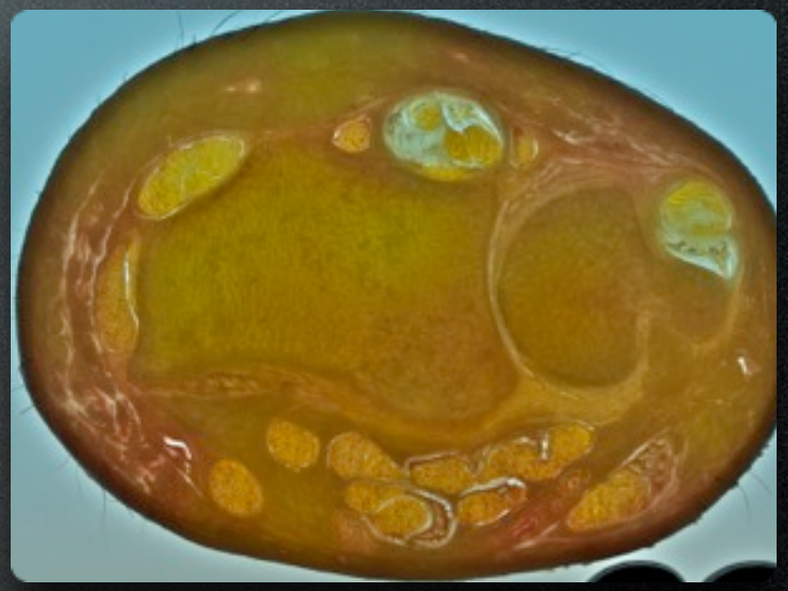


Photo

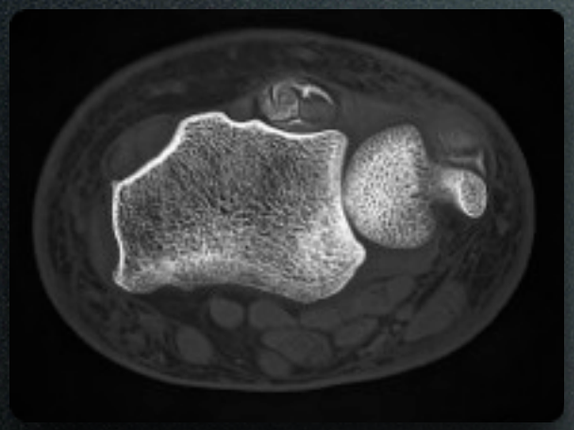


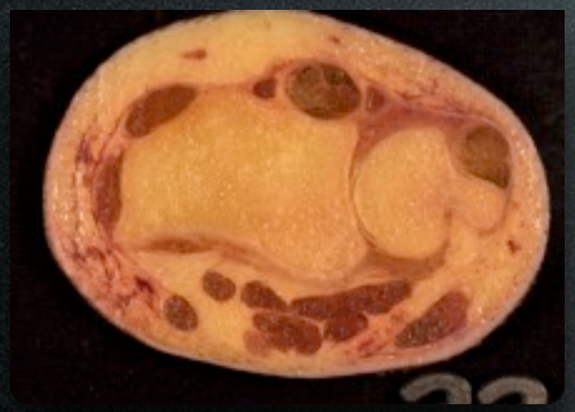
X-ray

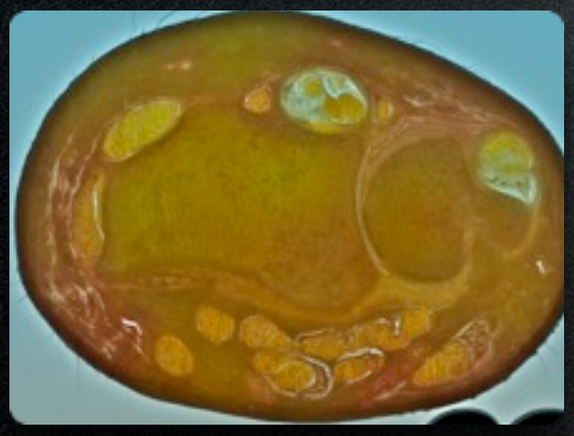


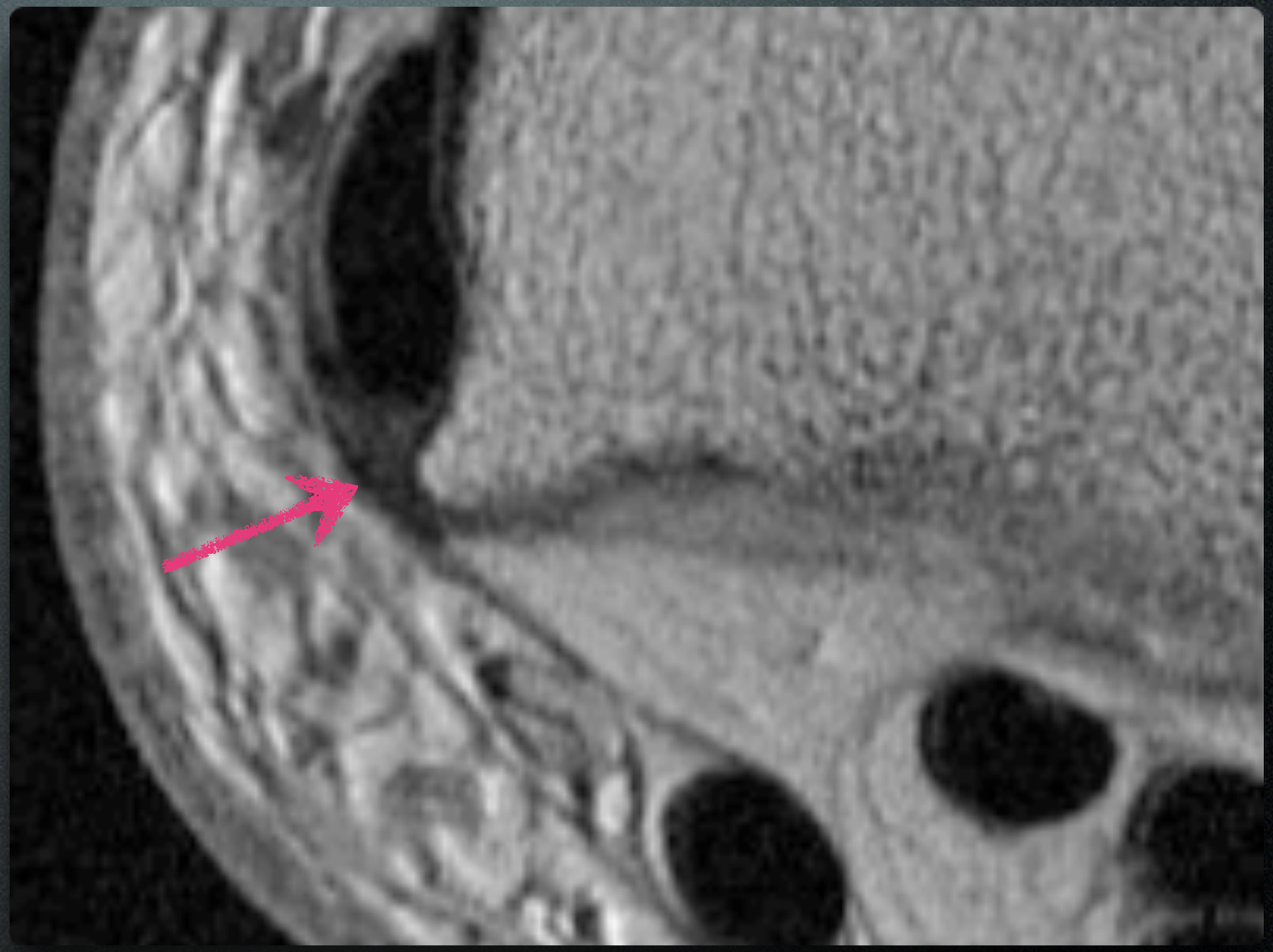
Photo

Central radial attachment site









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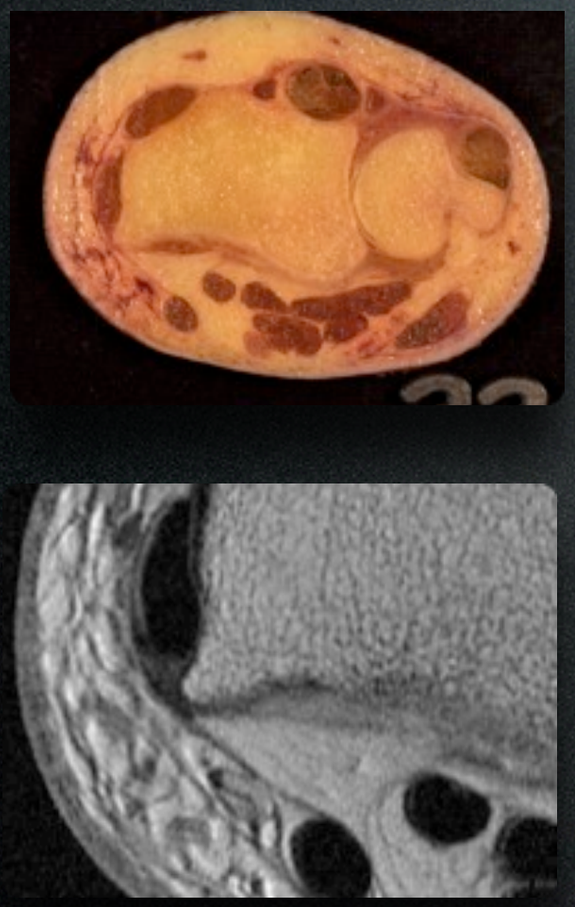

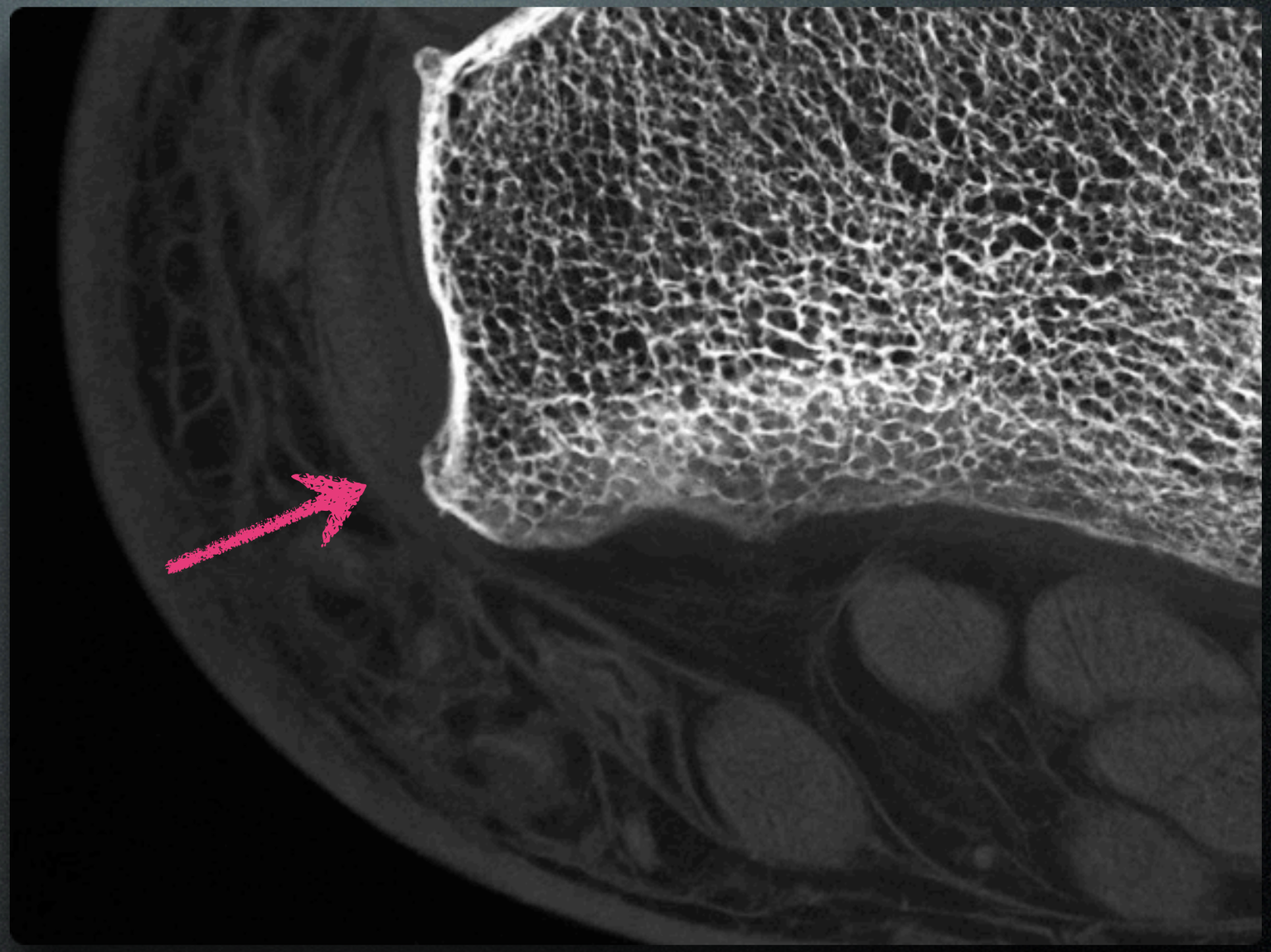

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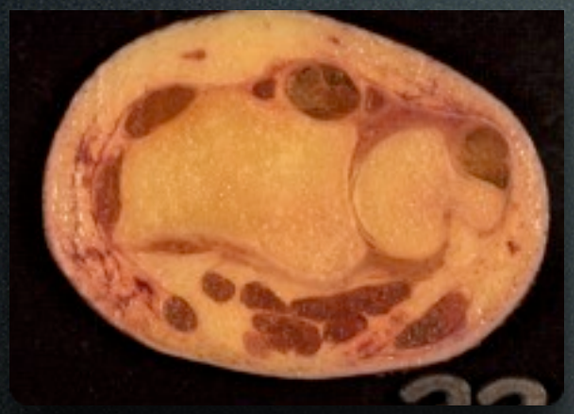

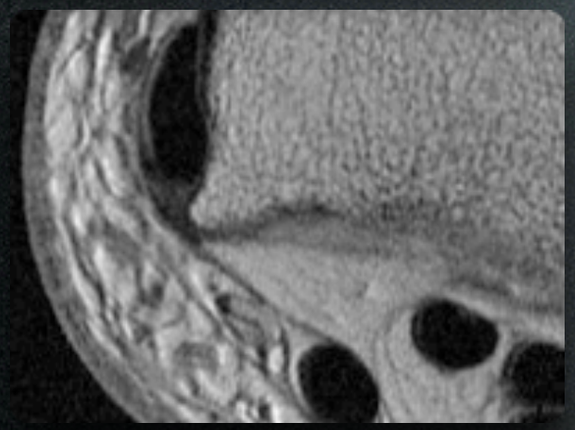

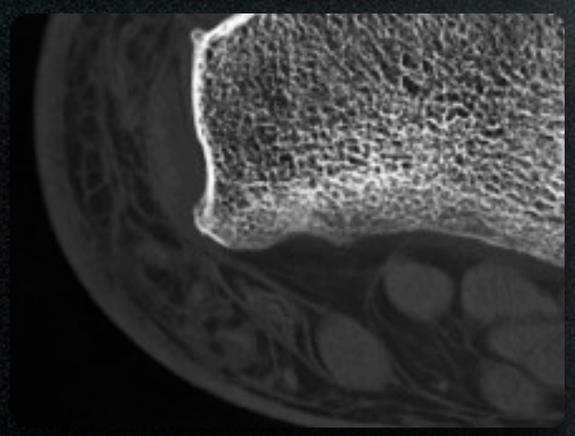

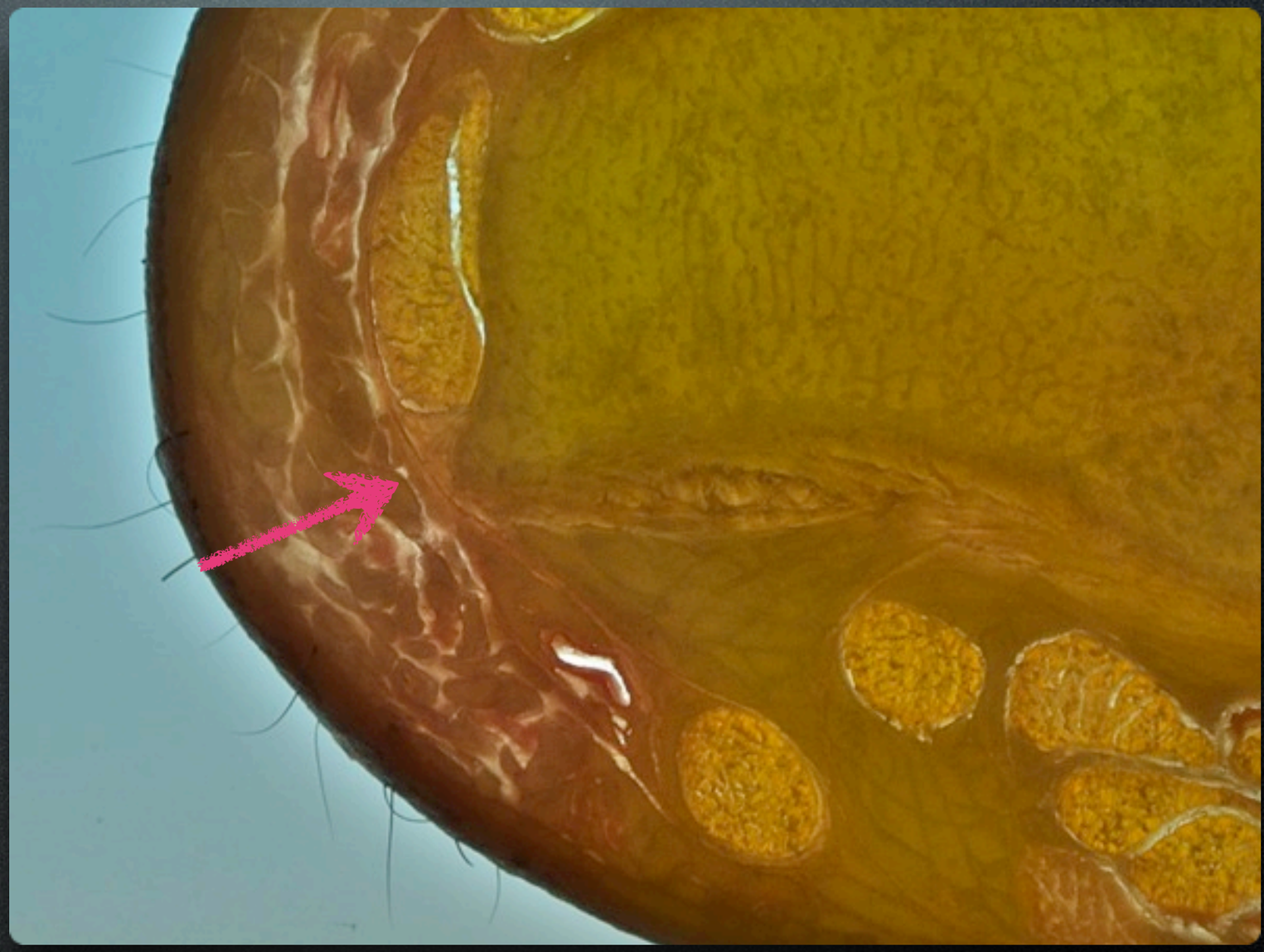

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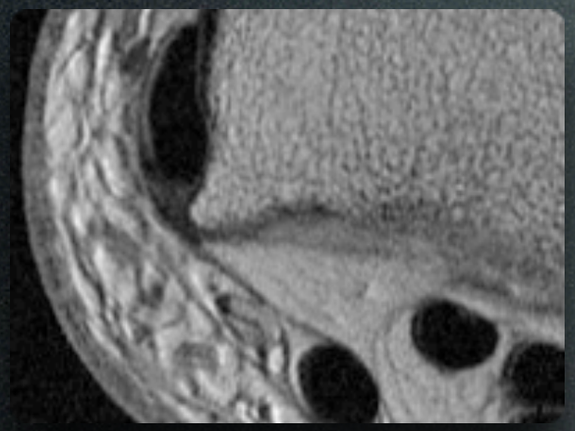
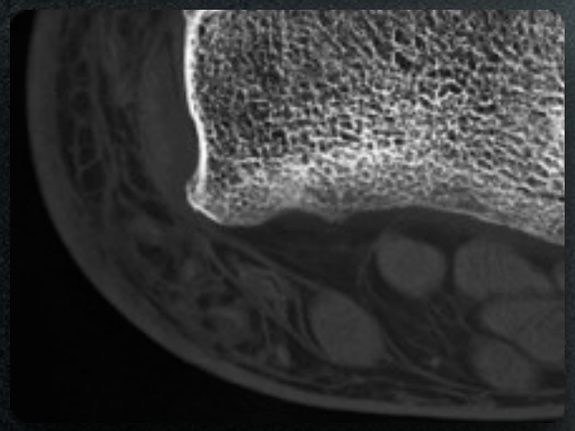
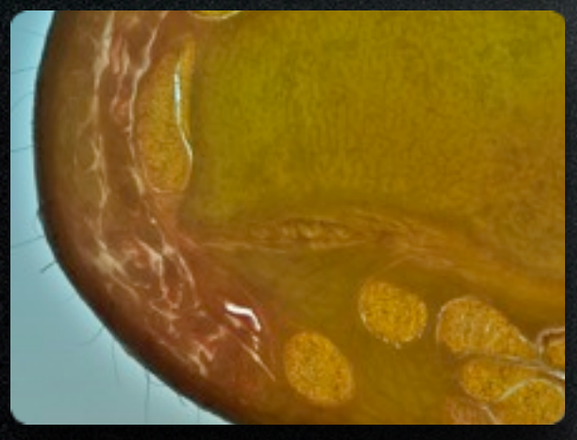
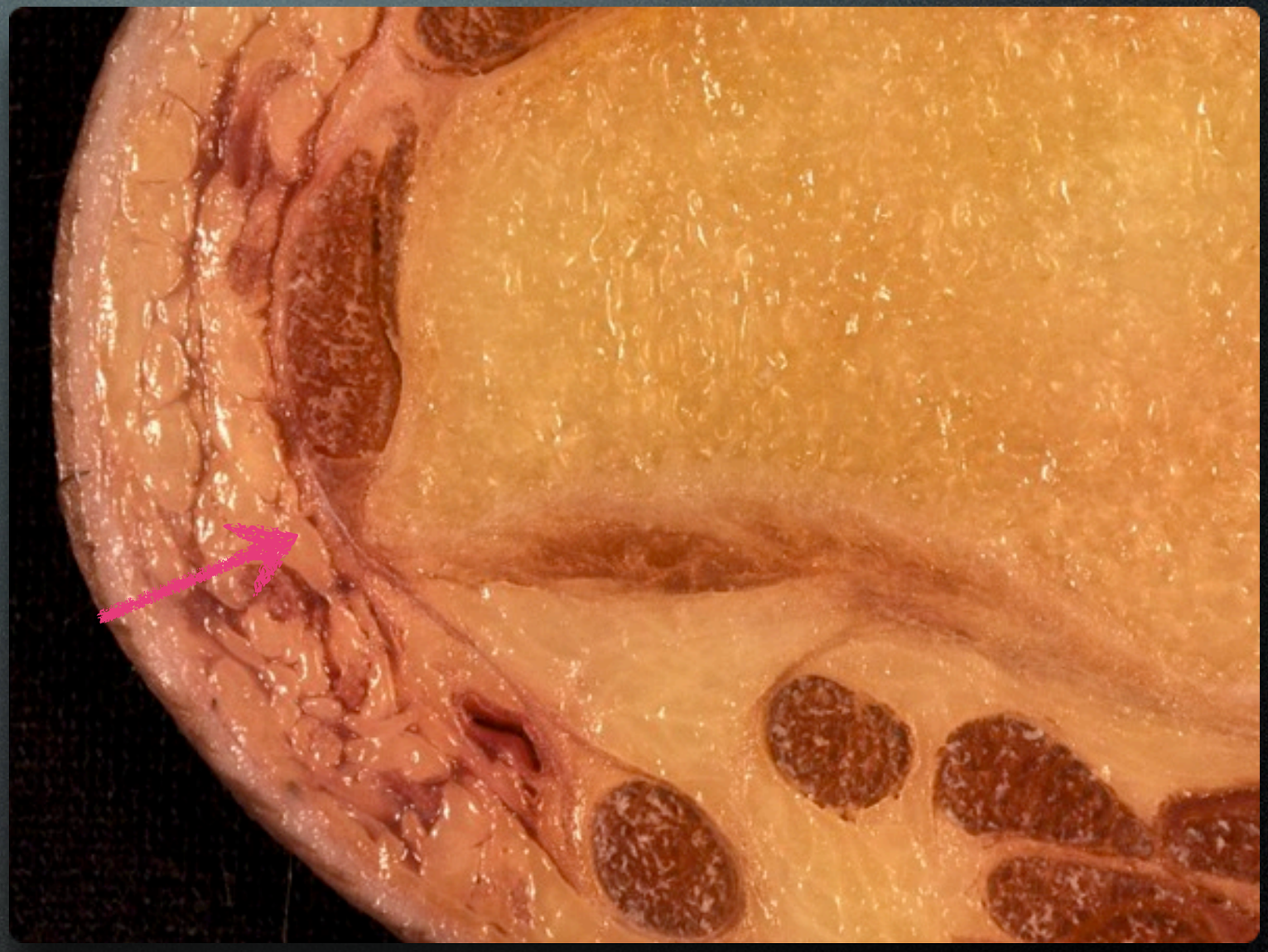




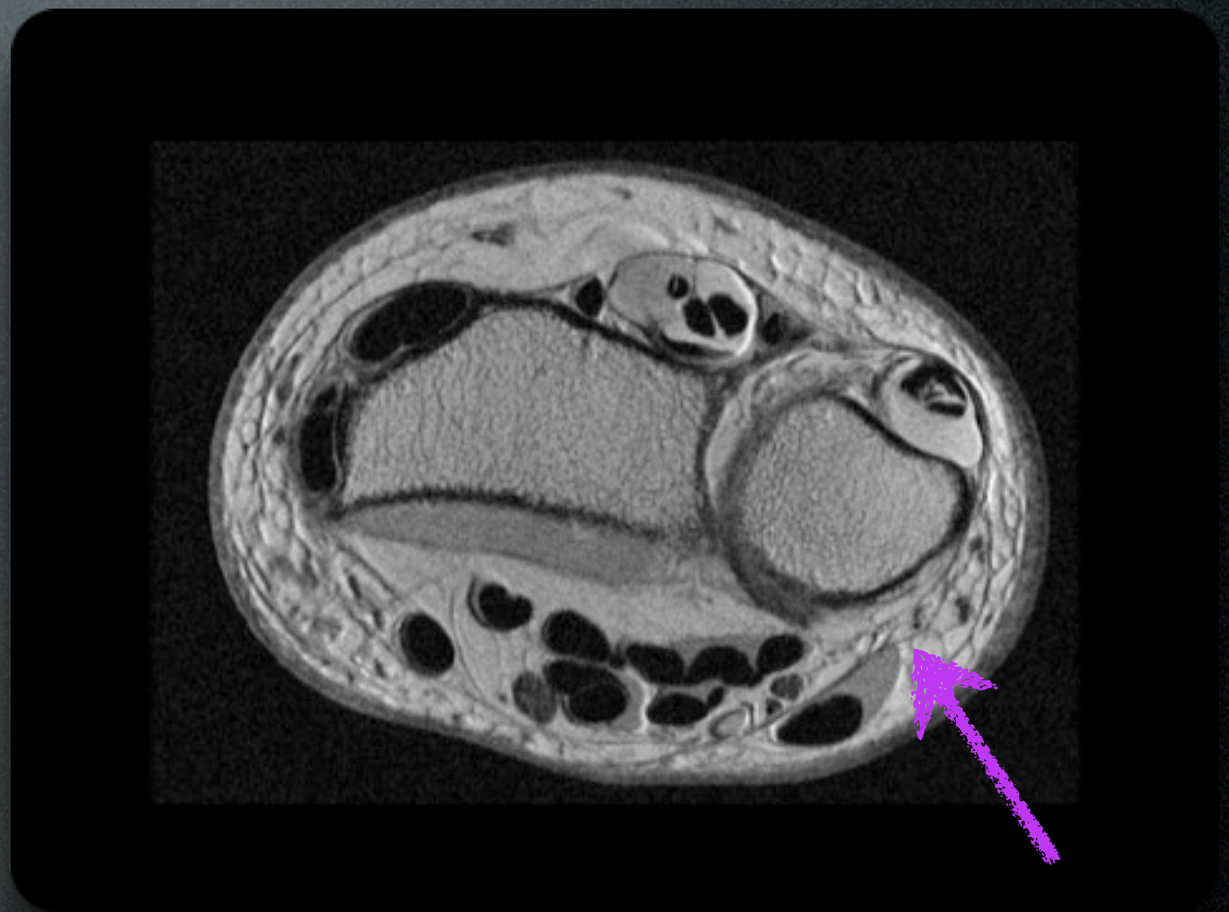


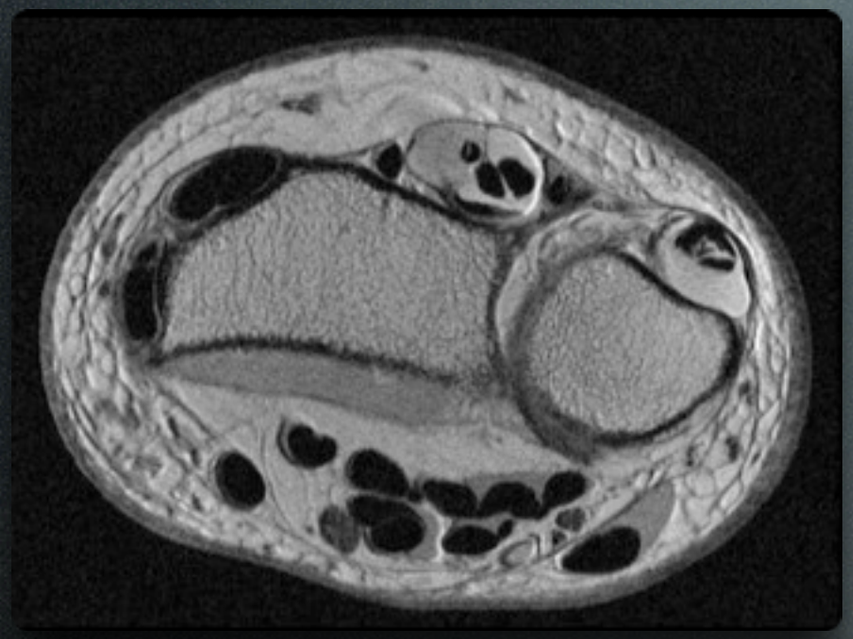


Central radial attachment site

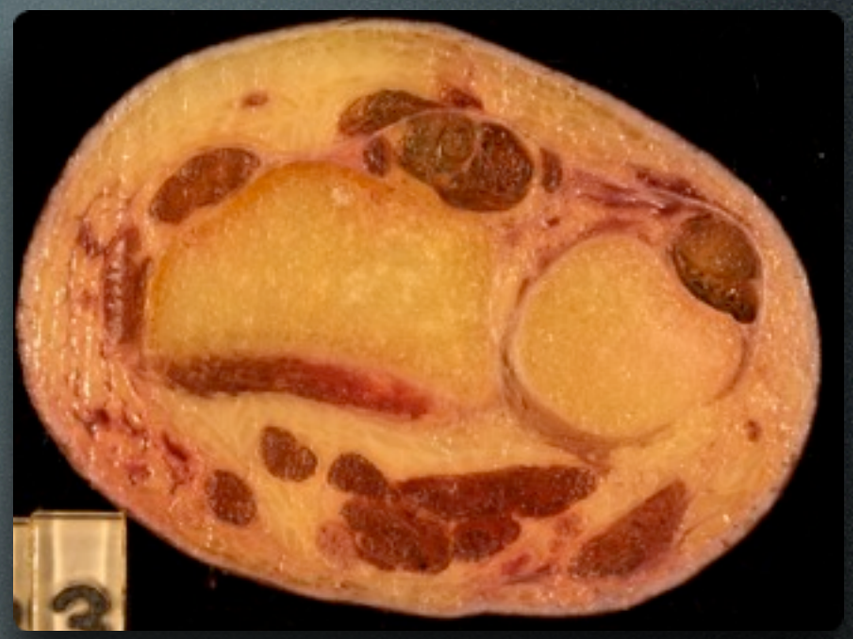
Ulnar attachment site

- Proximal portion extends around the ulna investing the flexor carpi ulnaris tendon to attach to the palmar antebrachial fascia
- Middle portion inserts onto the pisiform
- Distal portion inserts onto the base of the 5th metacarpal and fascia of the abductor digiti minimi muscle





Axial PD



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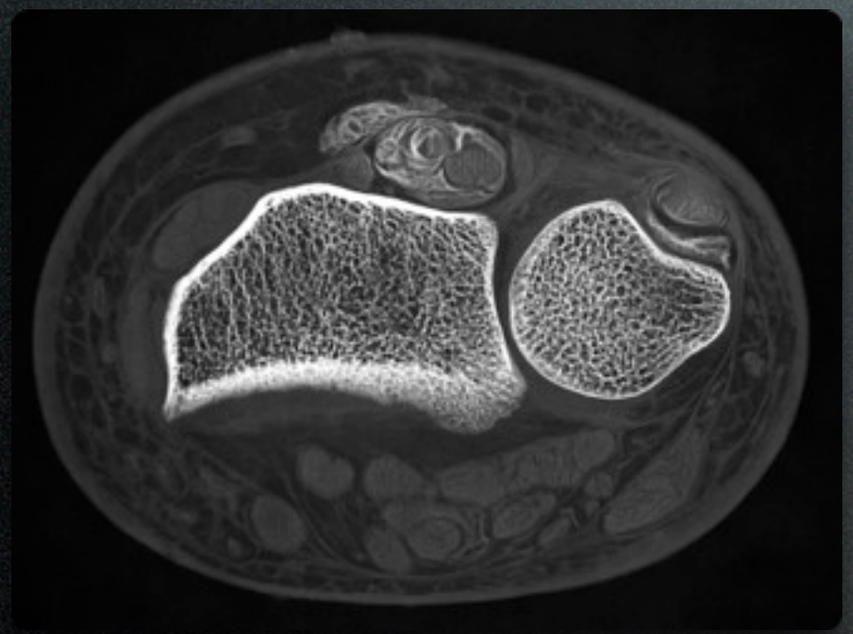
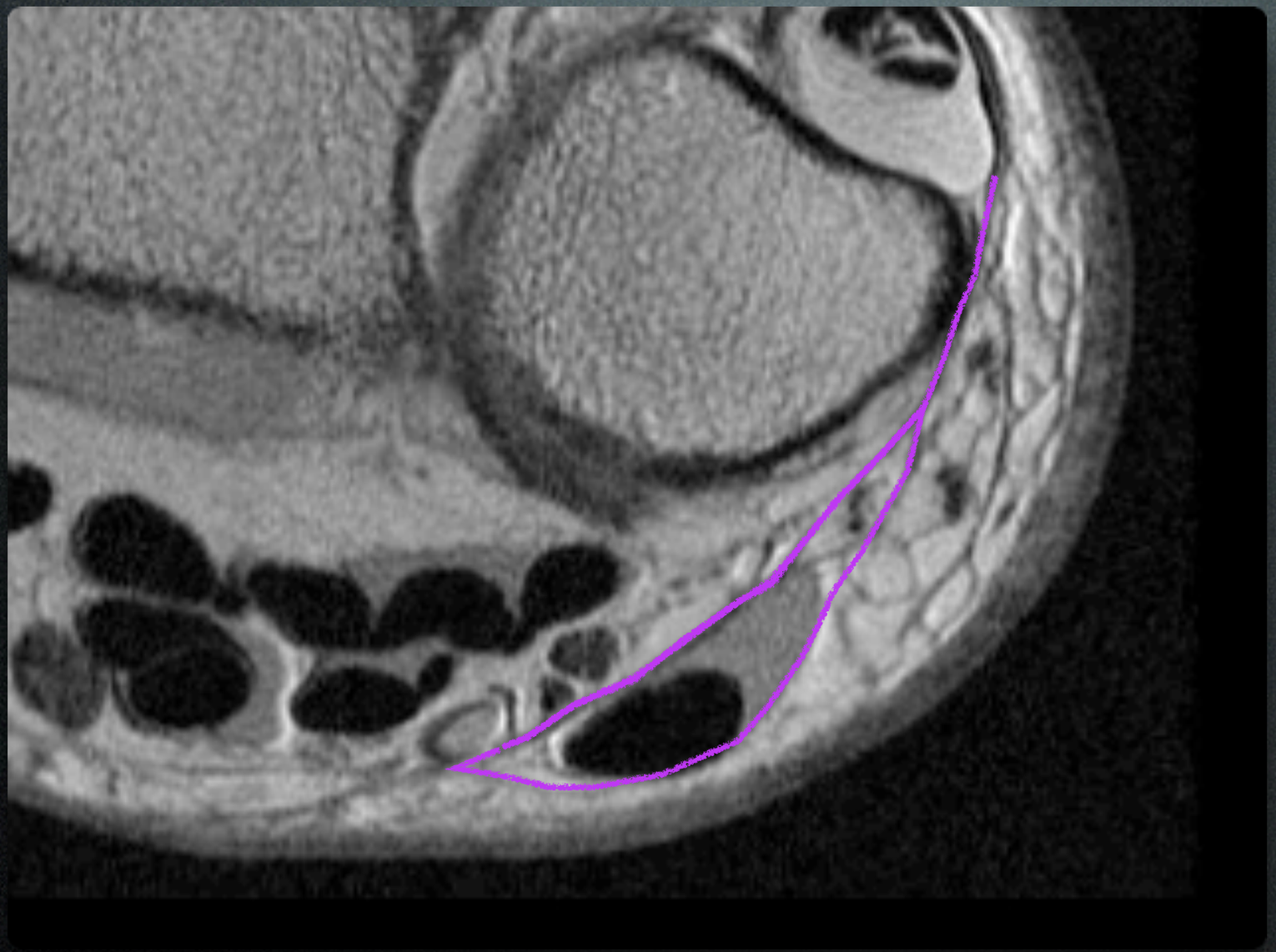
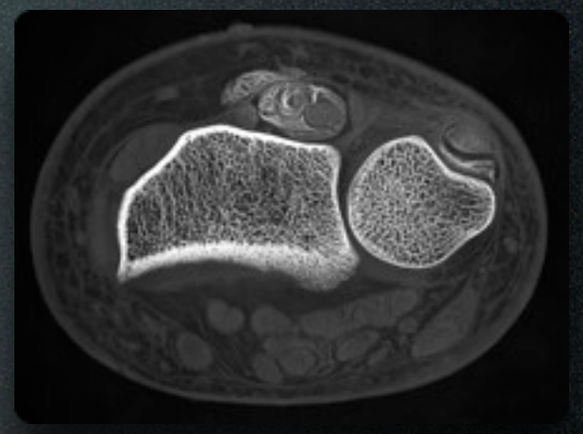


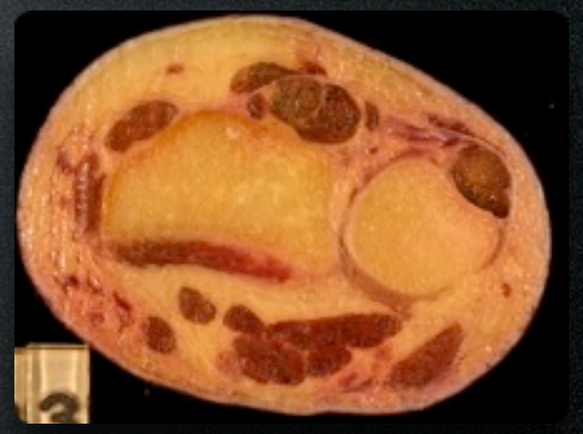
Faxitron

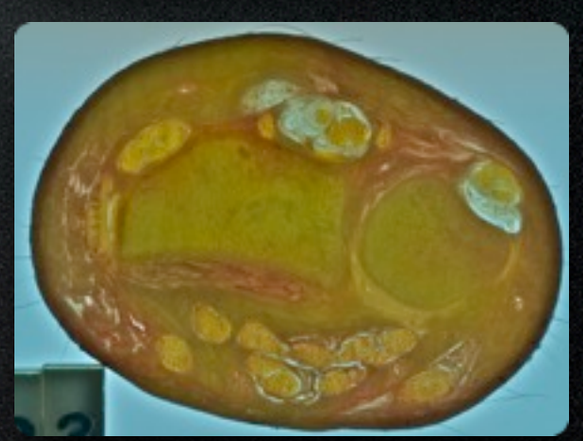
Photo

Proximal Ulnar attachment site

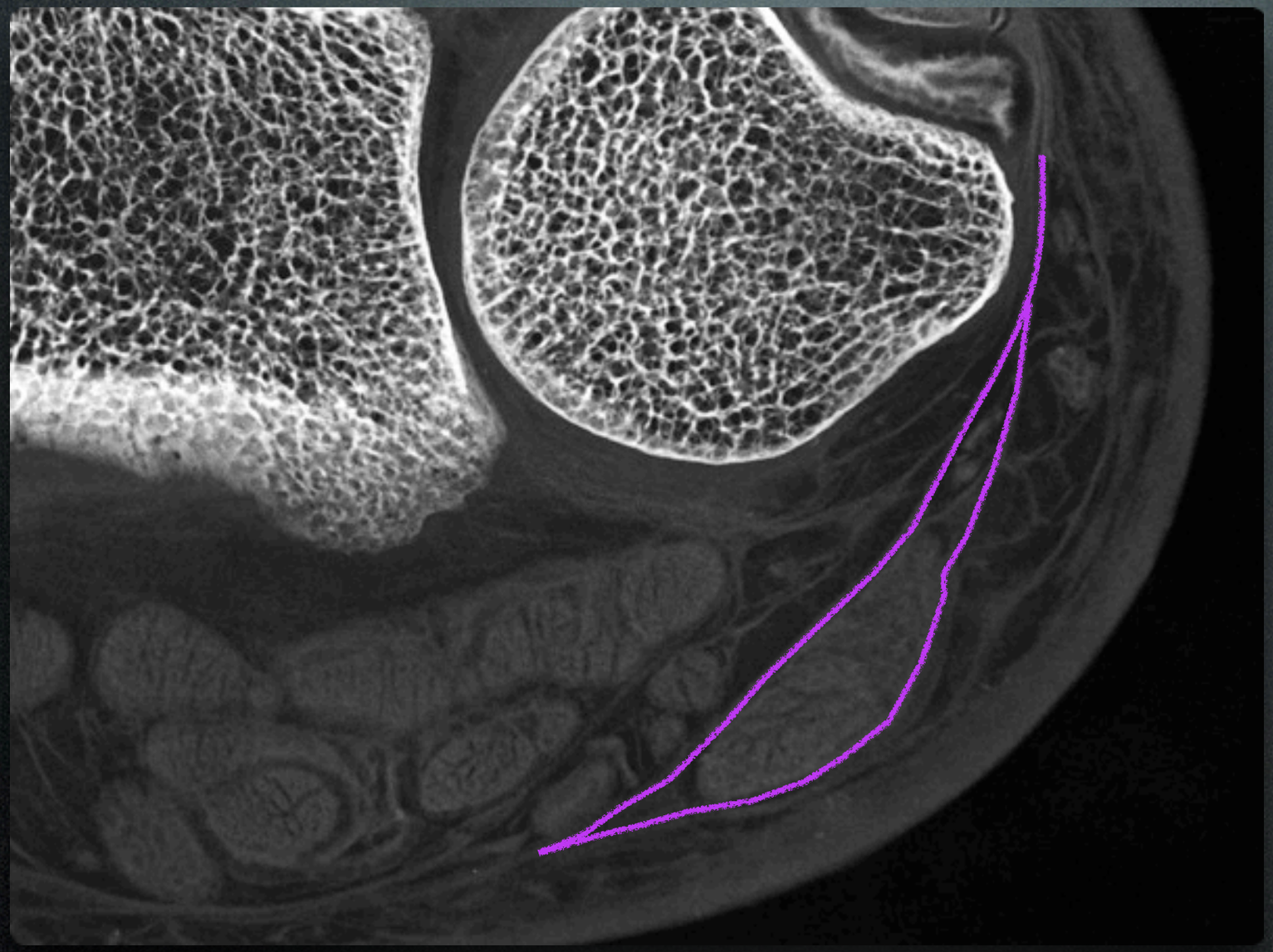


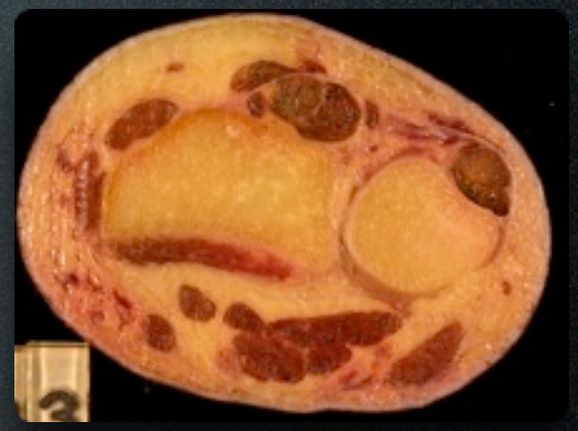


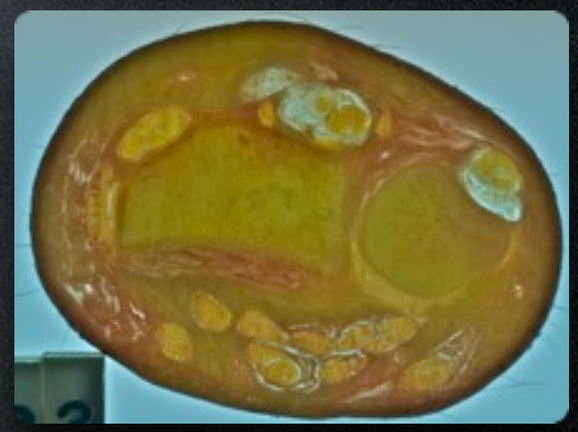


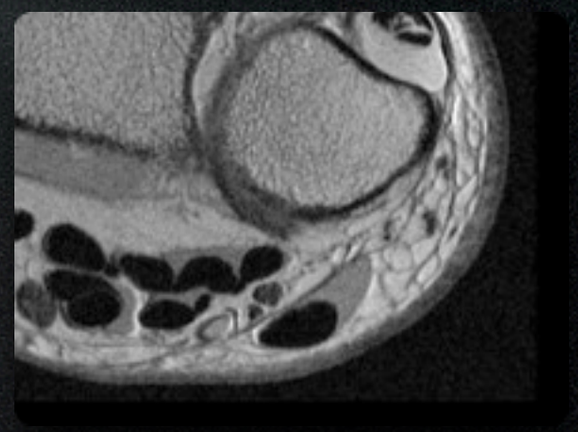


Proximal Ulnar attachment site

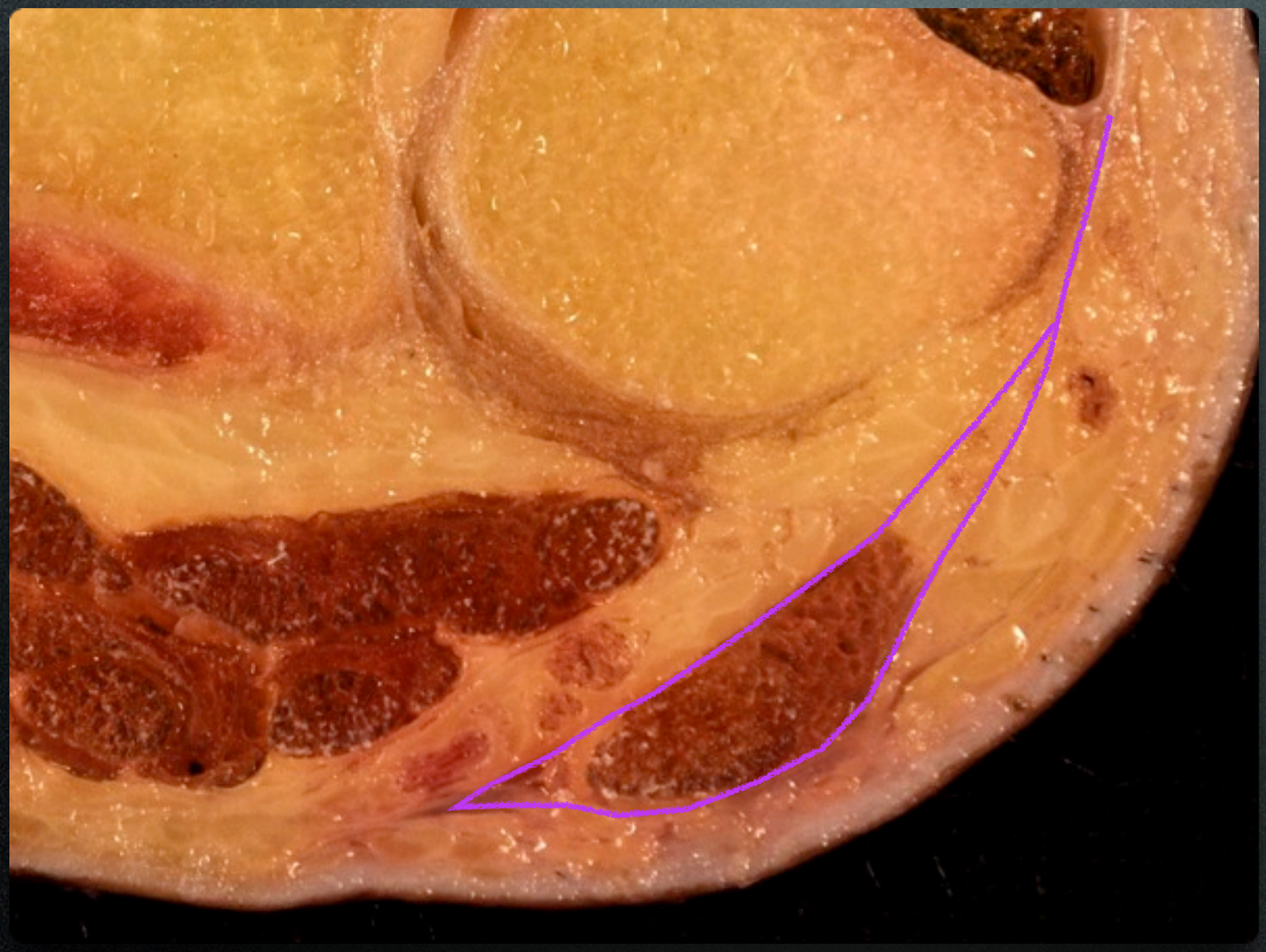


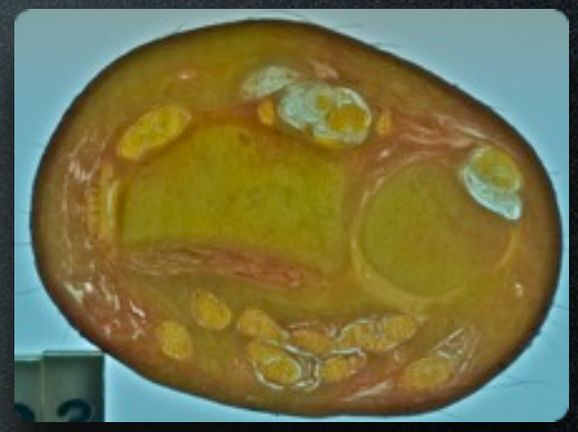


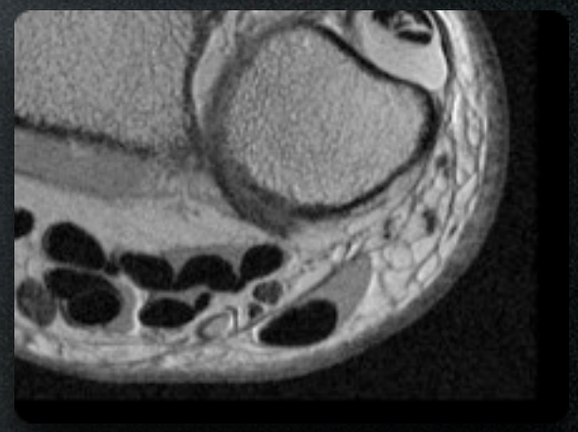


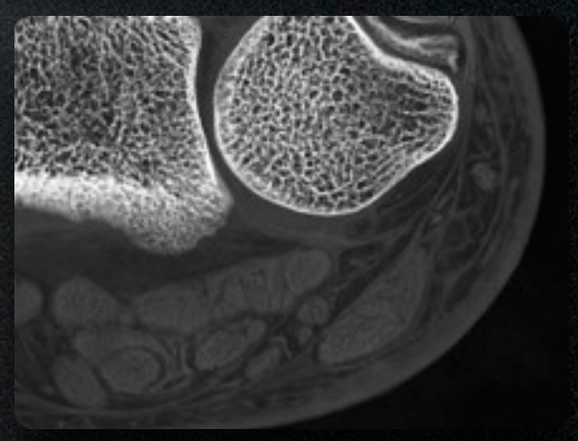


Proximal Ulnar attachment site

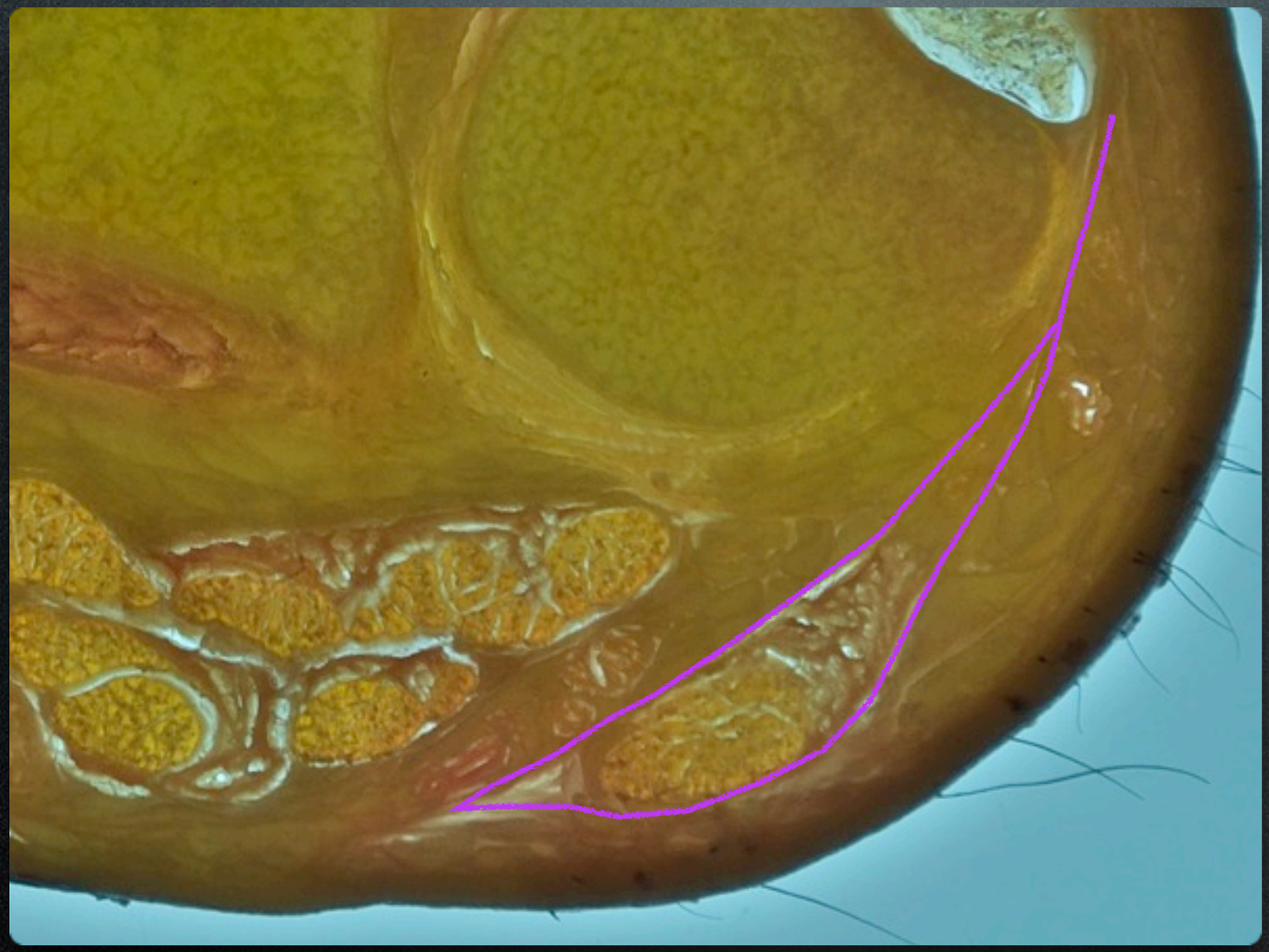


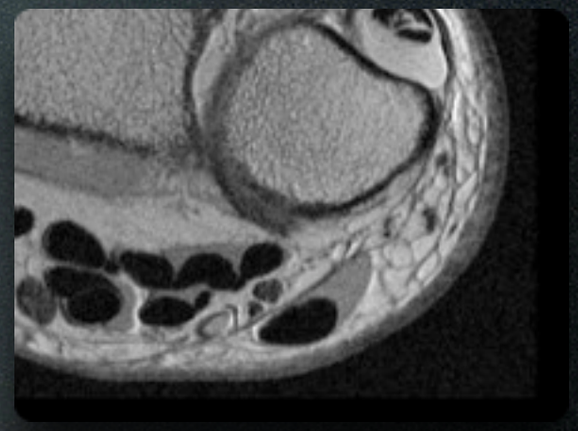


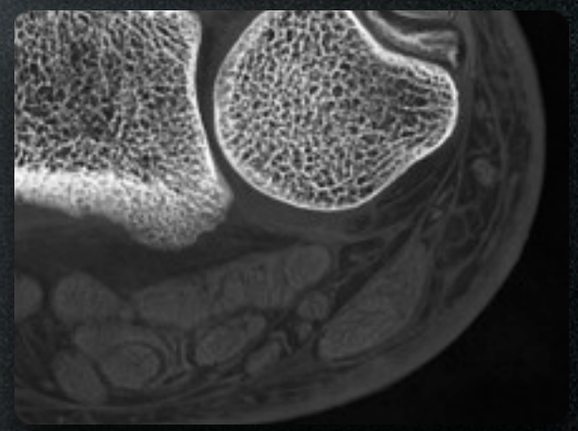




Proximal Ulnar attachment site







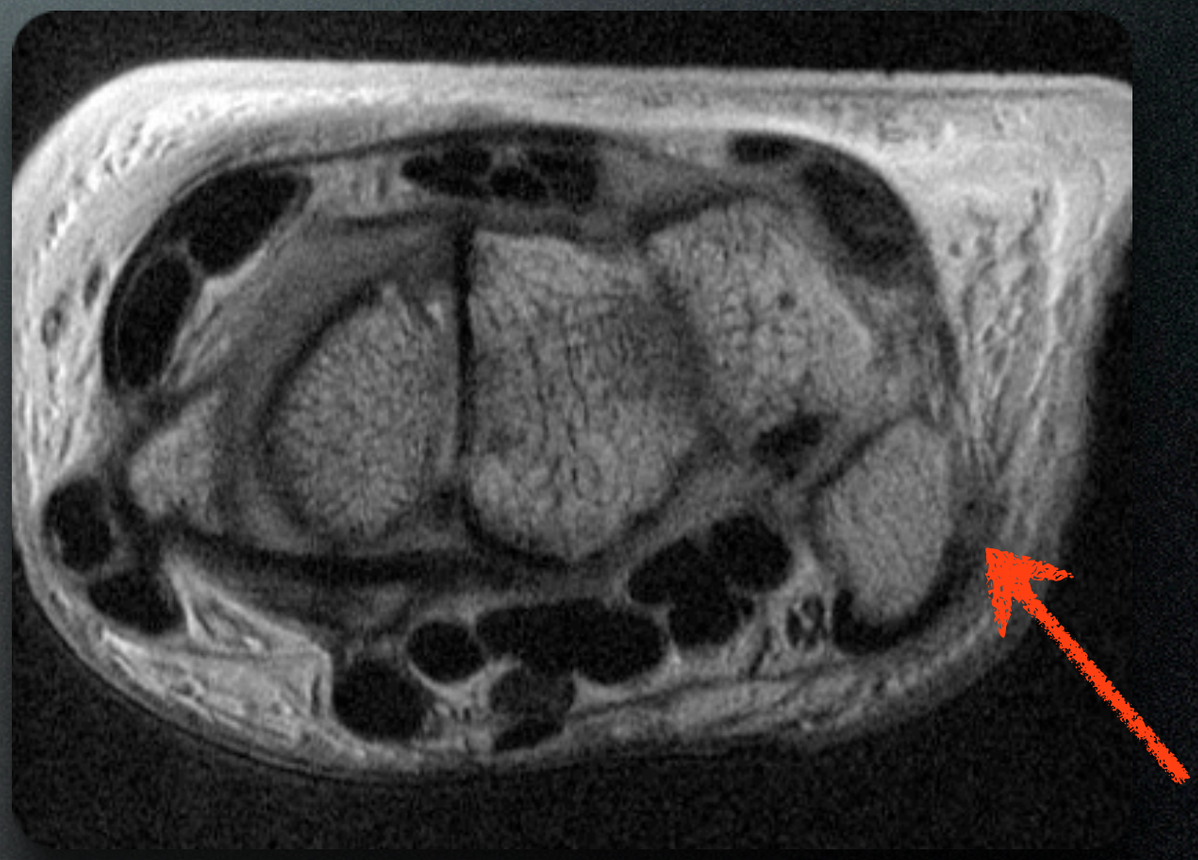
Proximal Ulnar attachment site

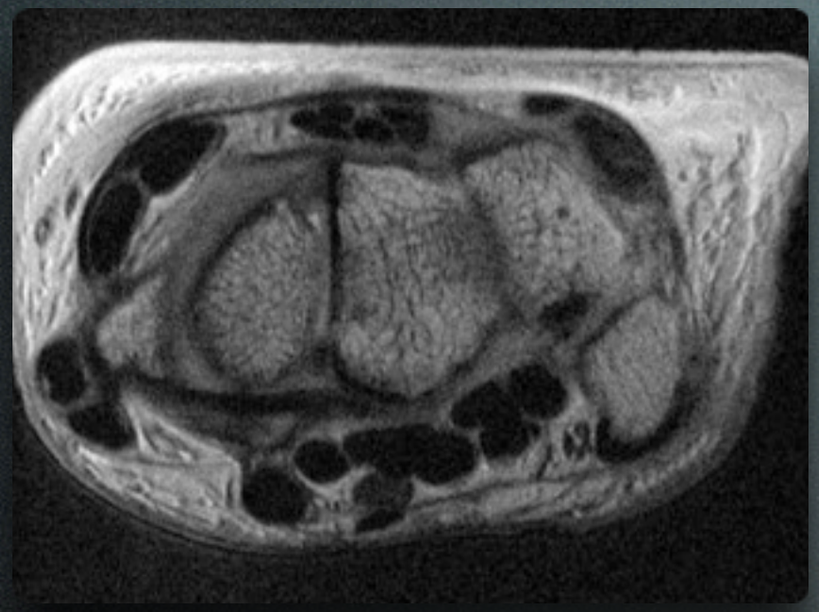
Ulnar attachment site

- Proximal portion extends around the ulna investing the flexor carpi ulnaris tendon to attach to the palmar antebrachial fascia

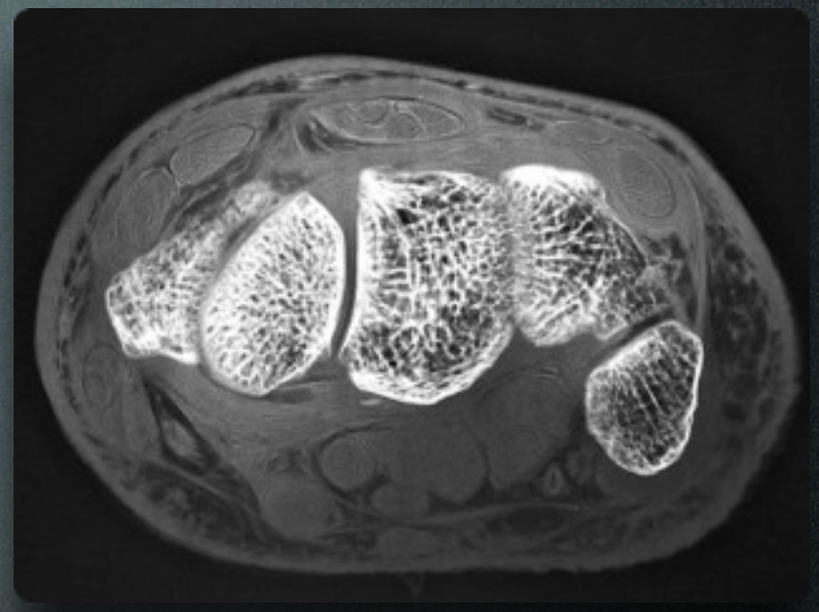
- Middle portion inserts onto the pisiform

- Distal portion inserts onto the base of the 5th metacarpal and fascia of the abductor digiti minimi muscle





Axial PD

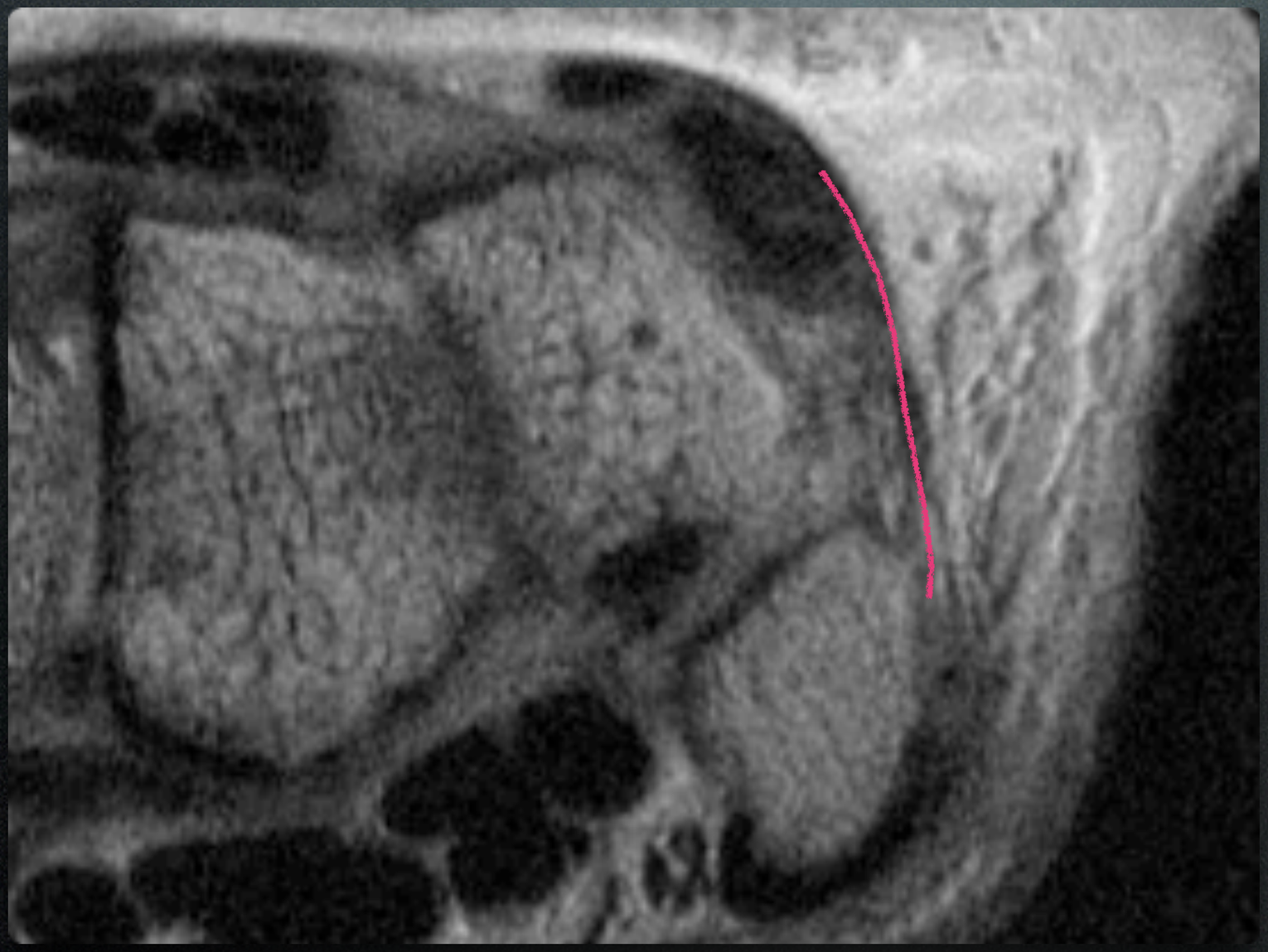


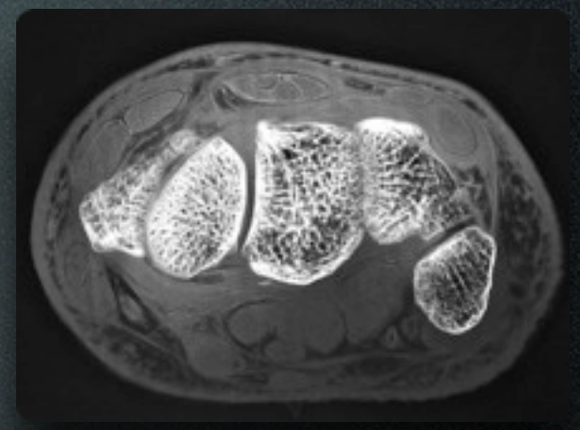
Faxitron

Photo

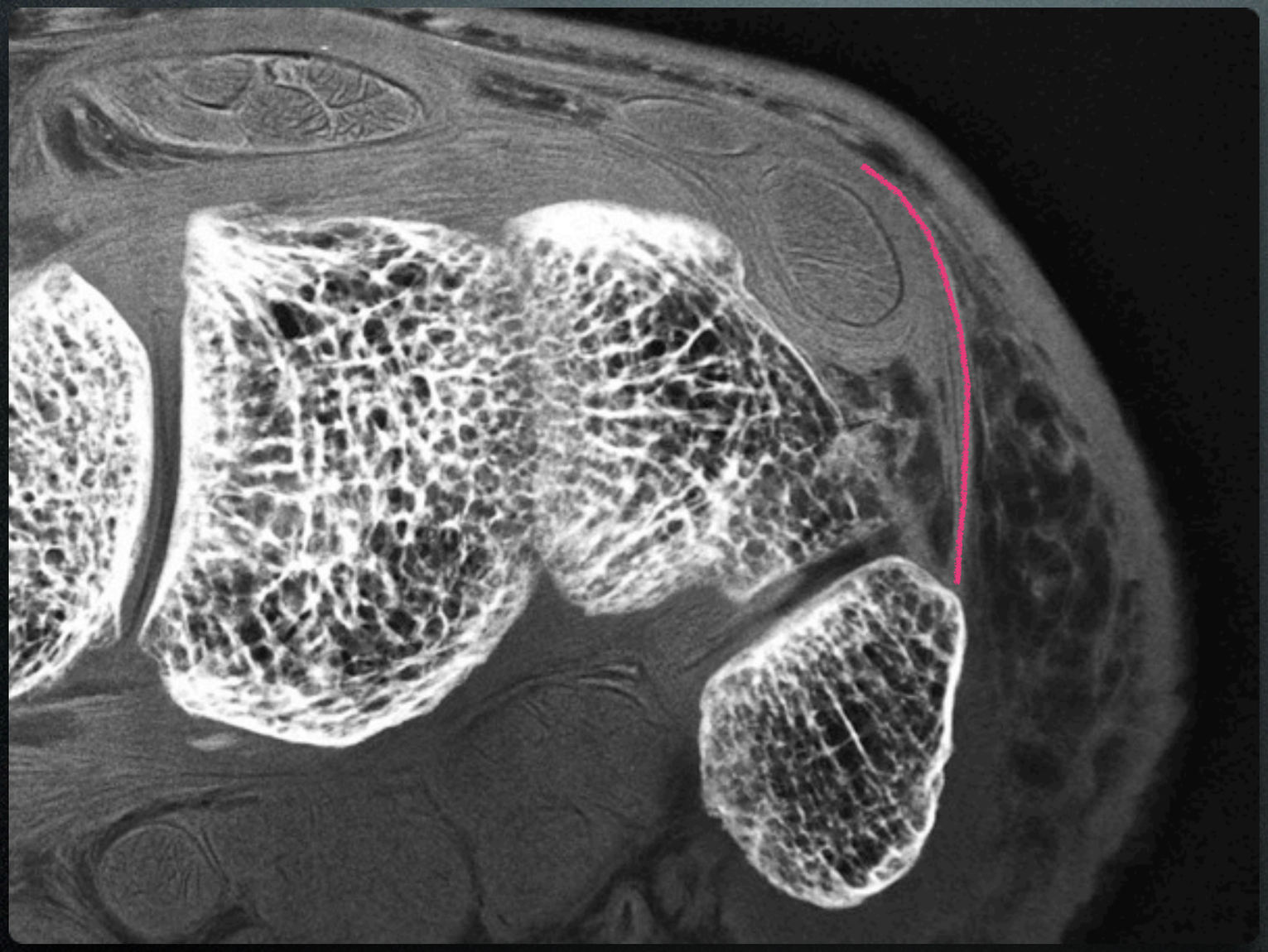
Photo

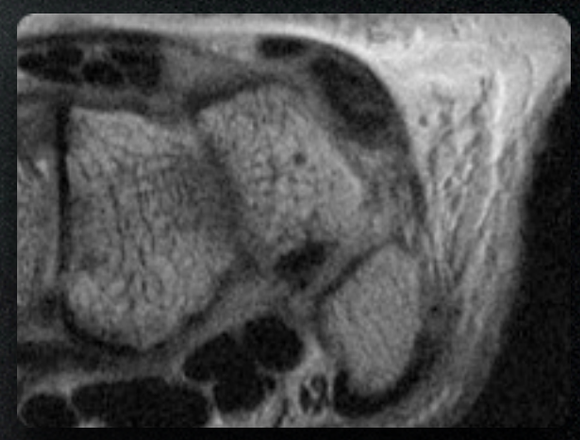
Middle portion - ulnar attachment site



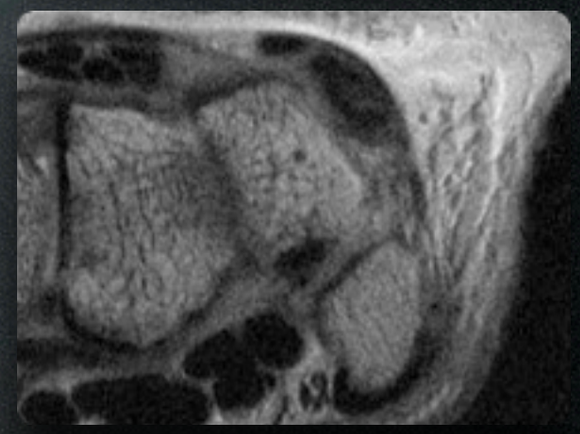


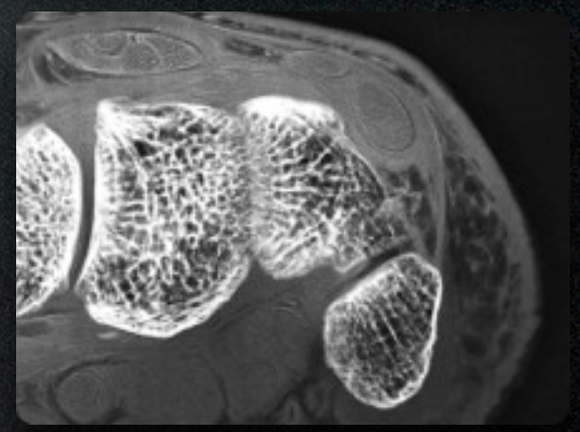
Middle portion - ulnar attachment site



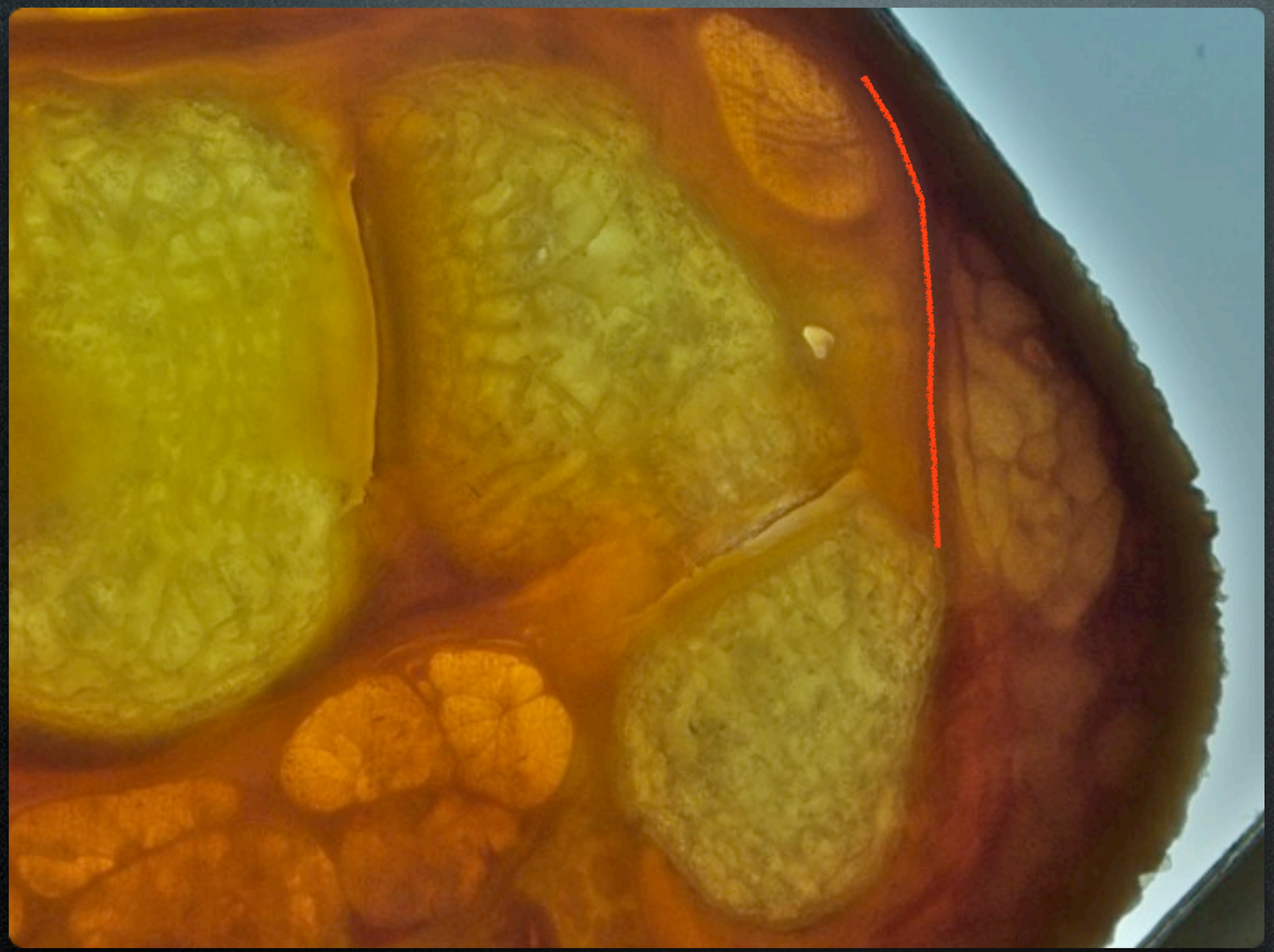


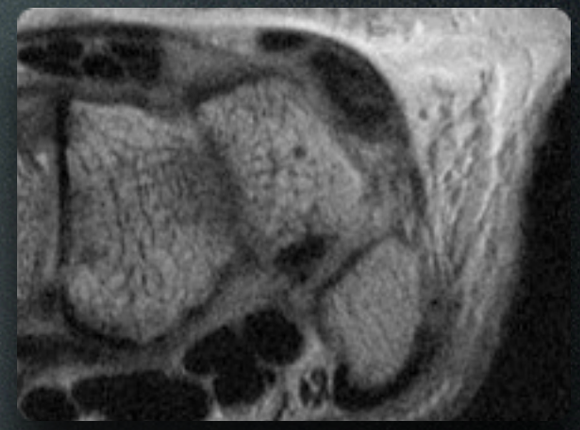
Middle portion - ulnar attachment site

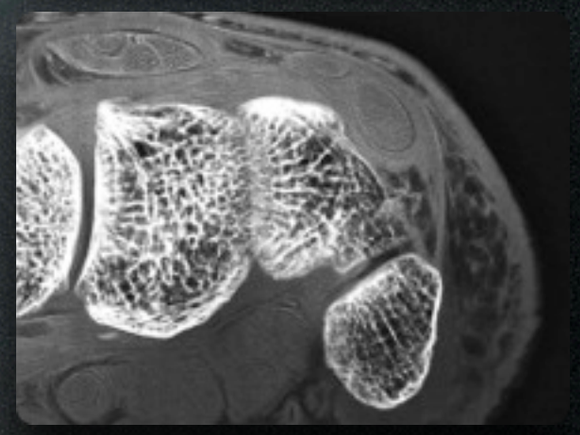




Middle portion - ulnar attachment site







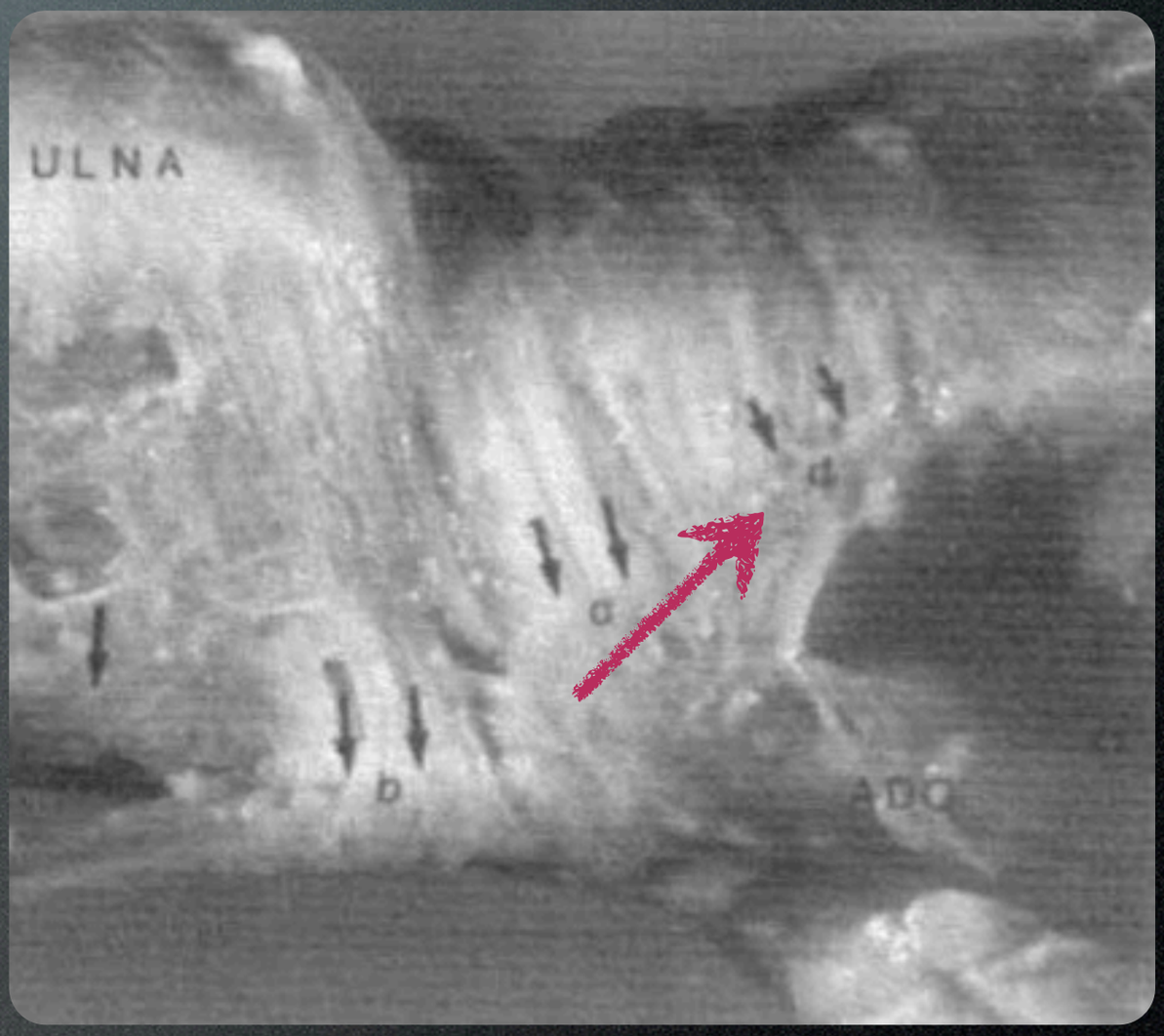
Middle portion - ulnar attachment site

Ulnar attachment site

- Proximal portion extends around the ulna investing the flexor carpi ulnaris tendon to attach to the palmar antebrachial fascia

- Middle portion inserts onto the pisiform

- Distal portion inserts onto the base of the 5th metacarpal and fascia of the abductor digiti minimi muscle



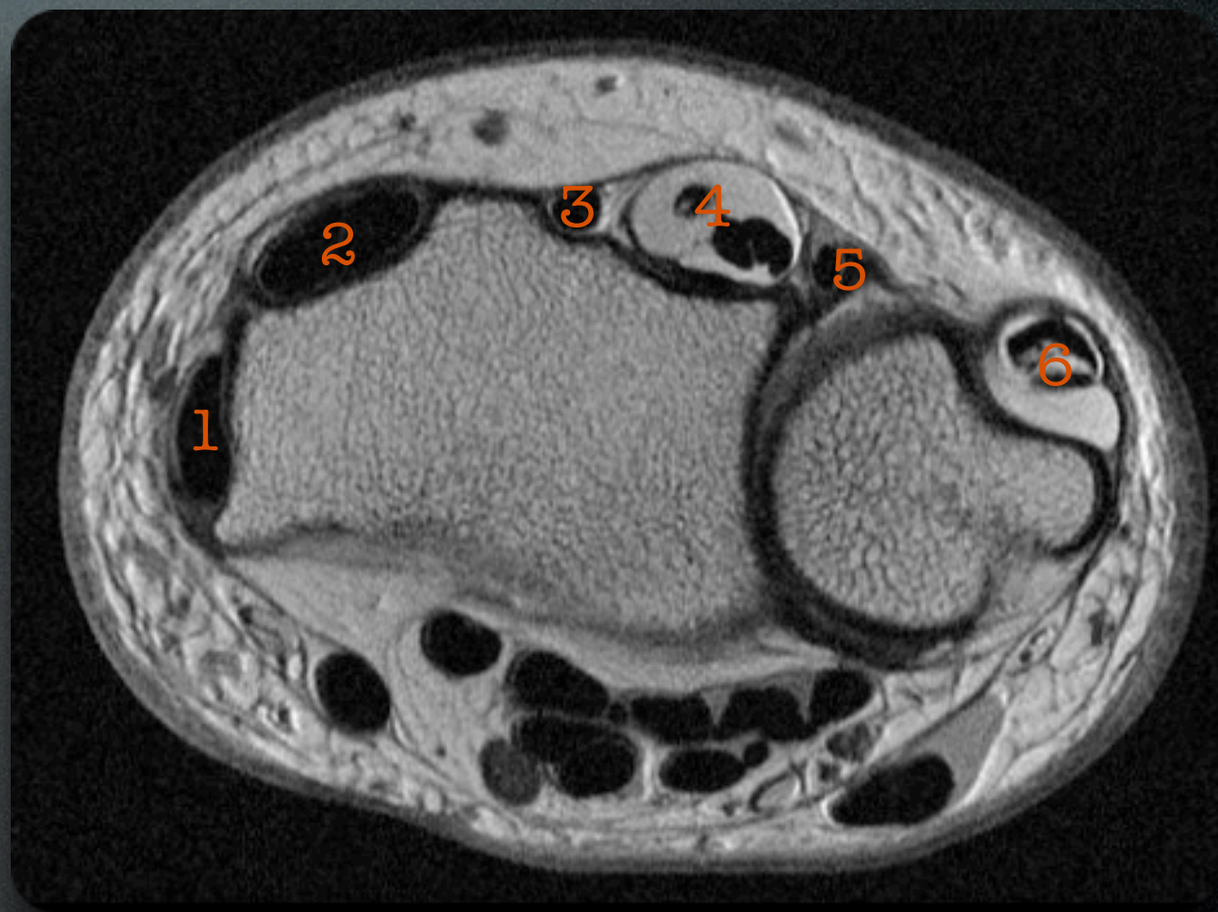
Palmer AK, Skahen JR, Werner FW, Glisson RR. The extensor retinaculum of the wrist: an anatomical and biomechanical study. J Hand Surg Br. 1985 Feb; 10(1):11-6

Summary of Supratendinous Extensor Retinaculum Peripheral attachments

- Radial attachment
  - Proximal portion invests the flexor carpi radialis tendon and coalesces with the palmar antebrachial fascia
  - Central fibers insert onto the radius
  - Distal fibers blend with fascia overlying the thenar eminence
- Ulnar Attachment
  - Proximal portion invests the flexor carpi ulnaris tendon to attach to the palmar antebrachial fascia
  - Middle portion inserts onto the pisiform
  - Distal portion inserts onto the base of the 5th MC and fascia of the abductor digiti quinti muscle

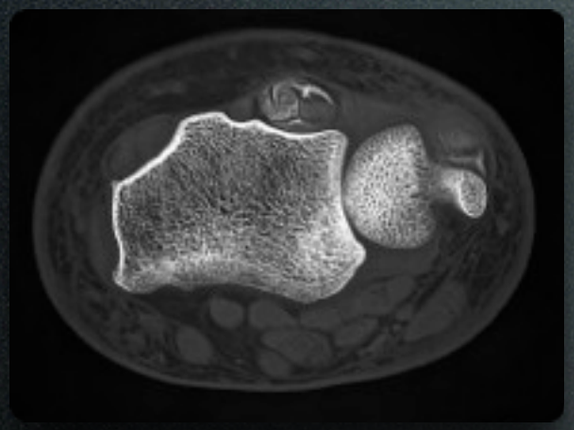
Extensor retinaculum
Septa and Dorsal compartments

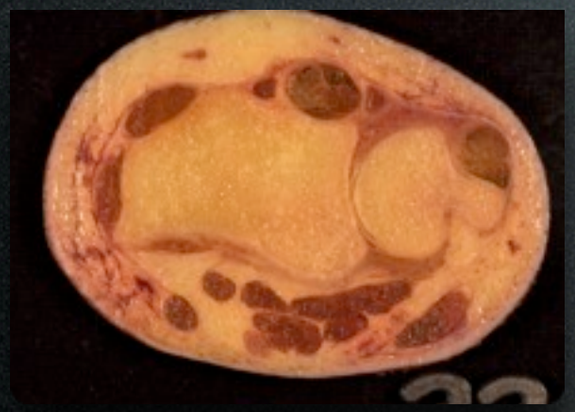
- 6 dorsal tendon compartments separated by 6 septa
  - 1 - Abductor pollicis longus, extensor pollicis brevis (APL, EPB)
  - 2 - Extensor carpi radialis longus, extensor carpi radialis brevis (ECRL, ECRB)
  - 3 - Extensor pollicis longus (EPL)
  - 4 - Extensor digitorum communis (ED)
  - 5 - Extensor digiti minimi (EDM)
  - 6 - Extensor carpi ulnaris (ECU)

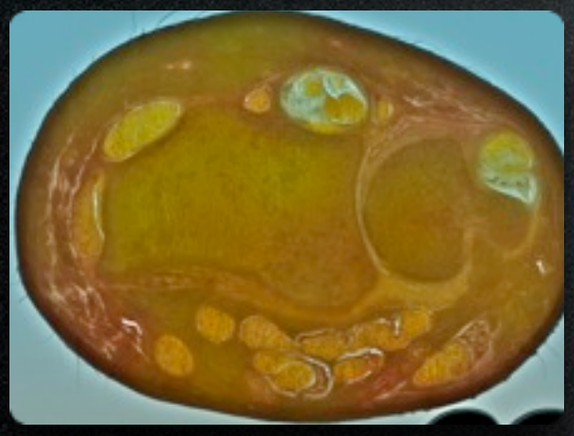


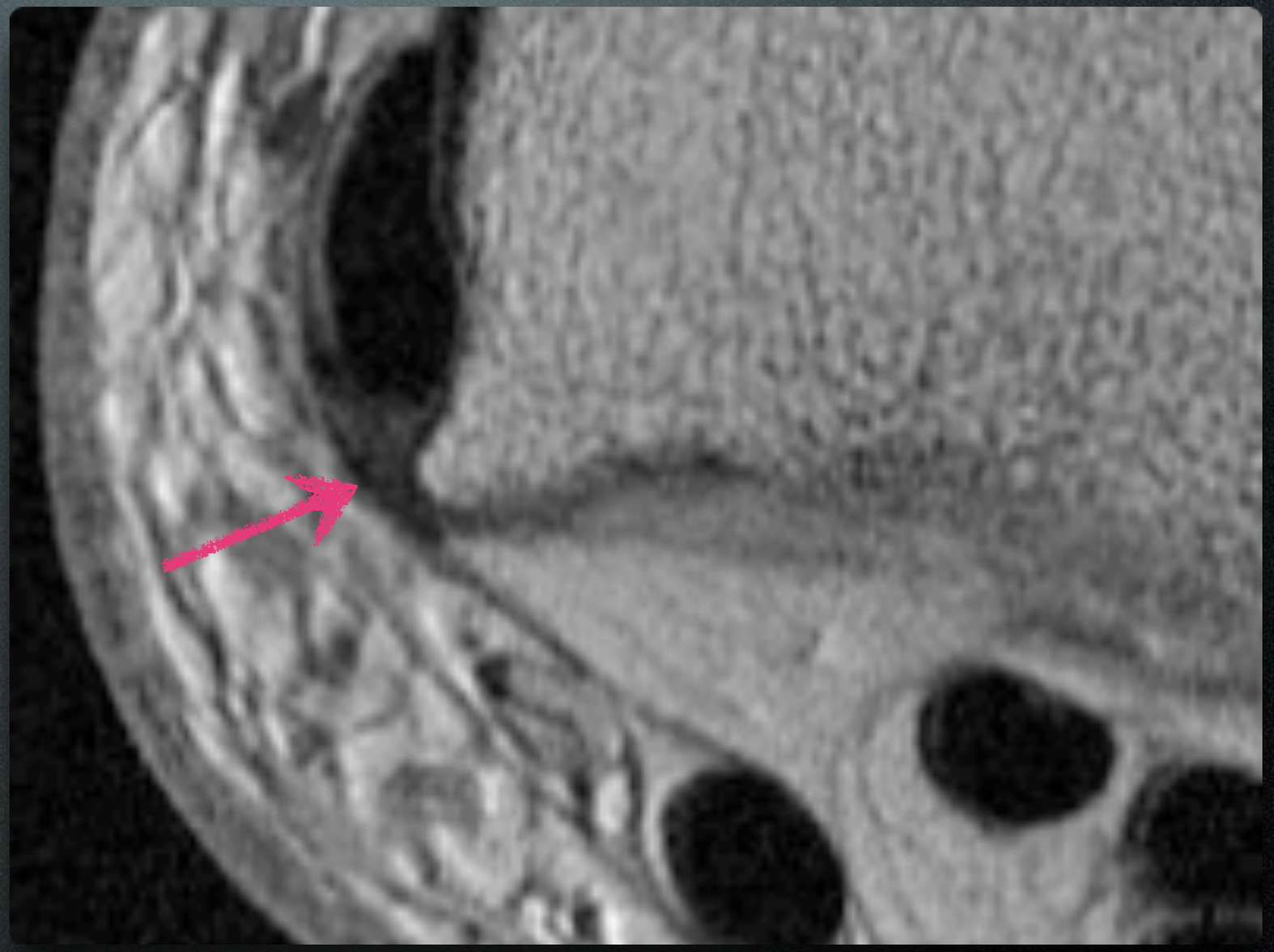
1st extensor compartment

- Tendons: Abductor pollicis longus, extensor pollicis brevis (APL, EPB)
- 1st septum is the bony attachment site of the supratendinous retinaculum on the radius

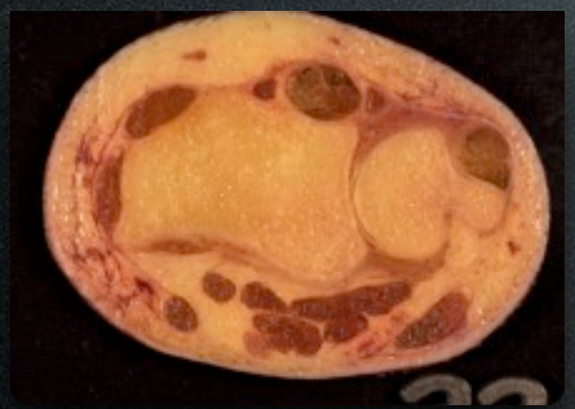


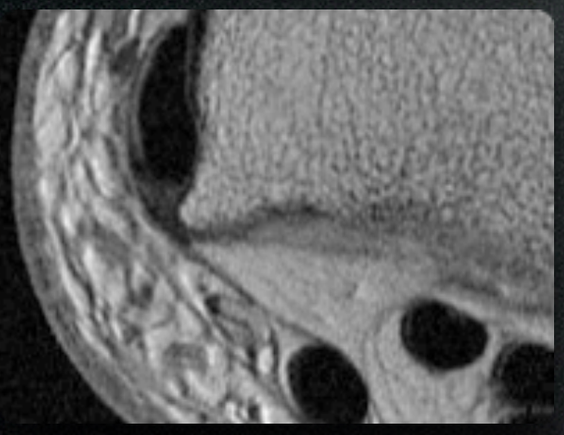


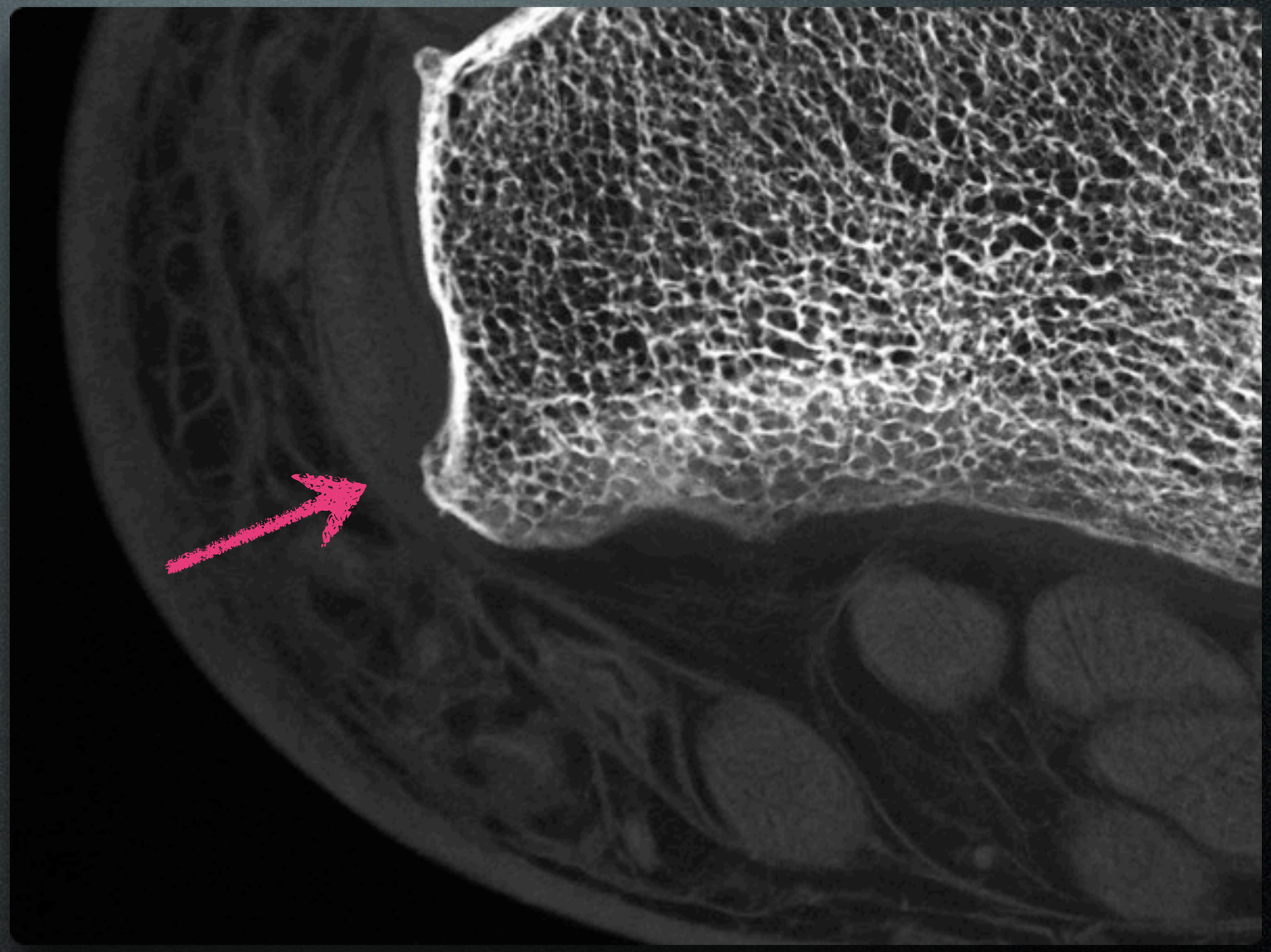




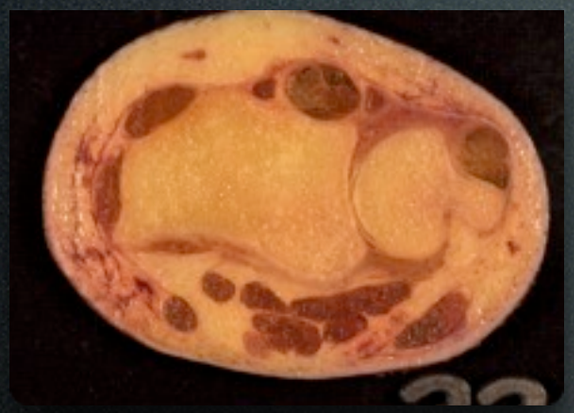
1st septum/Radial attachment site

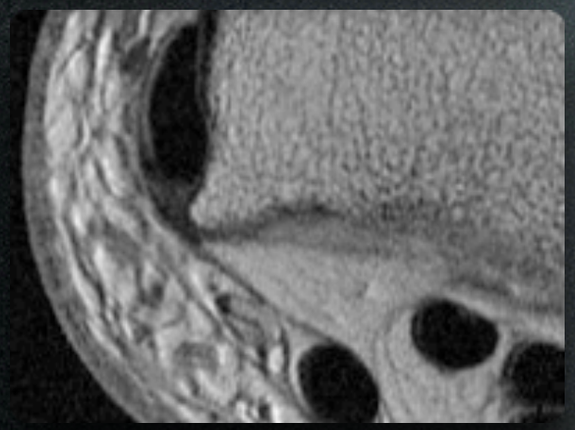


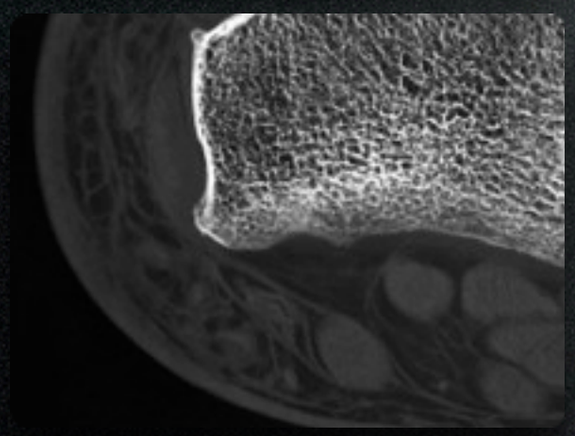


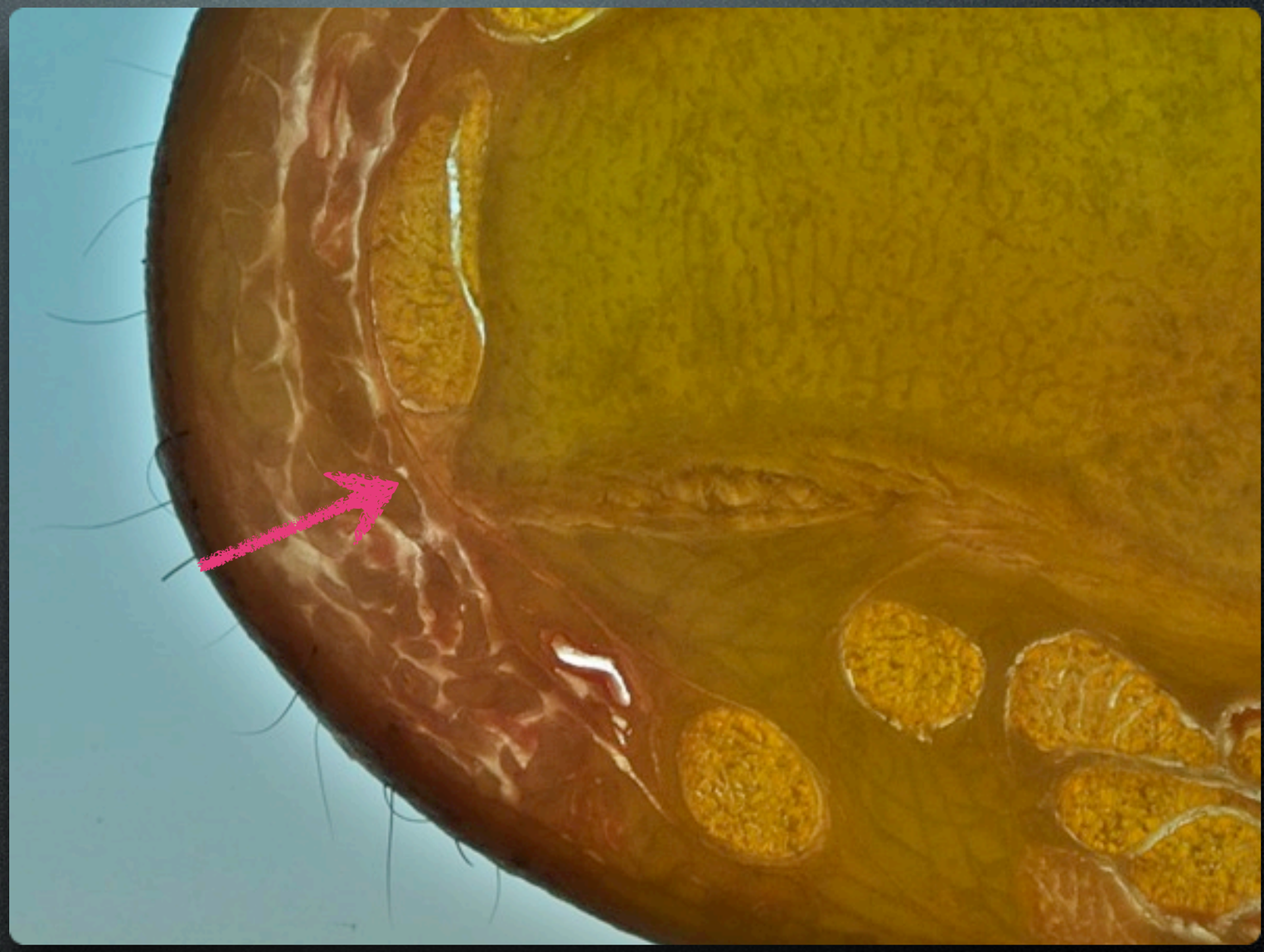


1st septum/Radial attachment site

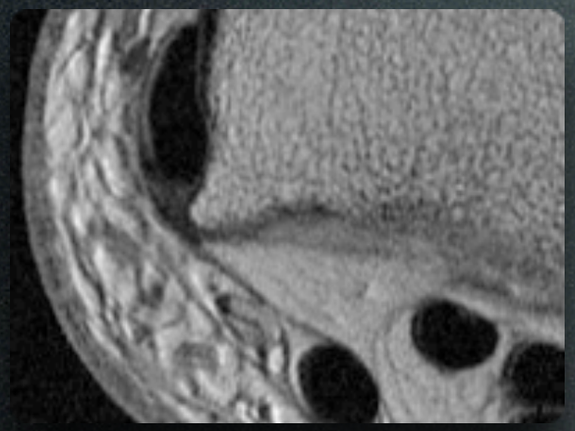


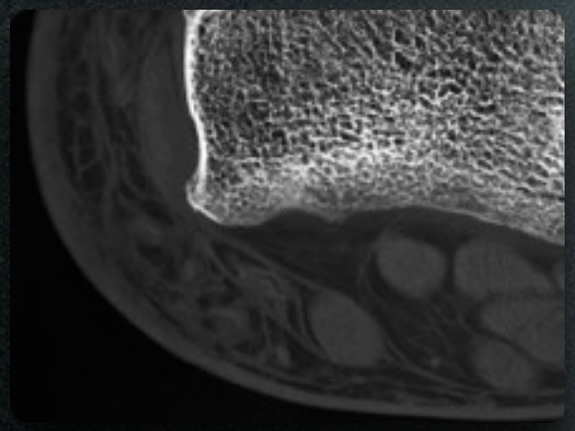


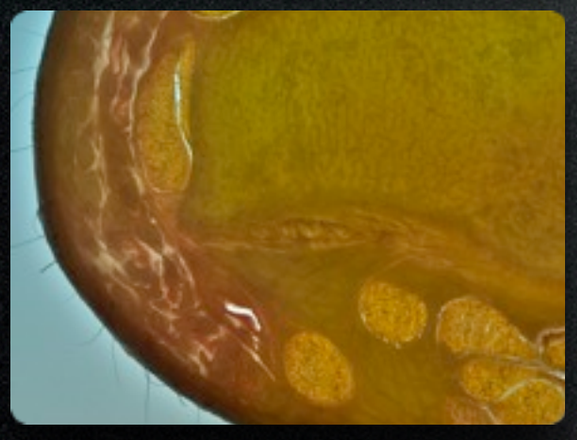


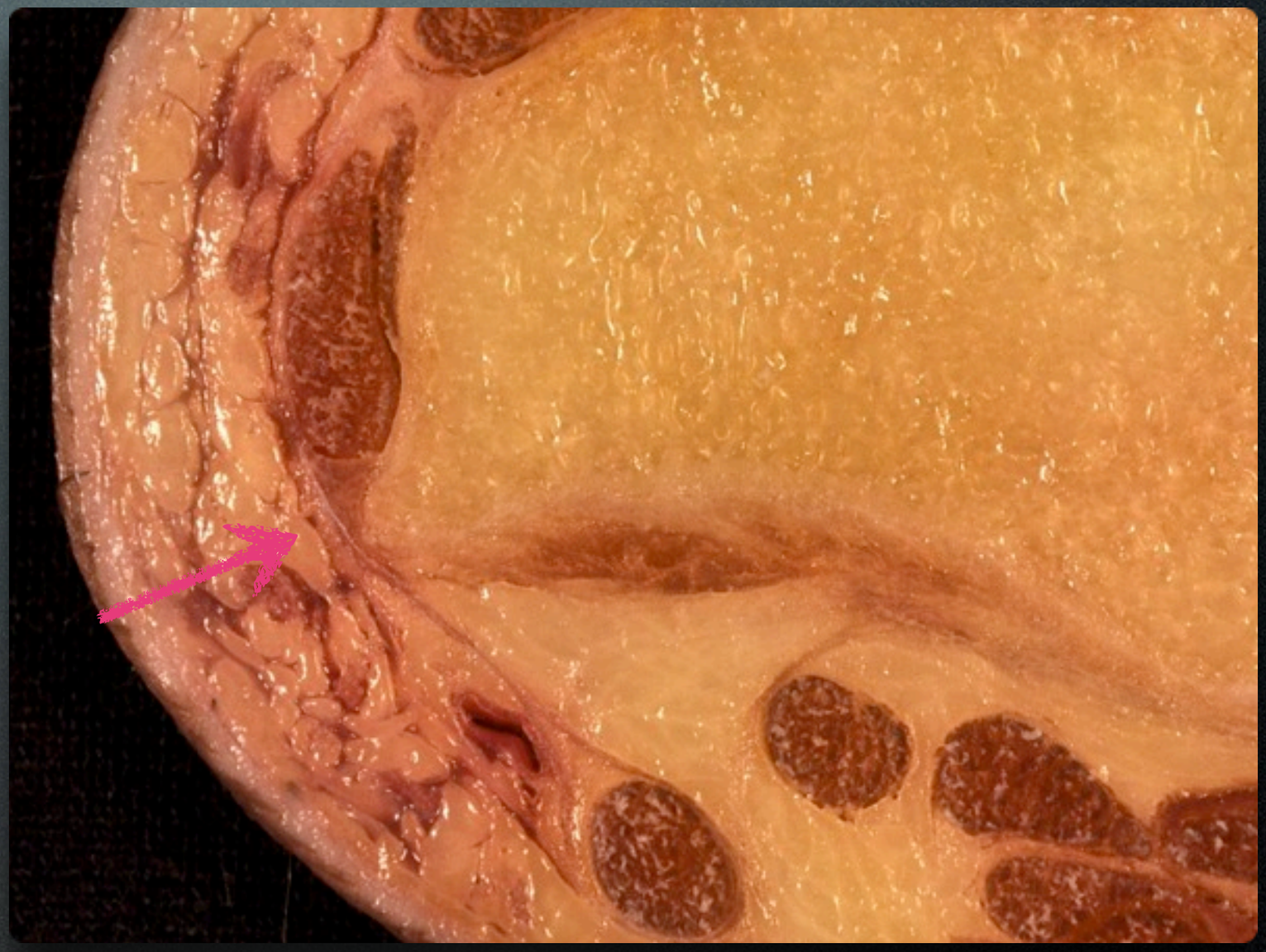


1st septum/Radial attachment site





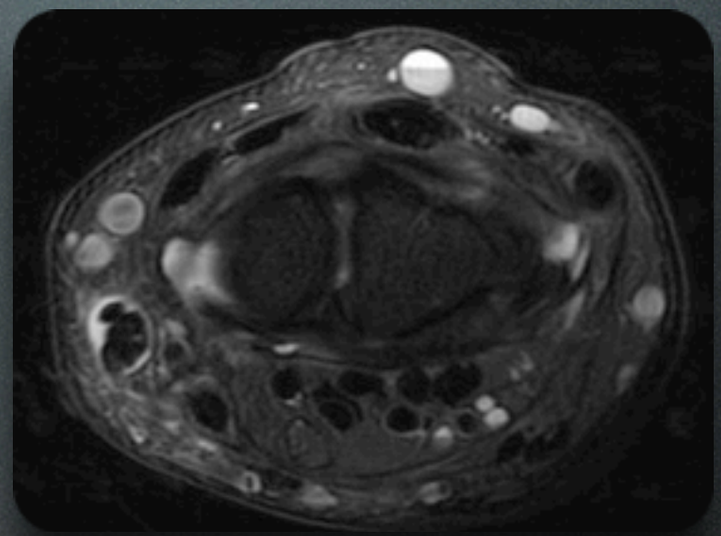


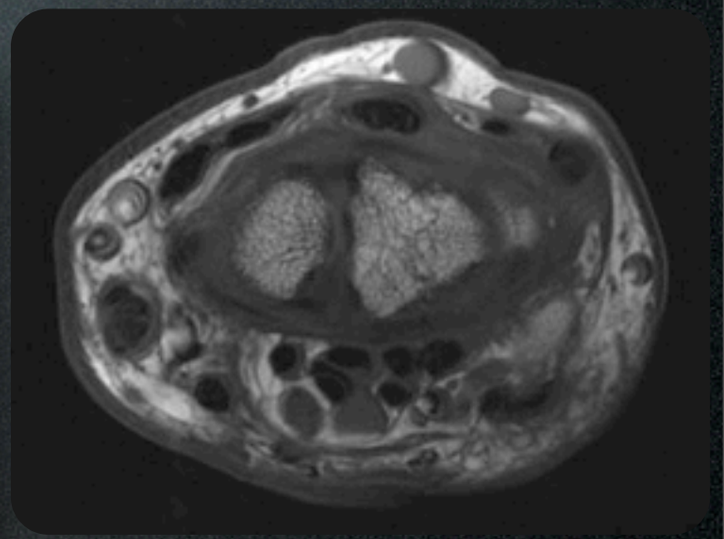


1st septum/Radial attachment site

de Quervain's tenosynovitis

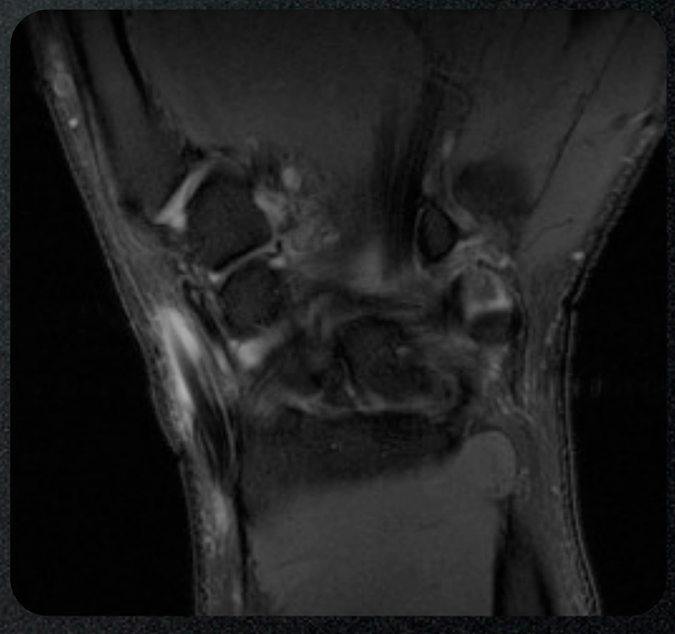
- Stenosing tenosynovitis of the extensor pollicis brevis (EPB) and abductor pollicis longus (APL) tendons in 1st dorsal compartment





- Entraps EPB and APL in tendon sheath with resultant pain and restricted movement

- Clinical diagnosis - Finkelstein test



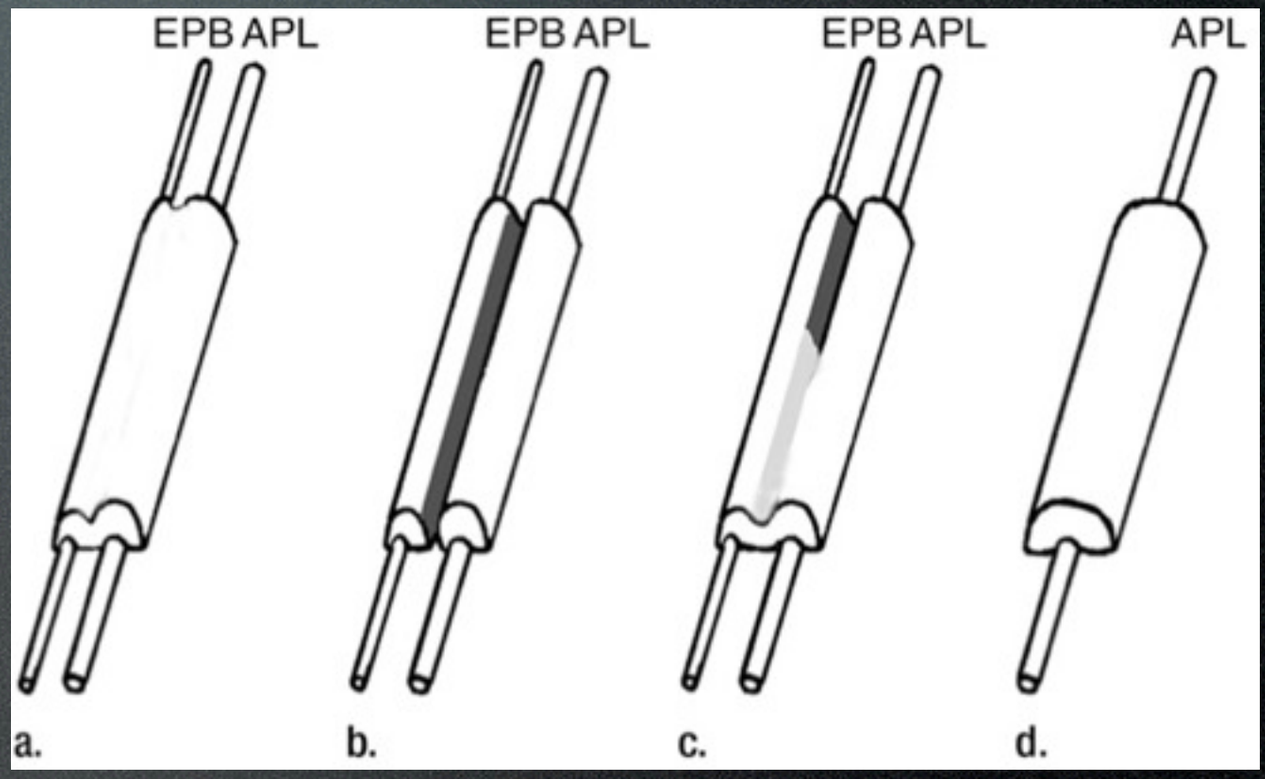
de Quervain's tenosynovitis
Finkelstein test

- Clinical exam - stretch the extensor tendons of the 1st dorsal compartment
- 3 staged test - start with patient's wrist in neutral position
- Positive test with pain at radial styloid
  - Stage 1 - gravity
  - Stage 2 - passive ulnar deviation
  - Stage 3 - gentle thumb flexion

Dawson C, Mudgal CS. Staged description of the Finkelstein test. J Hand Surg Am. 2010 Sep; 35(9):1513-5

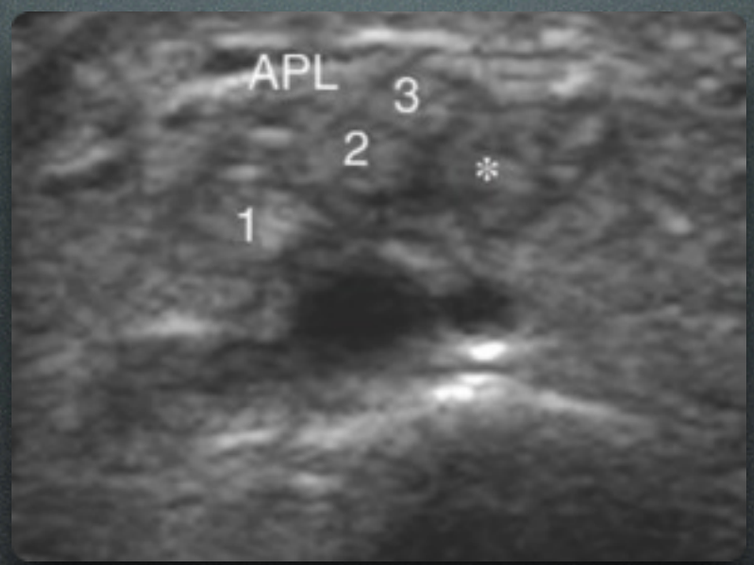
de Quervain's tenosynovitis Subcompartmentalization

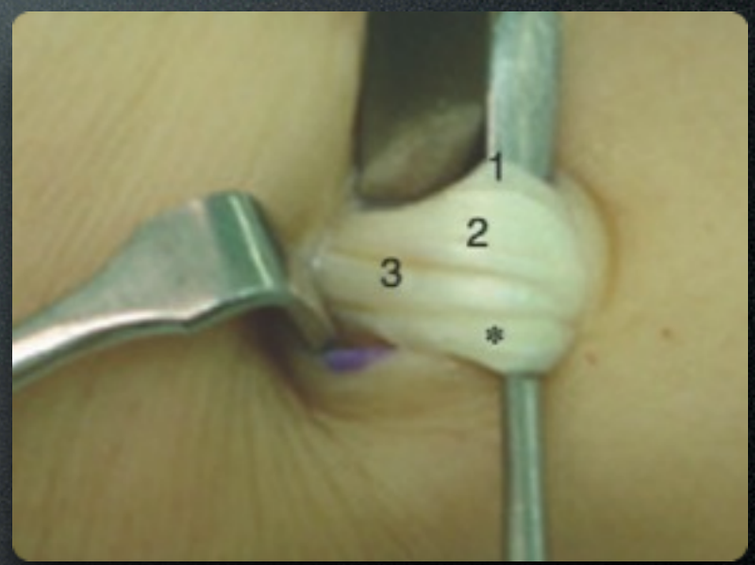
- Hiranuma classification
  - Type I - EPB & APL run in same sheath - 63%
  - Type II - EPB & APL complete septation - 23%
  - Type III - EPB & APL incomplete septation - 9%
  - Type IV - EPB lacking -5%
- Treatment
  - Immobilization/medications
  - Steroid injection
  - Surgical release



Choi SJ, Ahn JH, Lee YJ, Ryu DS, Lee JH, Jung SM, Park MS, Lee KW. de Quervain disease: US identification of anatomic variations in the first extensor compartment with an emphasis on subcompartmentalization. Radiology. 2011 Aug; 260(2):480-6

de Quervain's tenosynovitis
Subcompartmentalization





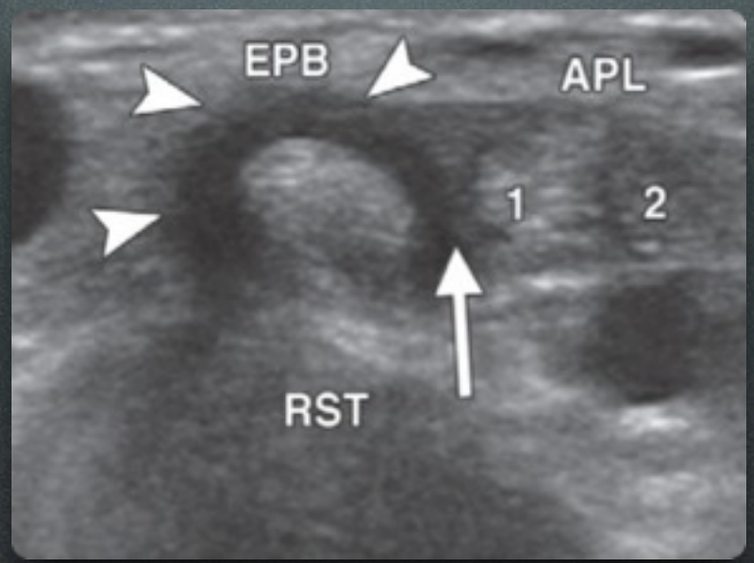
Distal Radius

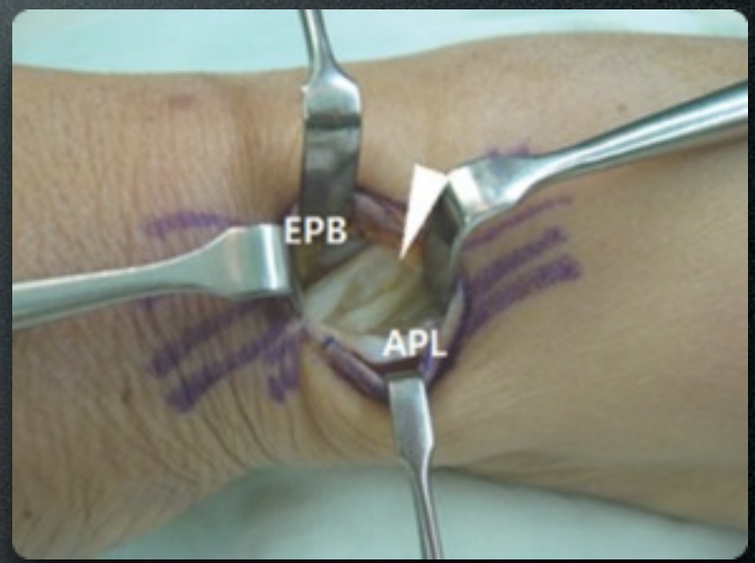
Radiocarpal Joint

Hiranuma Type I - single compartment

Choi et al, Radiology. 2011

de Quervain's tenosynovitis
Subcompartmentalization





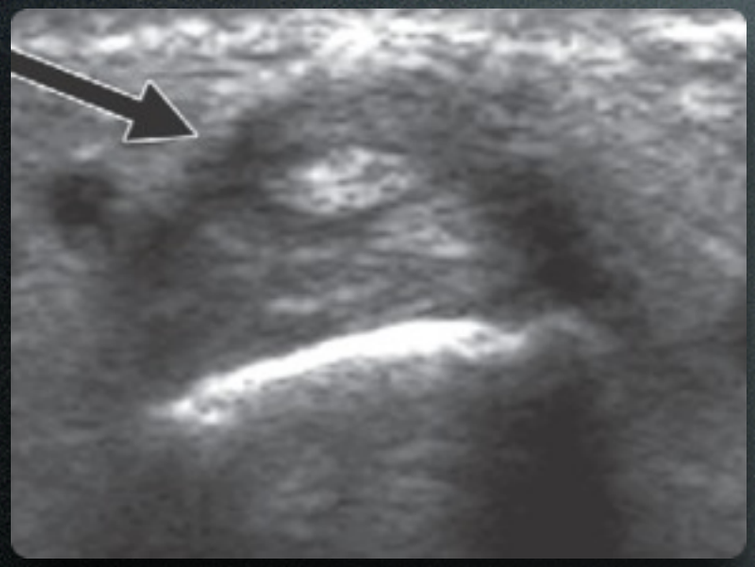
Distal Radius

Radial styloid

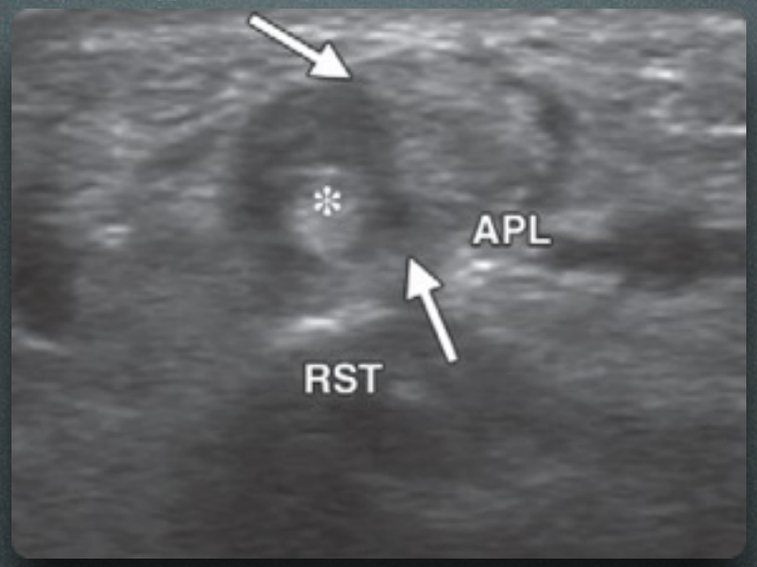
Hiranuma Type II - two compartments

Choi et al, Radiology. 2011

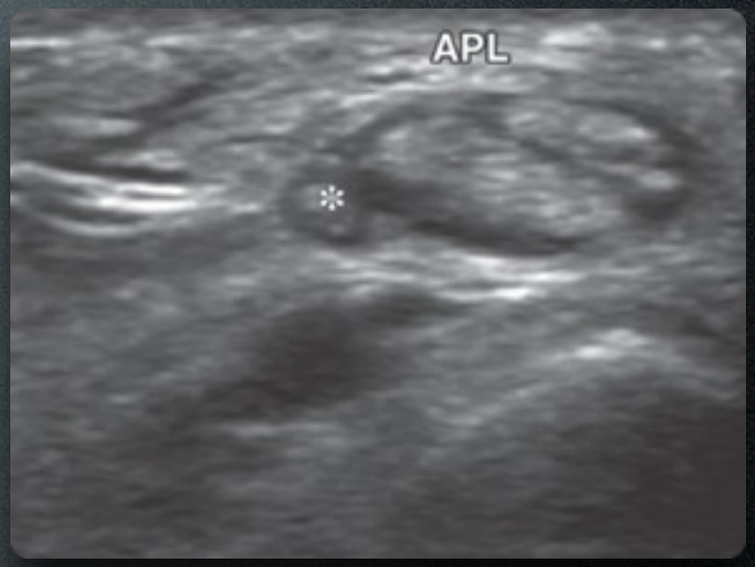
de Quervain's tenosynovitis Subcompartmentalization



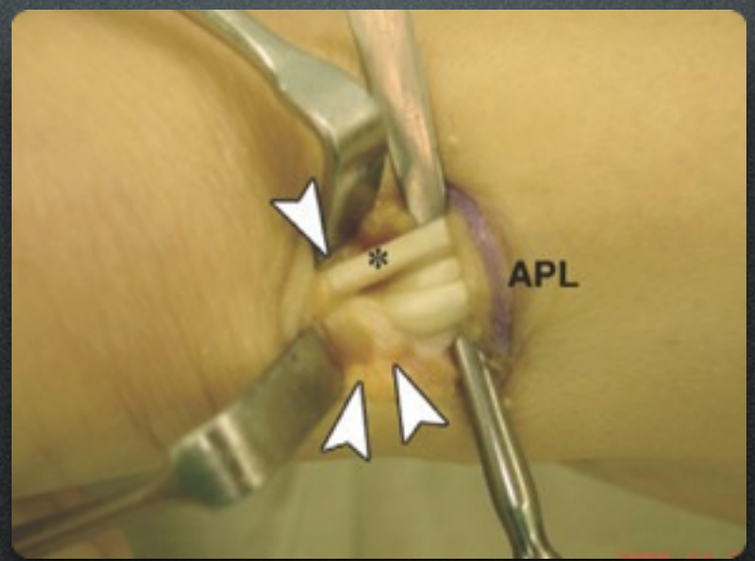
Distal Radius



Radial Styloid



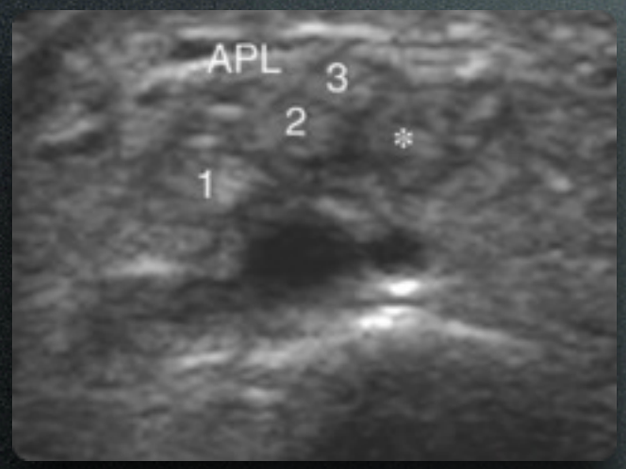
Radiocarpal joint

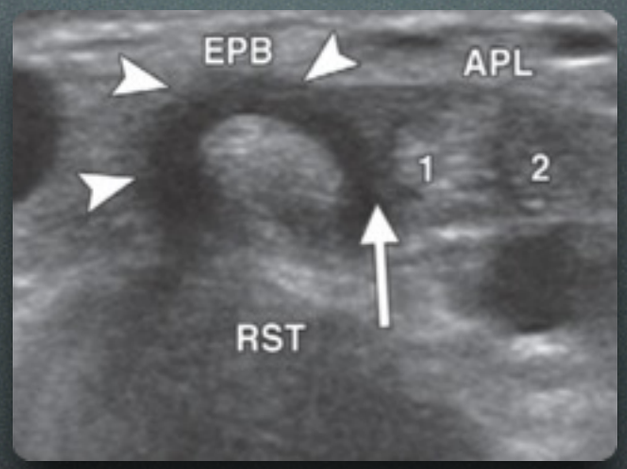


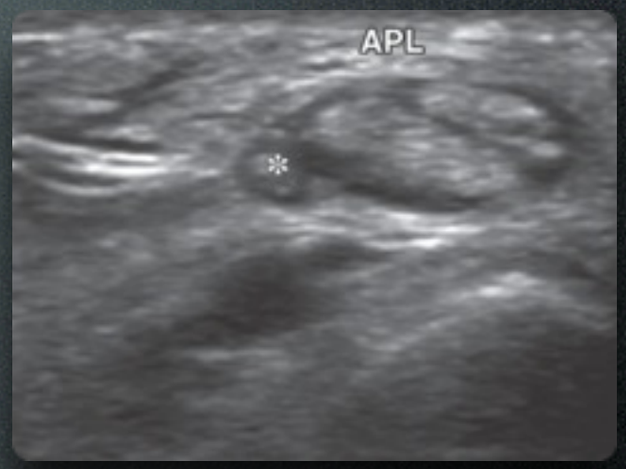
Hiranuma Type III - incomplete compartments

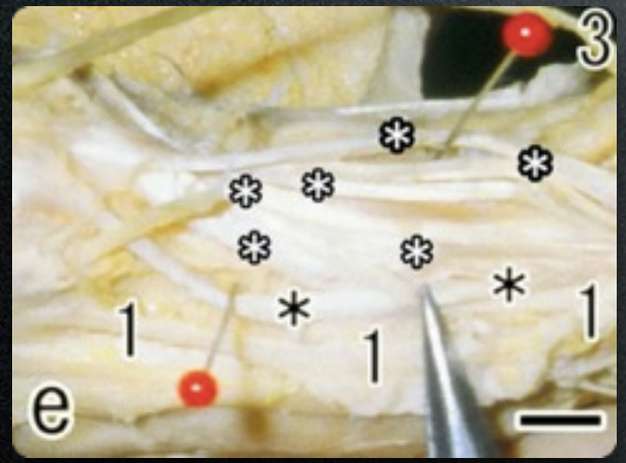
Choi et al, Radiology. 2011

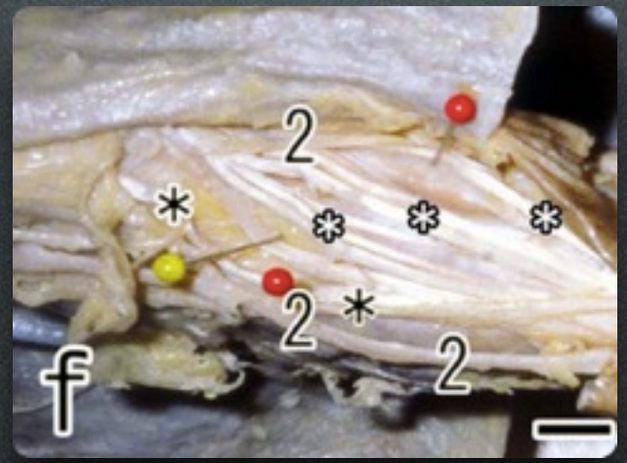
de Quervain's tenosynovitis
Subcompartmentalization

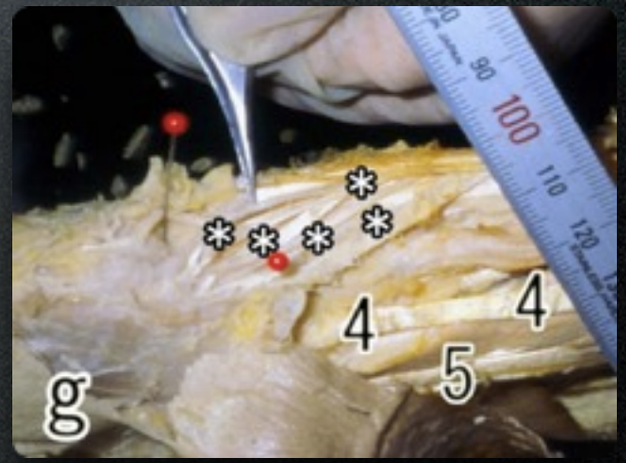










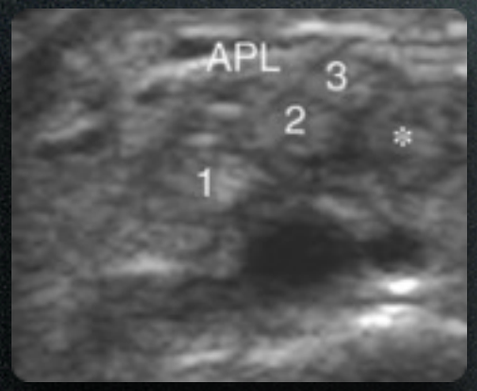


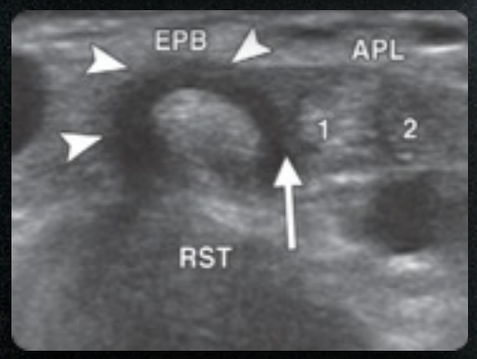
Abductor pollicis longus tendon slips

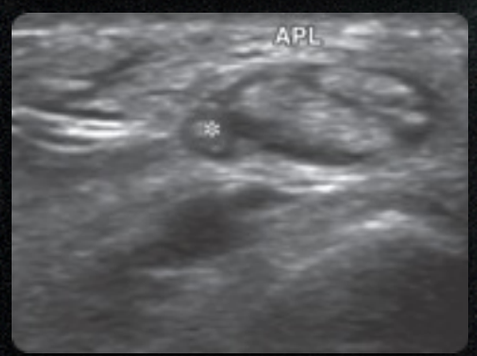
Choi et al, Radiology. 2011

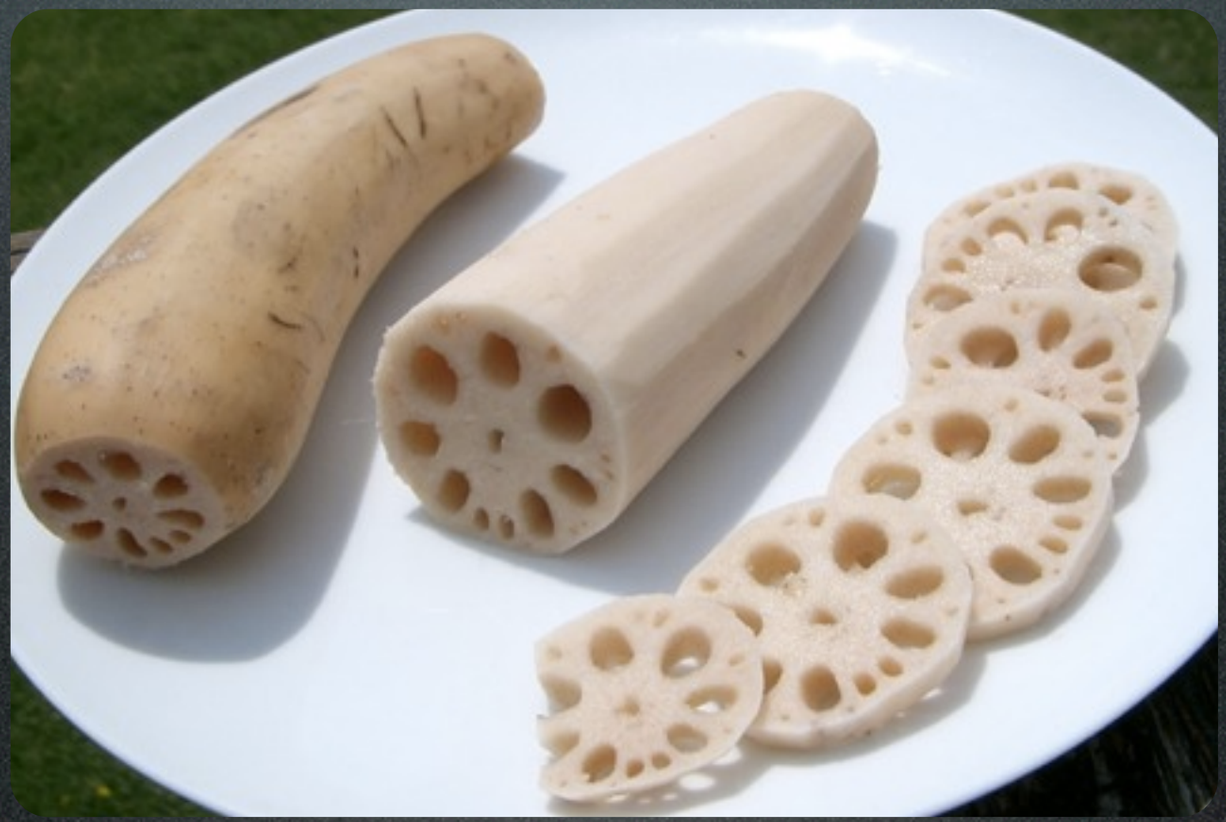
Motoura et al, Anat Sci Int. 2010

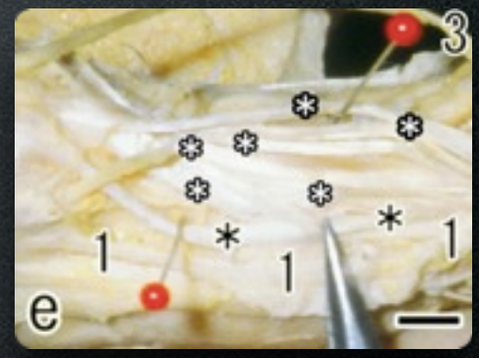
de Quervain's tenosynovitis
Subcompartmentalization

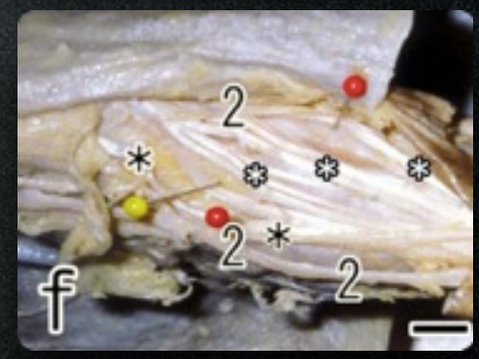


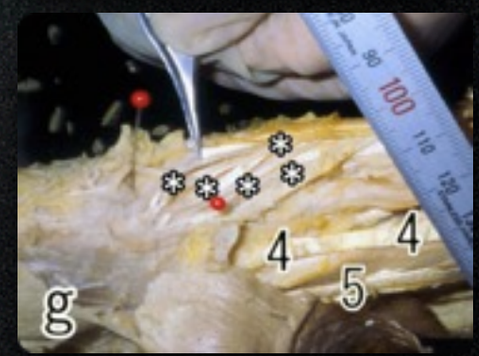








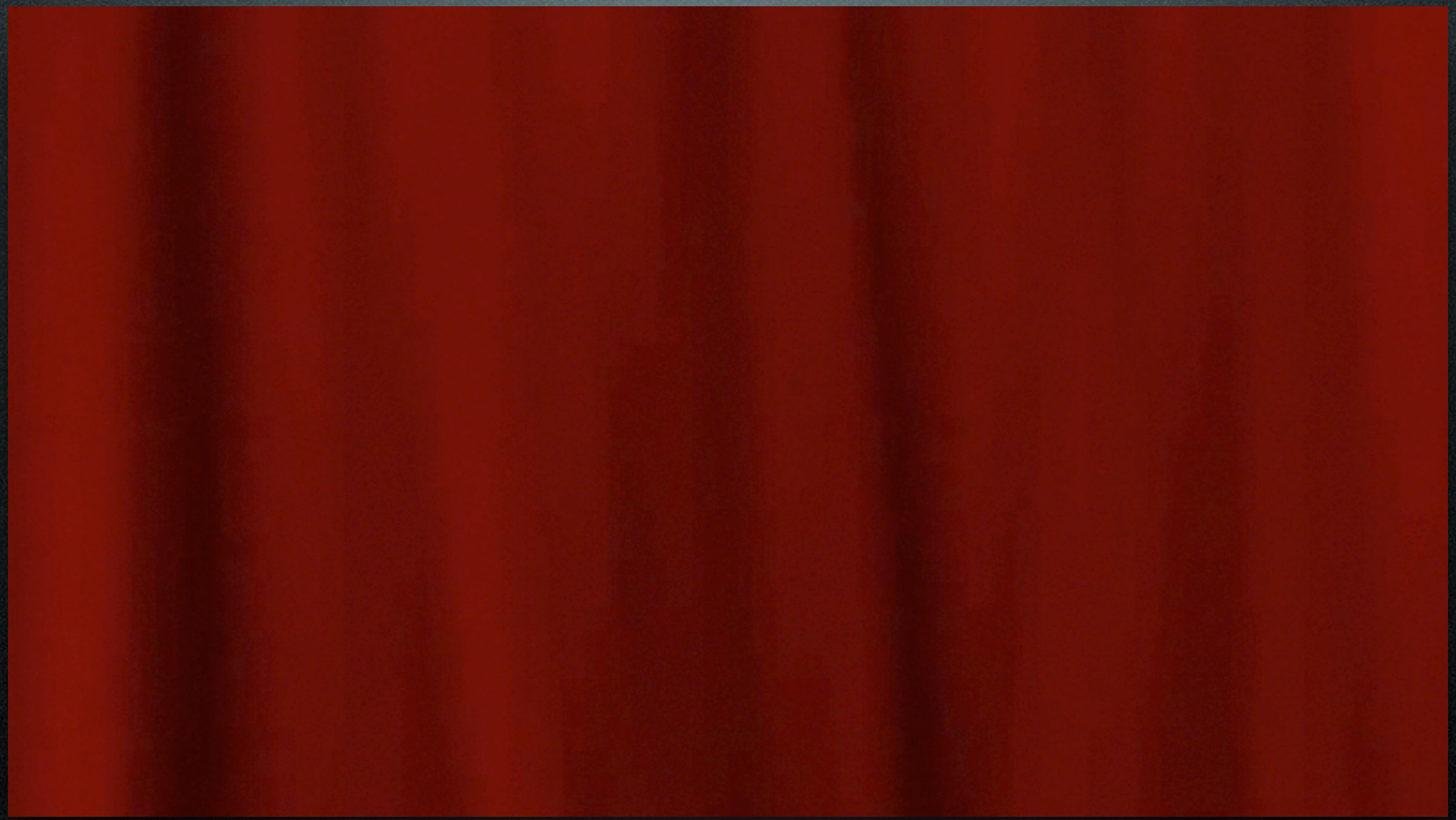




Abductor pollicis brevis tendon slips
"Lotus Root Sign"

Choi et al, Radiology. 2011

Motoura et al, Anat Sci Int. 2010

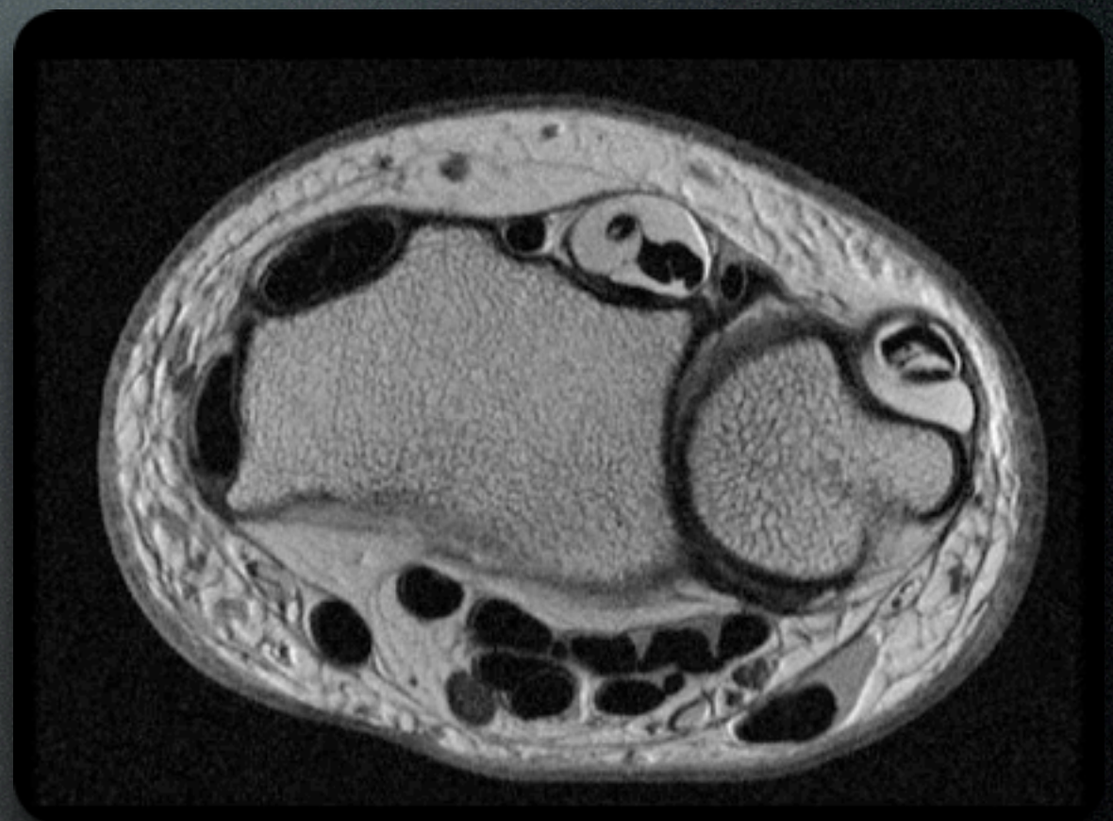


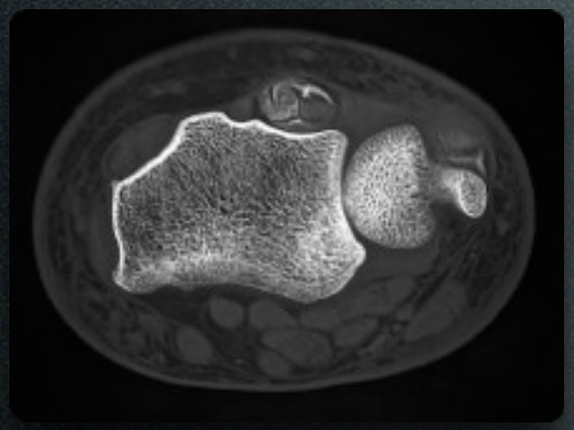
Sectioning Step 1
Position sample

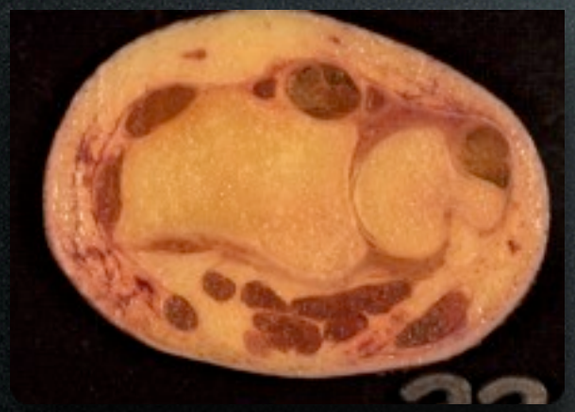
2nd extensor compartment

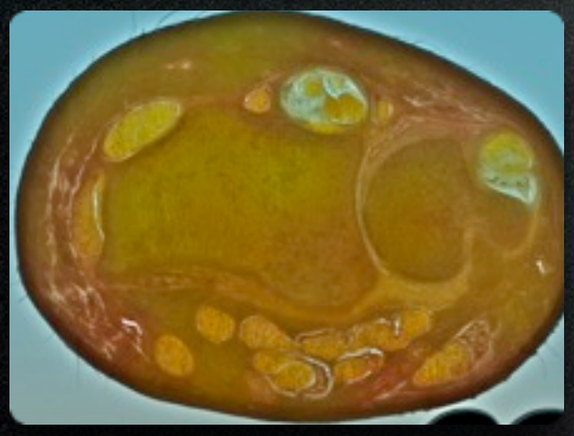
- Tendons: Extensor carpi radialis longus, extensor carpi radialis brevis (ECRL, ECRB)

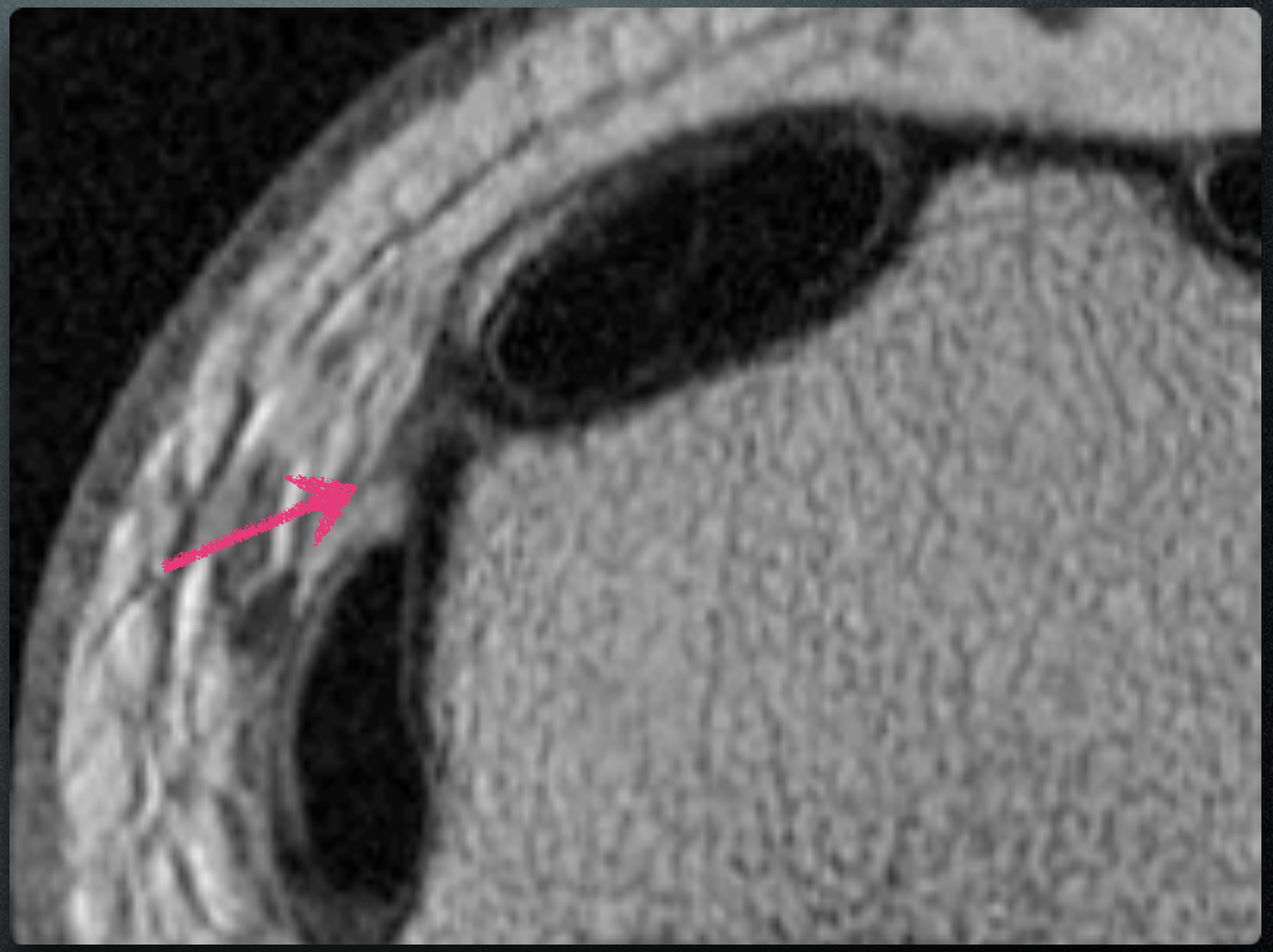
- 2nd septum attaches to both sides of a triangular protuberance separating the 1st and 2nd compartments



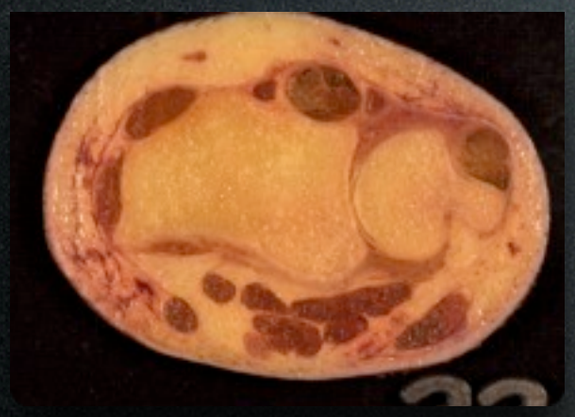


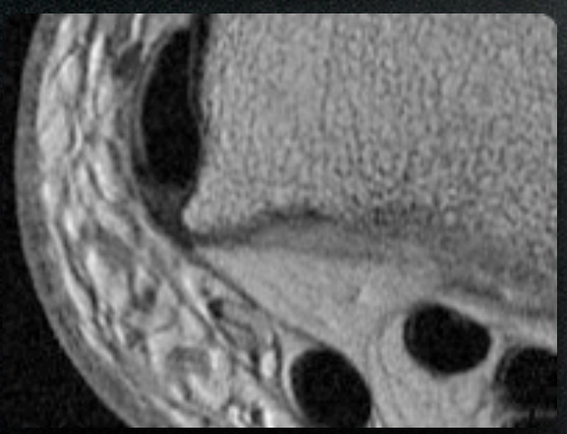


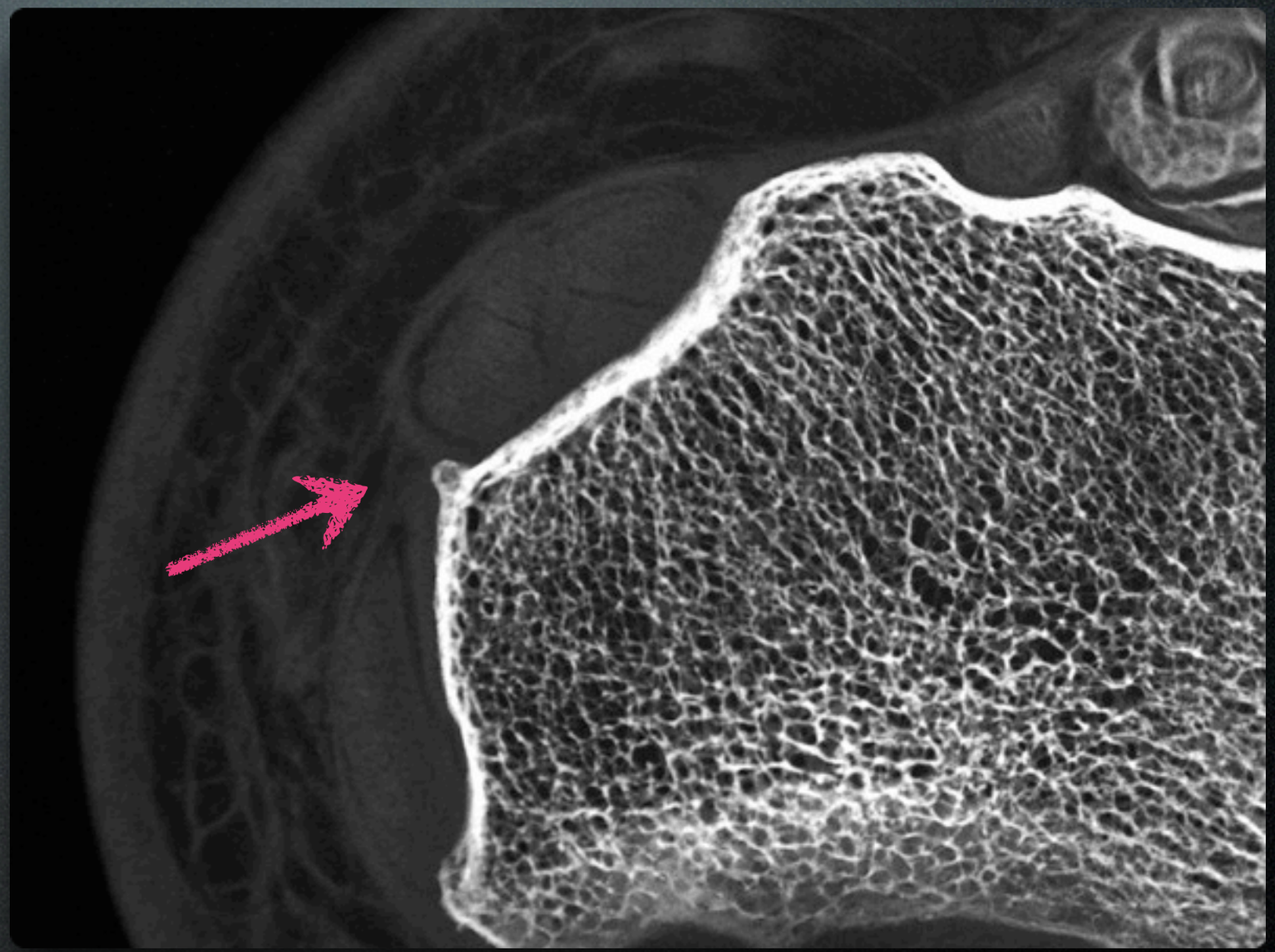




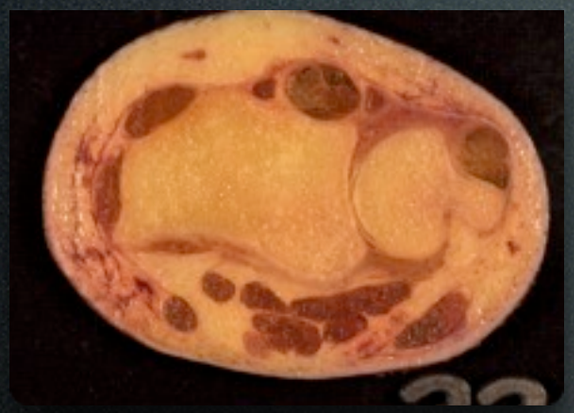
2nd septum/Radial attachment site

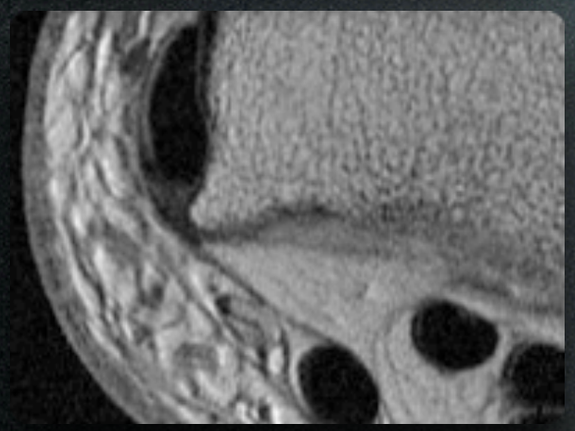


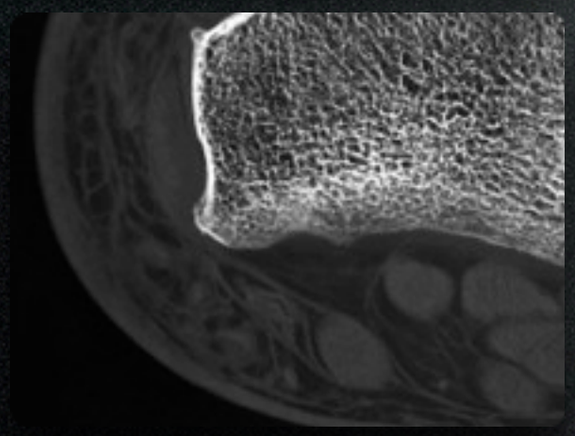


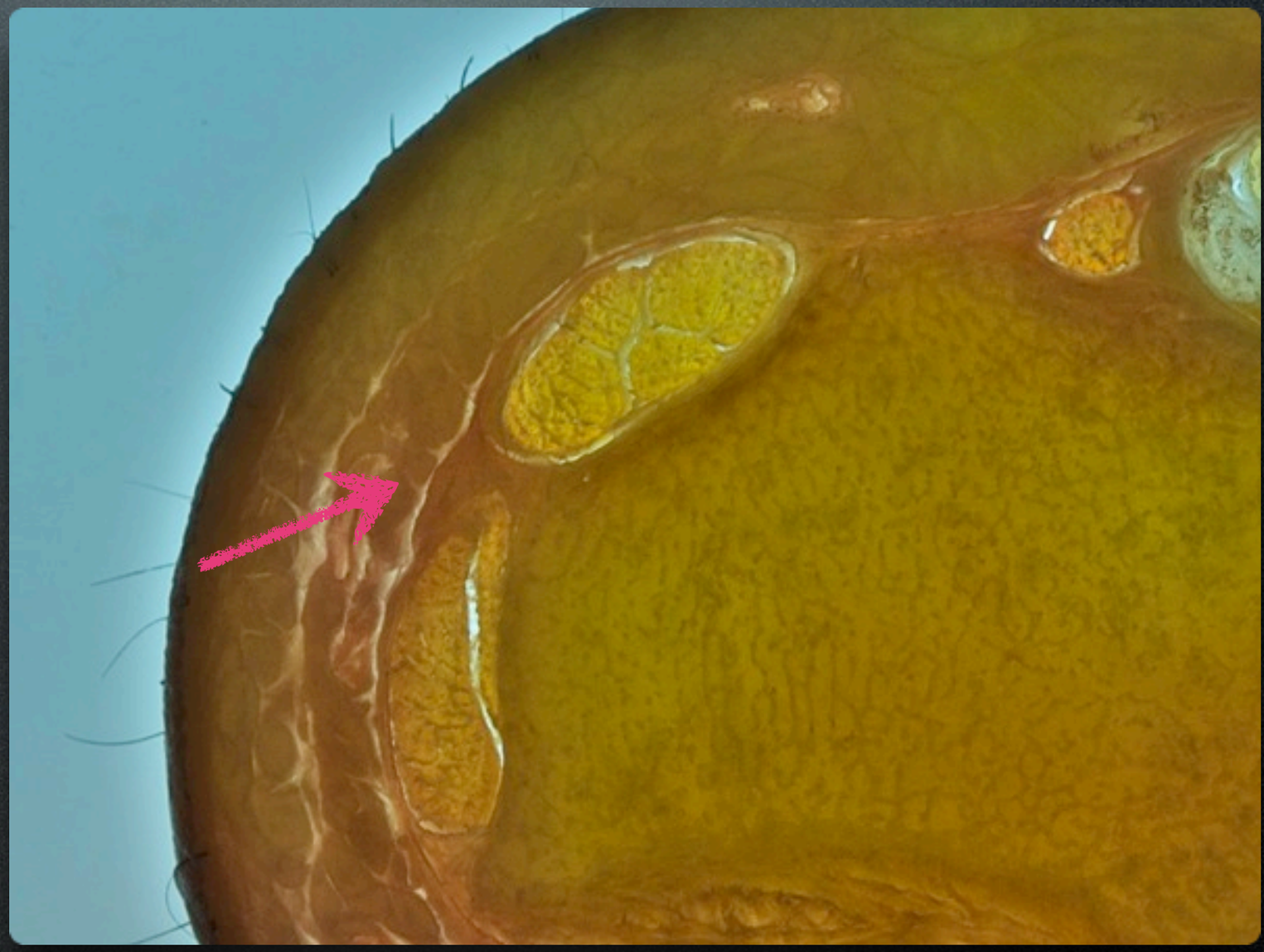


2nd septum/Radial attachment site

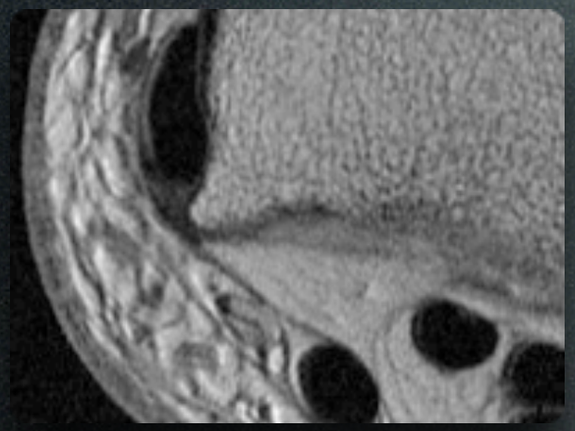


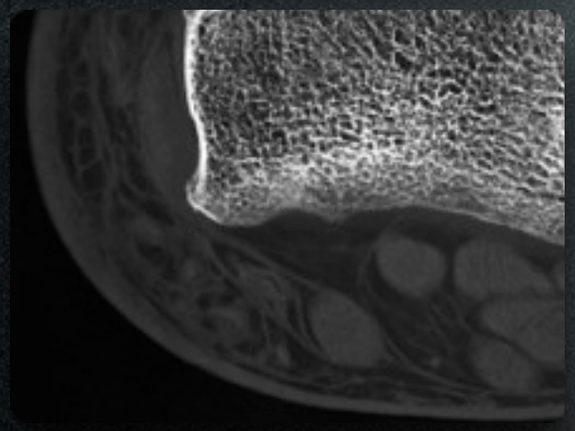


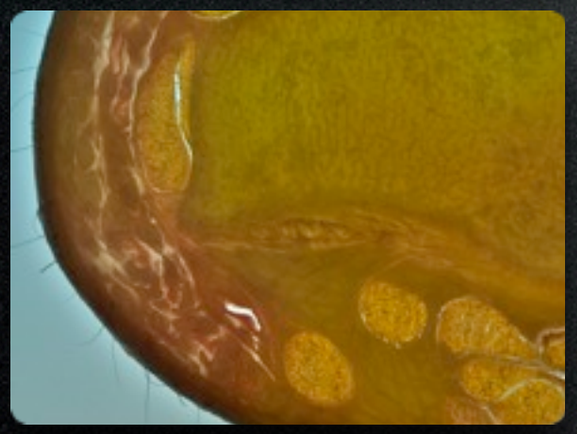


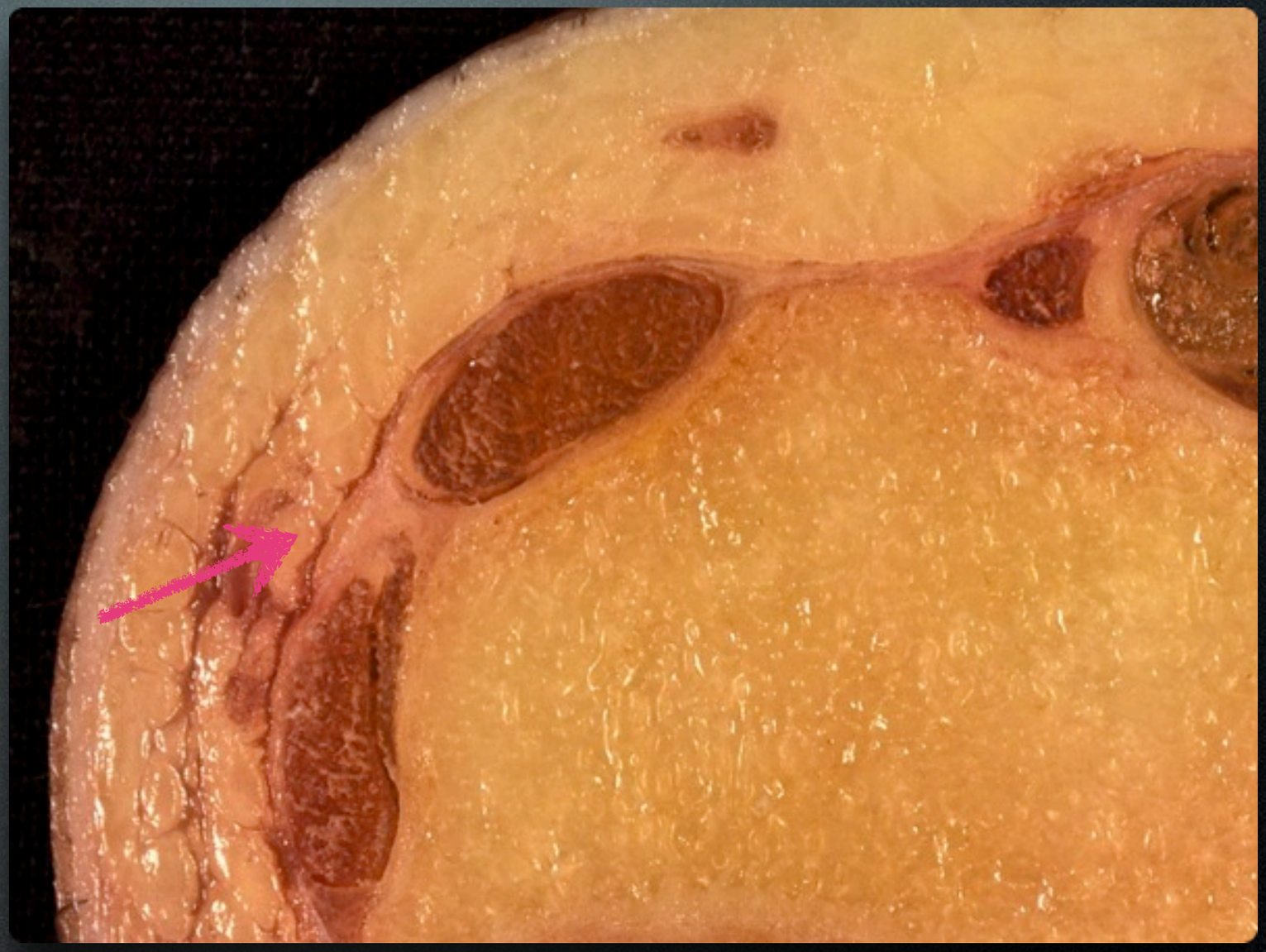


2nd septum/Radial attachment site





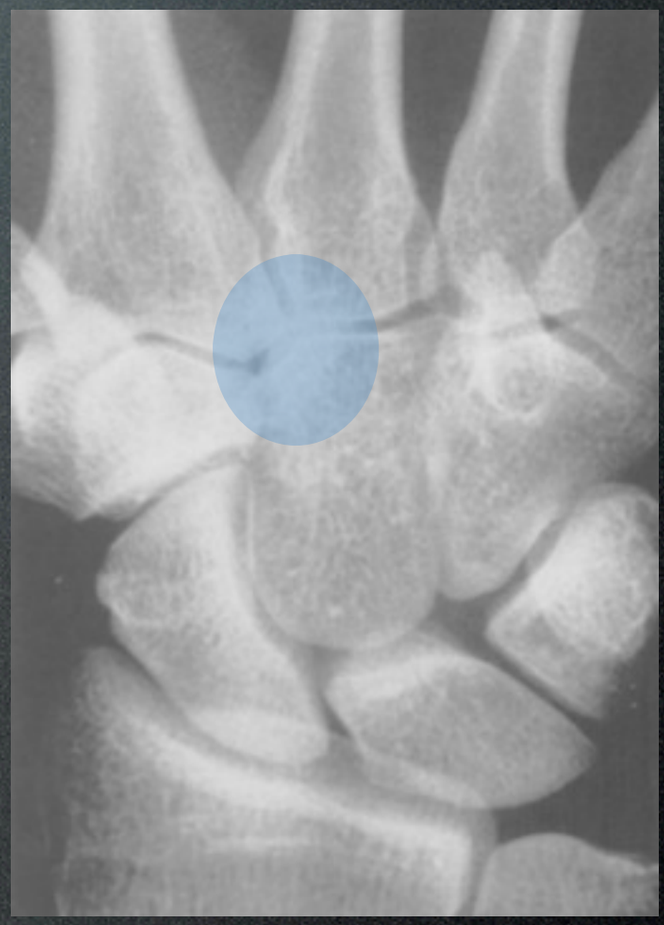




2nd septum/Radial attachment site

Carpal boss

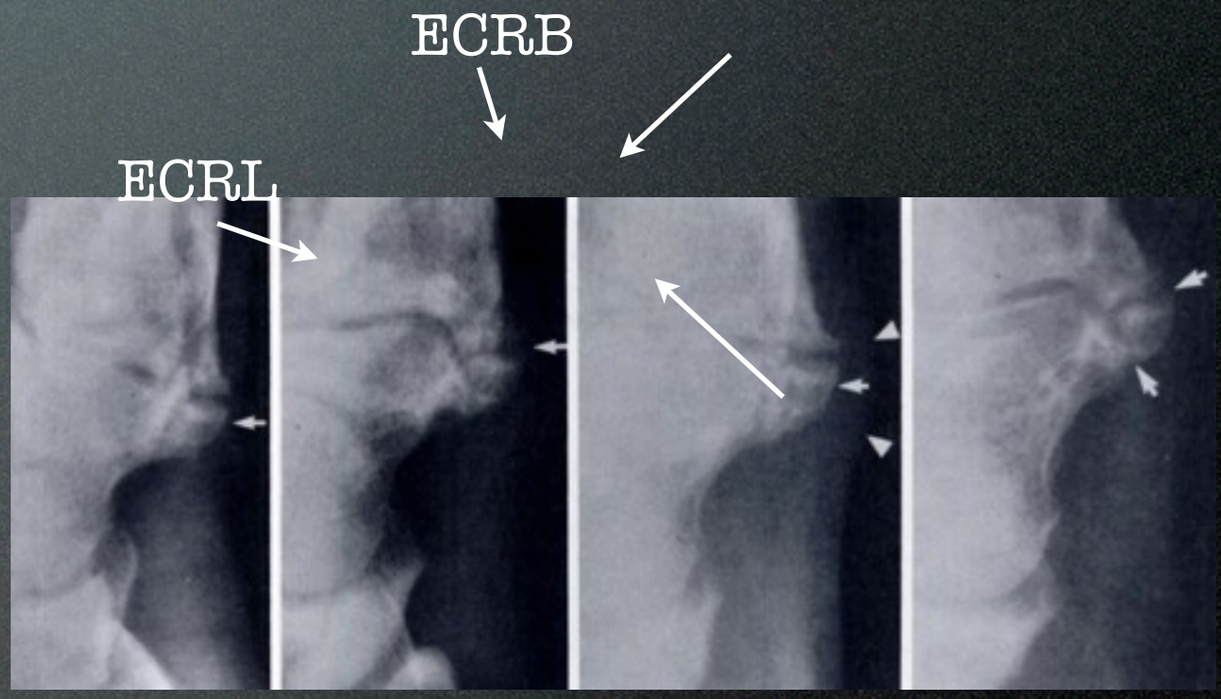
- First described by Saltzman in 1725 and re-described as “carpe bossu” in 1931 by Fiolle
- Bony protuberance at the quadrangular trapezoidal-capitate-metacarpal (2nd-3rd) joint
  - Osteophyte
  - Accessory ossification - Os styloideum
  - Both
- Differentiate from a ganglion cyst



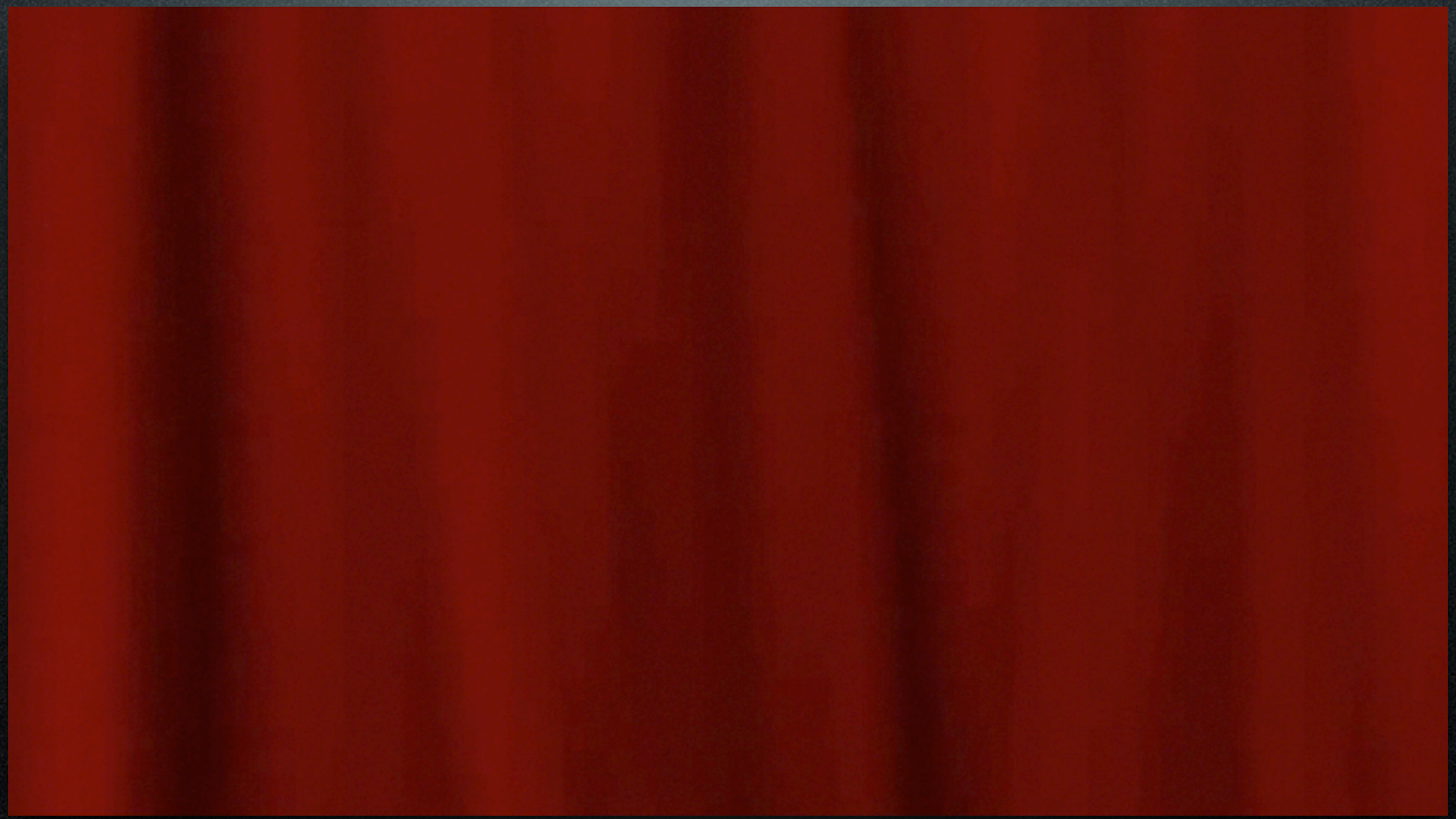
Fusi et al, J Hand Surg Br 1995.
Park et al, J Hand Surg 2008.

Carpal boss

- Imaging
  - X-ray: Modified lateral with hand flexed and supinated 30˚to 40˚ with ulnar deviation of 20˚ to 30˚
  - Computed tomography
  - MRI
    - Bone edema in symptomatic cases
    - ECRL/ECRB tendinosis/ tenosynovitis
- Treatment - conservative to surgery (most authors advocate surgery for symptomatic patients)



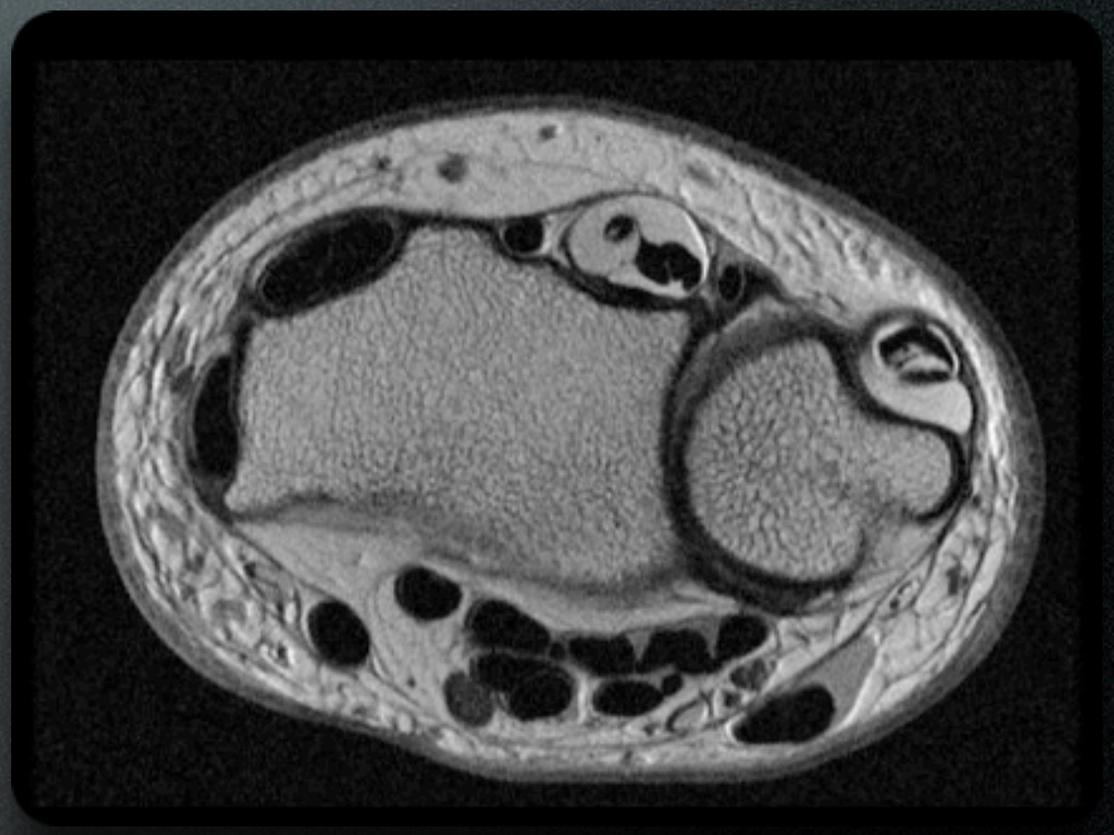
Carlson et al, J Hand Surg 2008

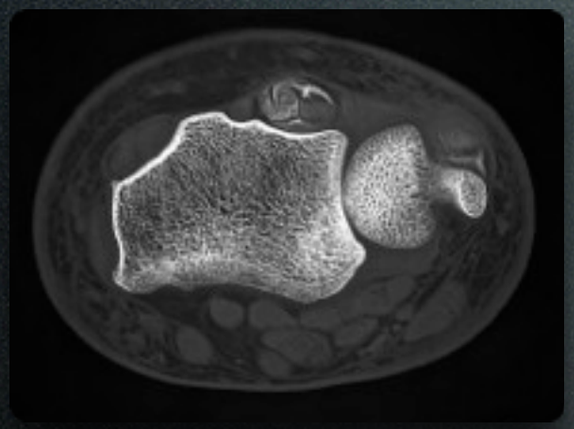


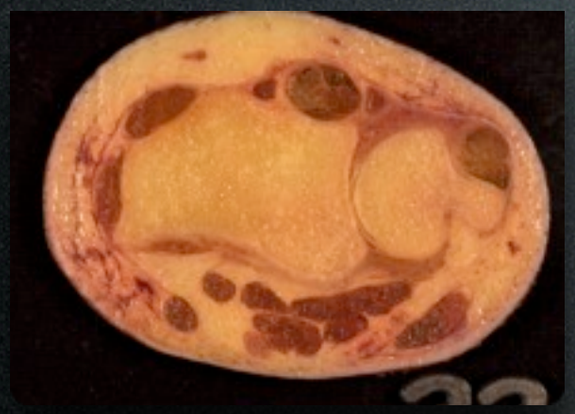
Sectioning Step 2
Mark sample

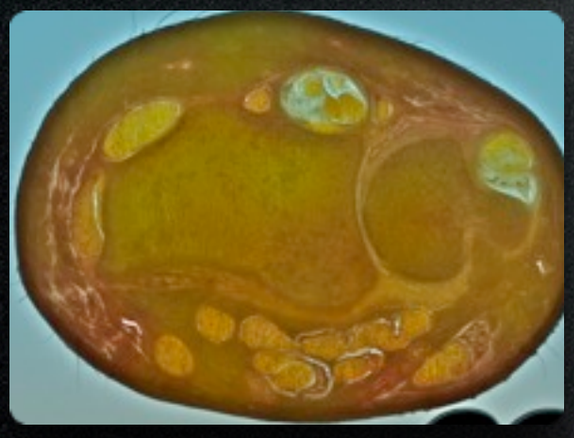
3rd extensor compartment

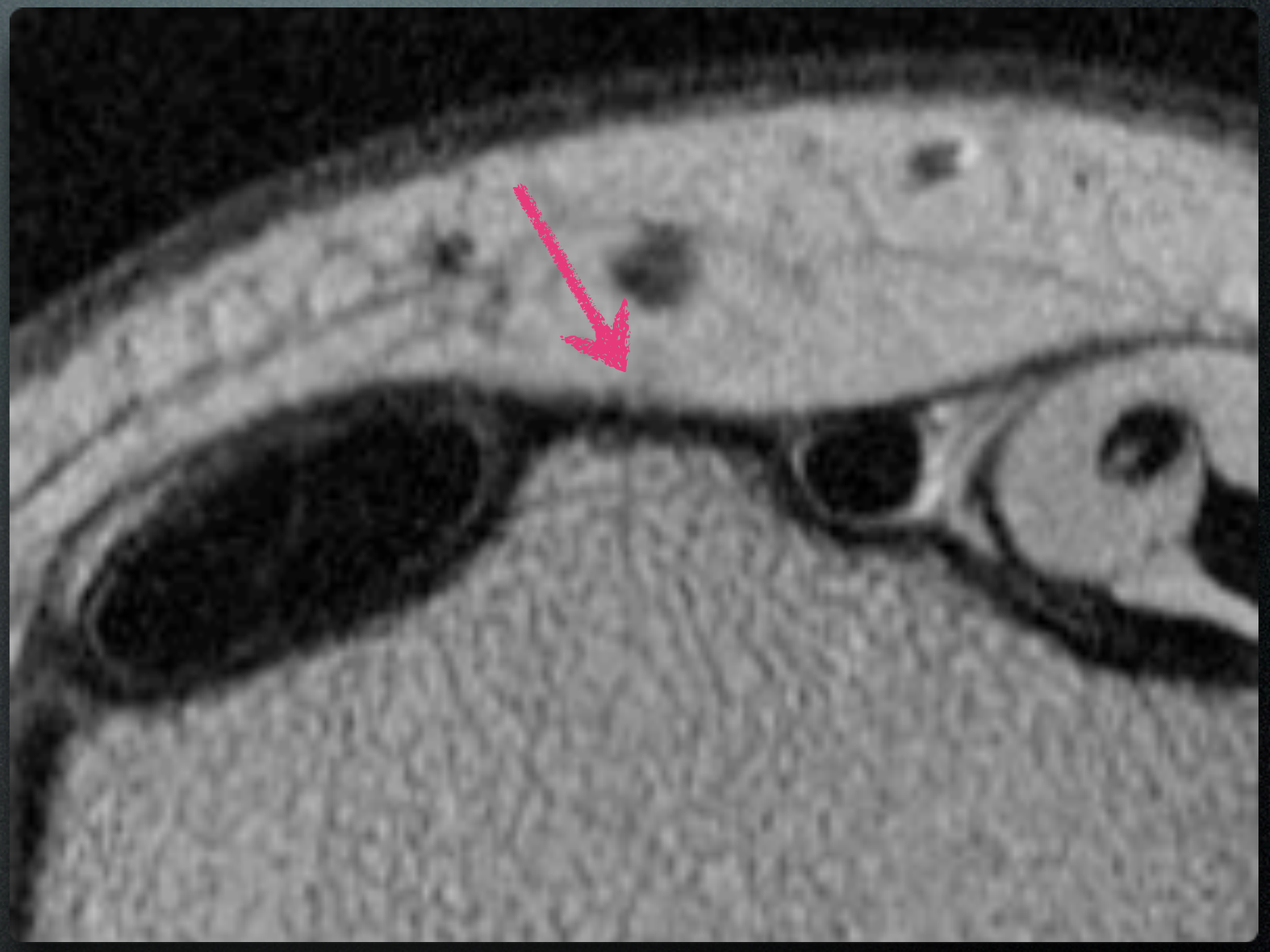
- Tendons: Extensor pollicis longus (EPL)
- 3rd septum inserts onto Lister's tubercle and separates the 2nd and 3rd dorsal compartments



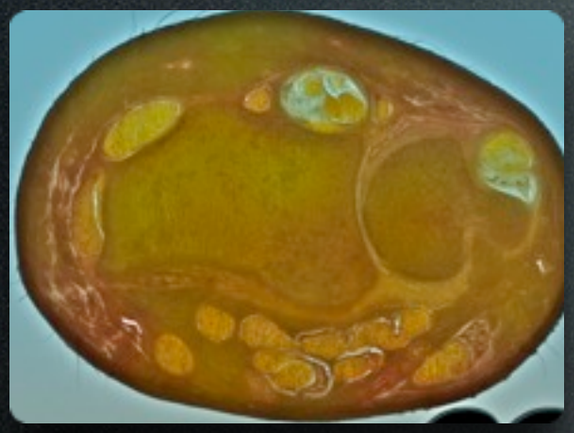


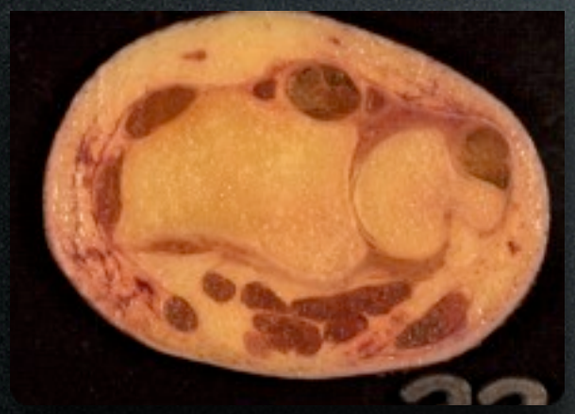


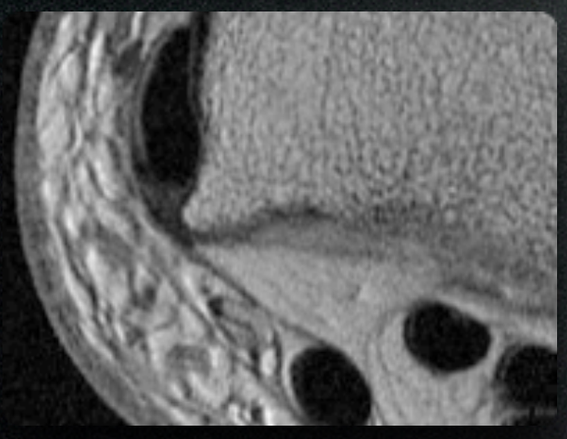




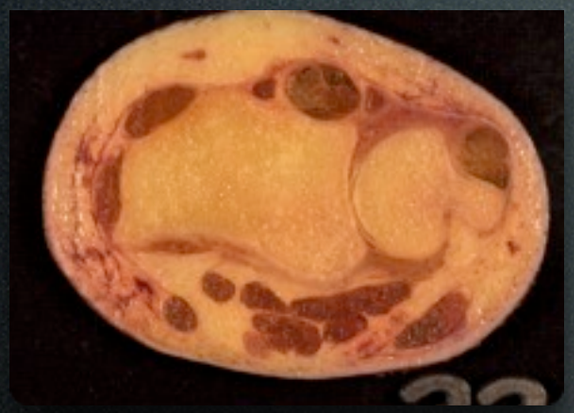
3rd septum/Radial attachment site

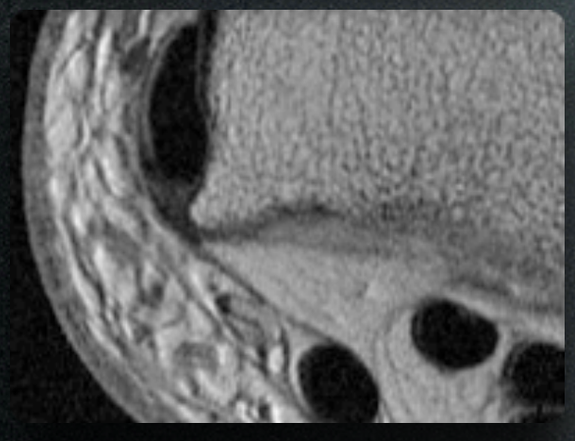


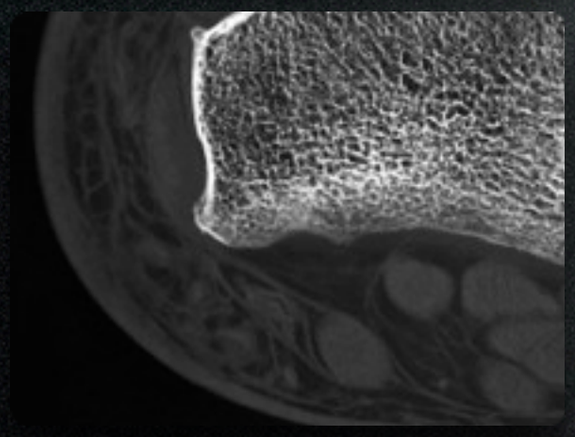


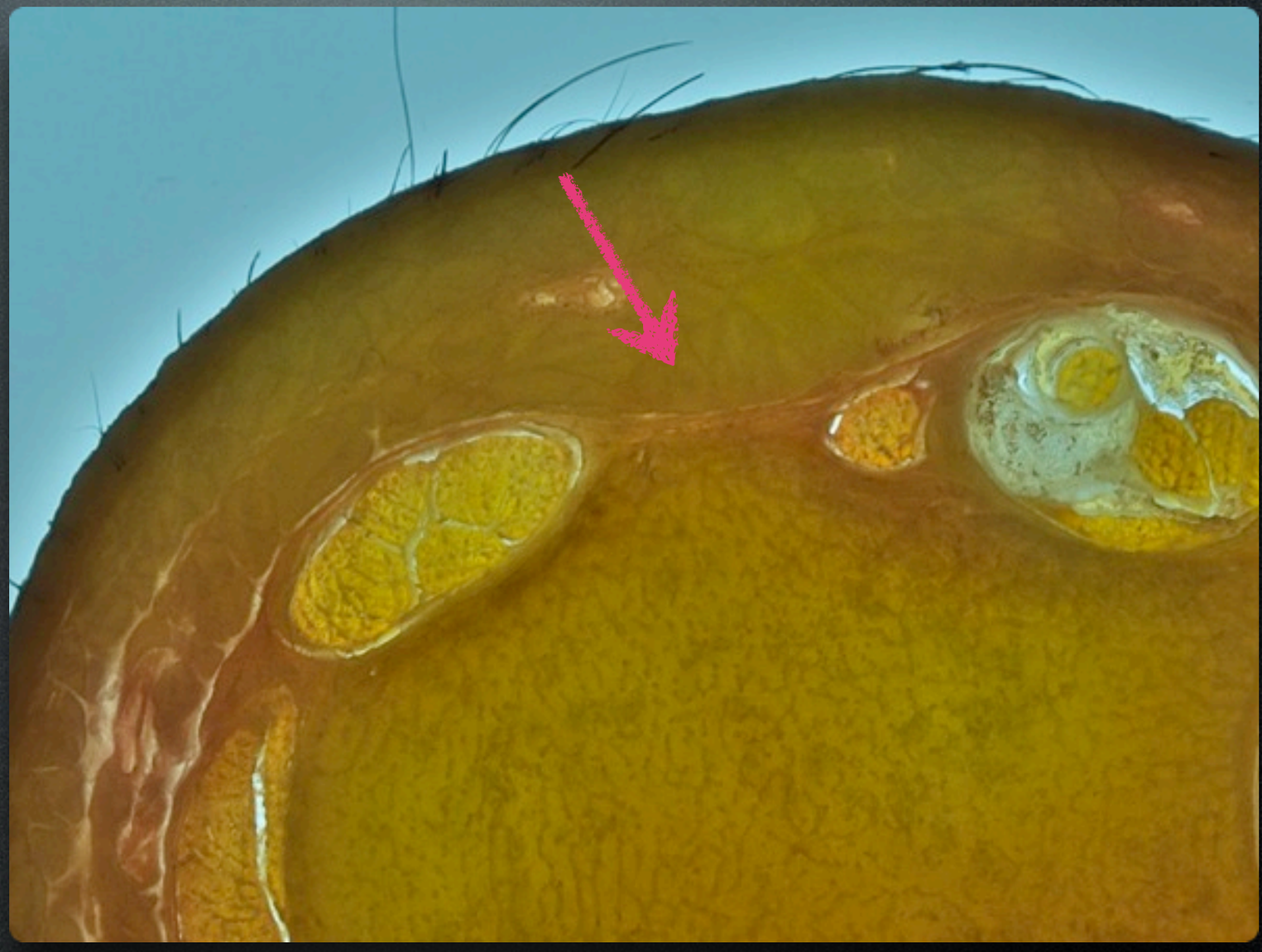


3rd septum/Radial attachment site

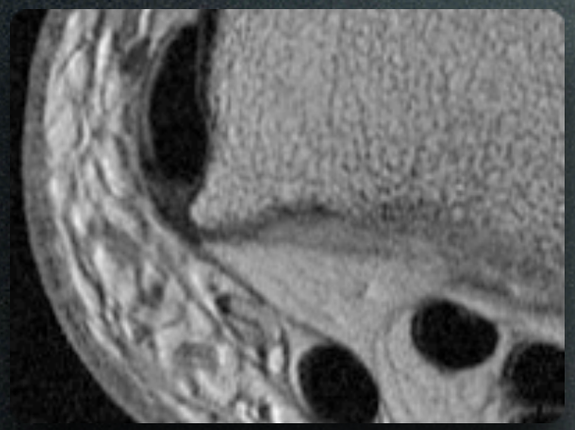


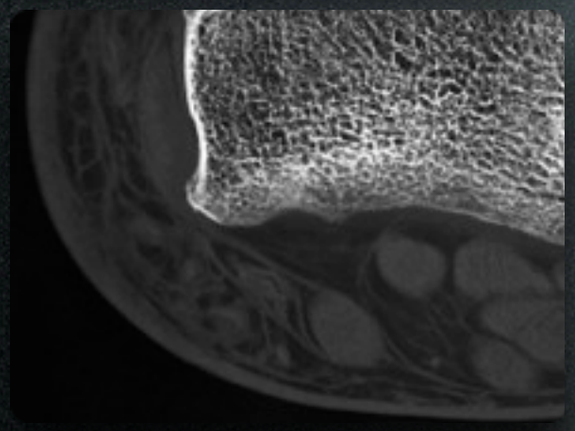


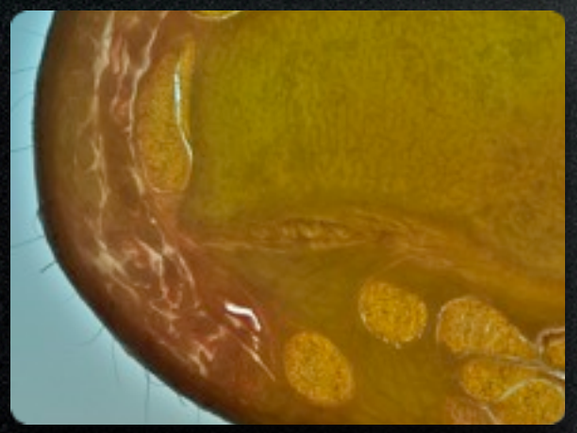


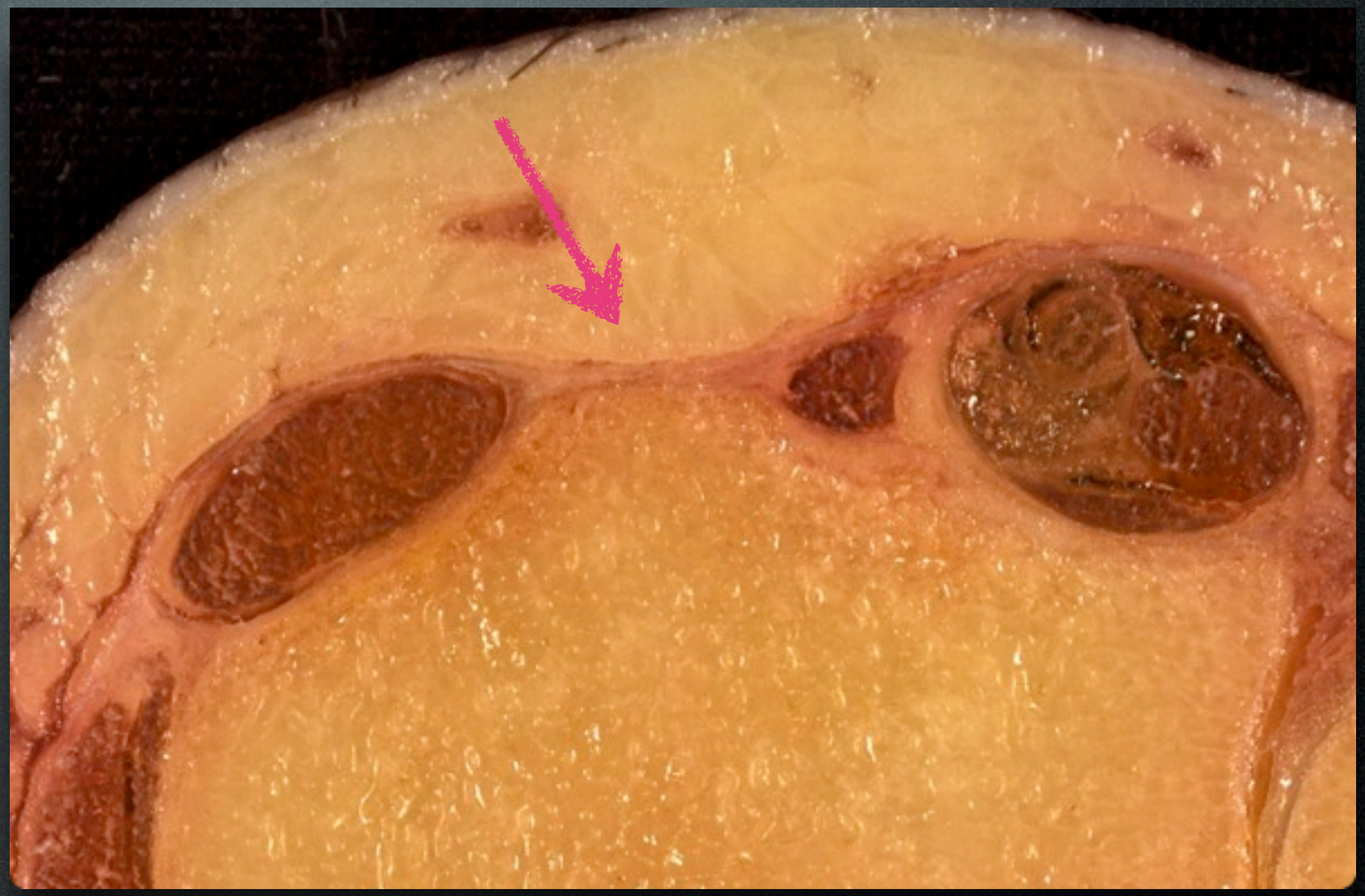


3rd septum/Radial attachment site





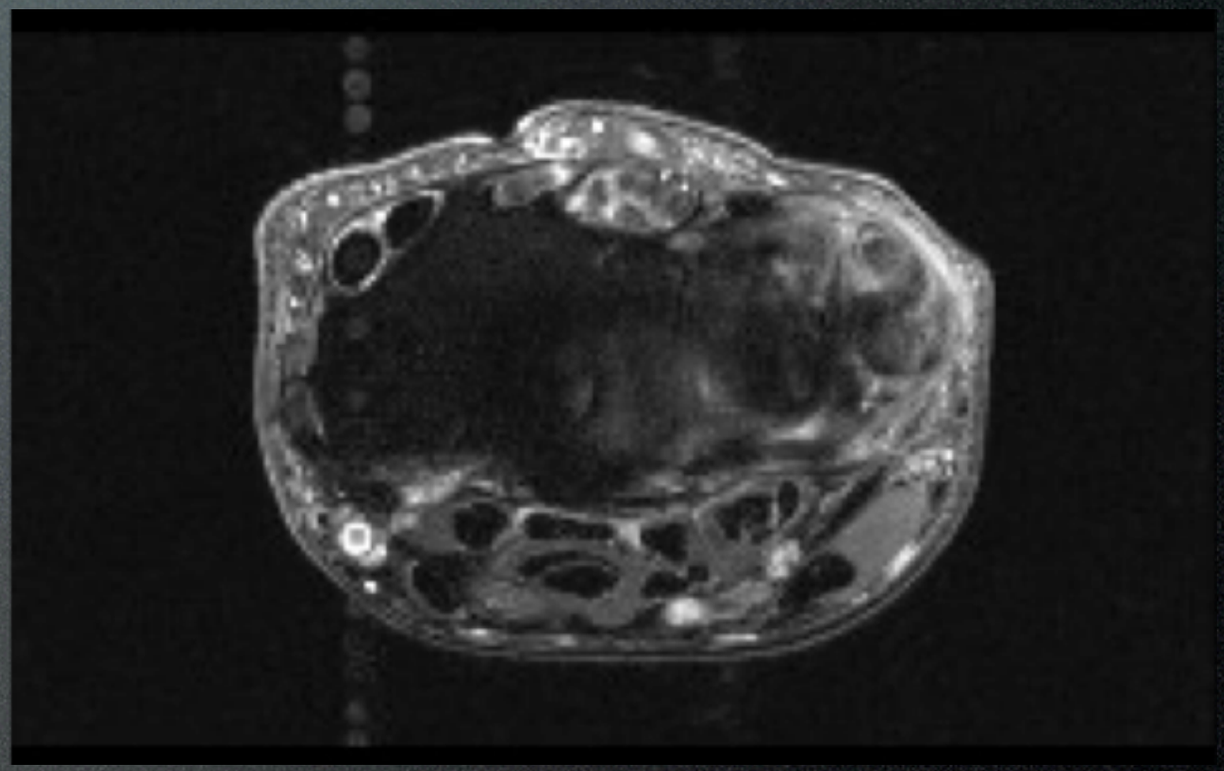




3rd septum/Radial attachment site

Distal Intersection Syndrome

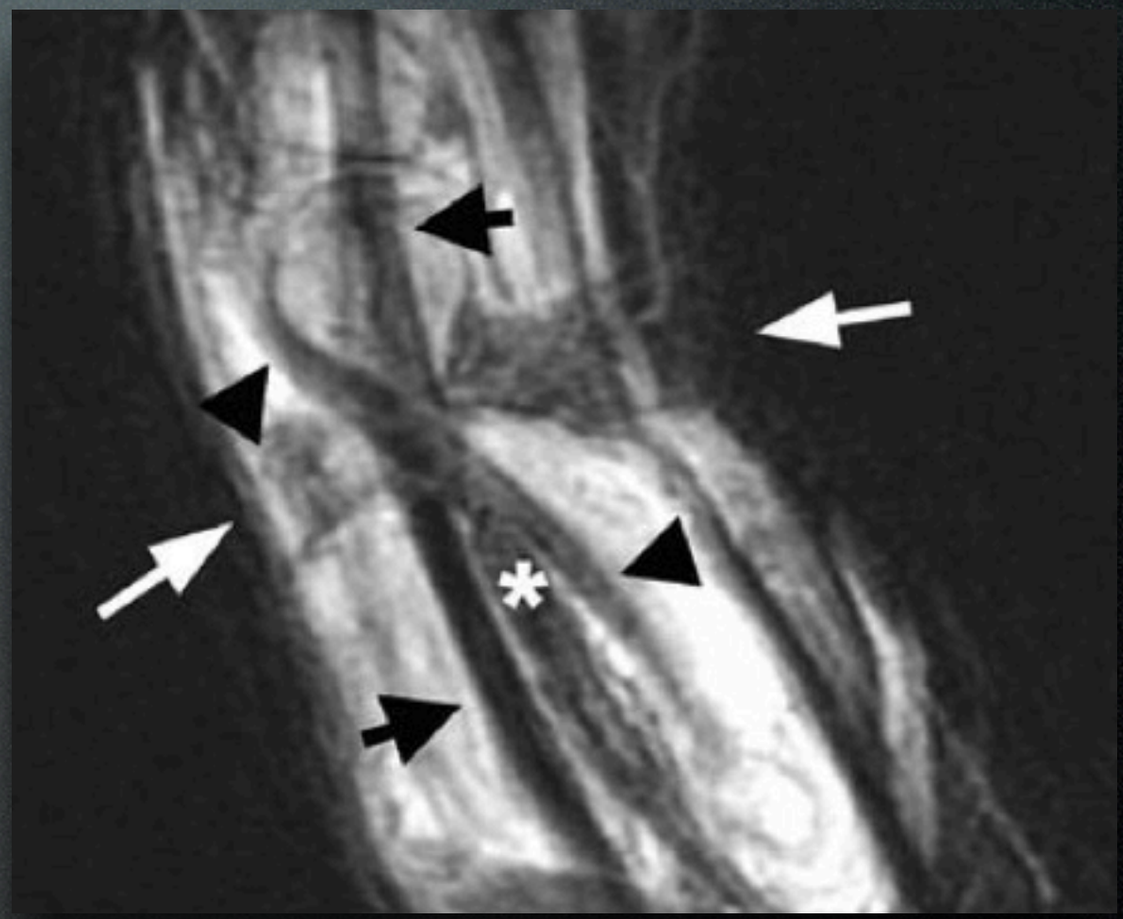
- Extensor pollicis longus (EPL) tendon crosses the extensor carpi radialis longus/brevis tendons (ECRL /ECRB) before inserting on the distal phalanx of the thumb
- Uses Lister's tubercle as a pulley
- Deep to the extensor retinaculum



Case courtesy of Sarah Kao

Distal Intersection Syndrome

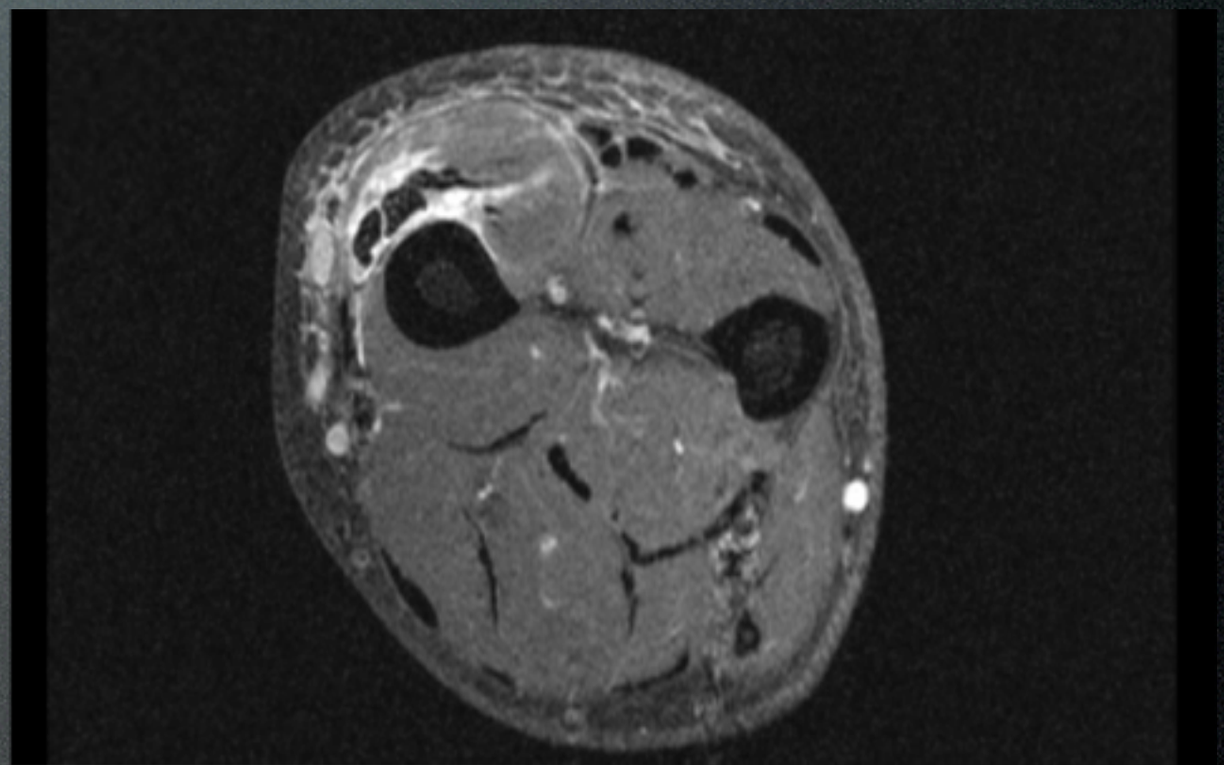
- Most accepted pathophysiology - stenosing tenosynovitis of 2nd compartment
- Watershed vascularity of EPL
- Focal narrowing at extensor retinaculum



Parellada et al, Skeletal Rad 2007, 36: 203-208.

Intersection syndrome (proximal)

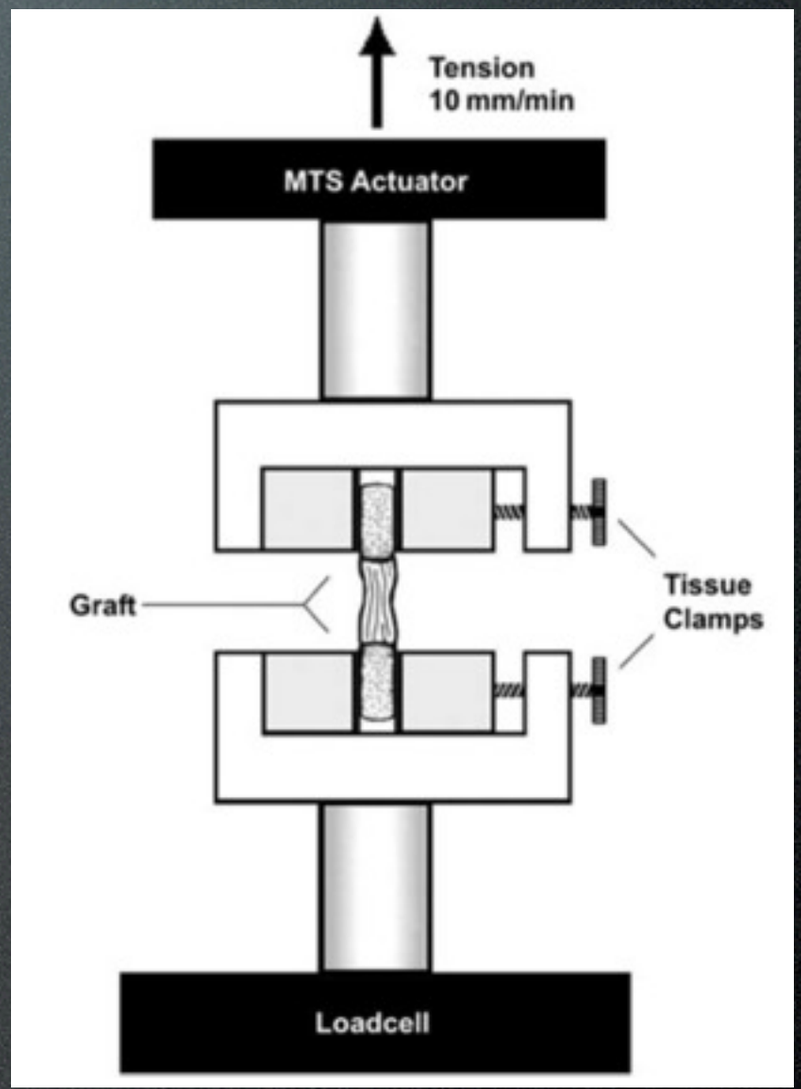
- Noninfectious inflammatory process at the proximal crossing of the 2nd compartment (ECRB, ECRL) and the 1st compartment (APL, EPB)
- Dorsoradial distal forearm ~4 cm proximal to Lister's tubercle
- Most commonly seen in patients with repetitive wrist flexion and extension
- Unknown pathophysiology
  - Friction
  - Stenosing tenosynovitis
- Treatment - immobilization, steroid injection, surgical



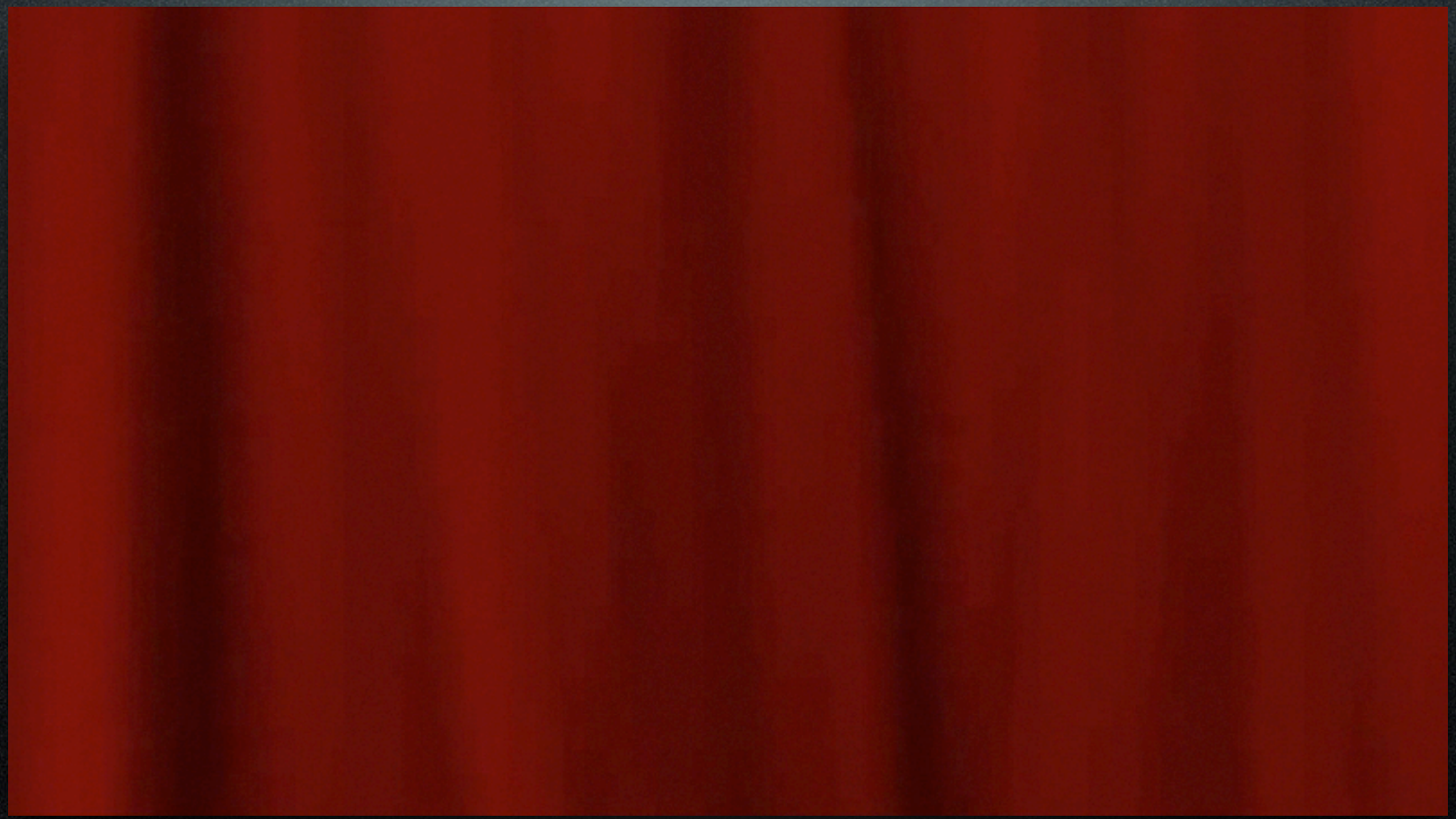
Case courtesy of Sarah Kao

Septal attachments and extensor retinaculum biomechanics

- Biomechanical testing
- Septum 2 and septum 3 are the strongest
- Collectively, septal failure force of 112 N (36 lbs)
- Failure force of extensor retinaculum of first 4 compartments approaches 1000 N (225 lbs)



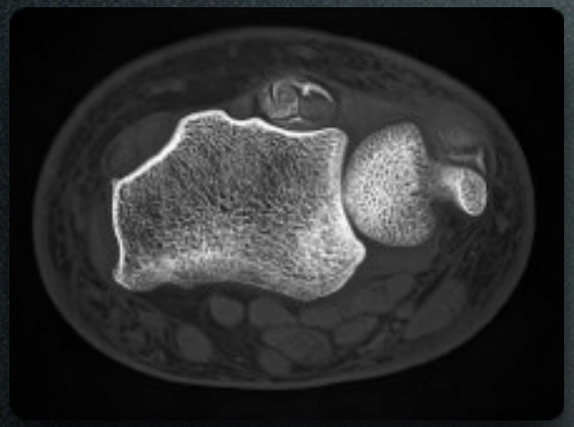
Iwamoto et al, J Hand Surgery 2006

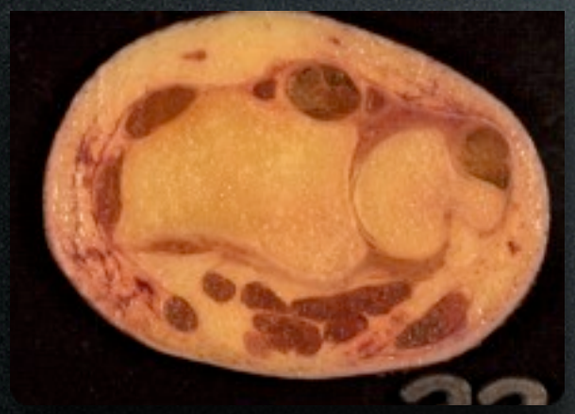


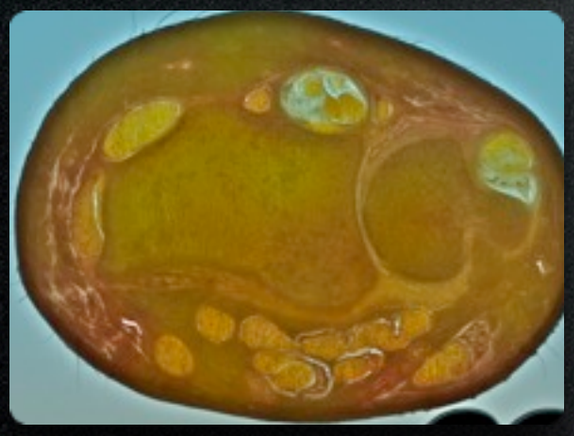
Sectioning Step 3
Remove excess tissue

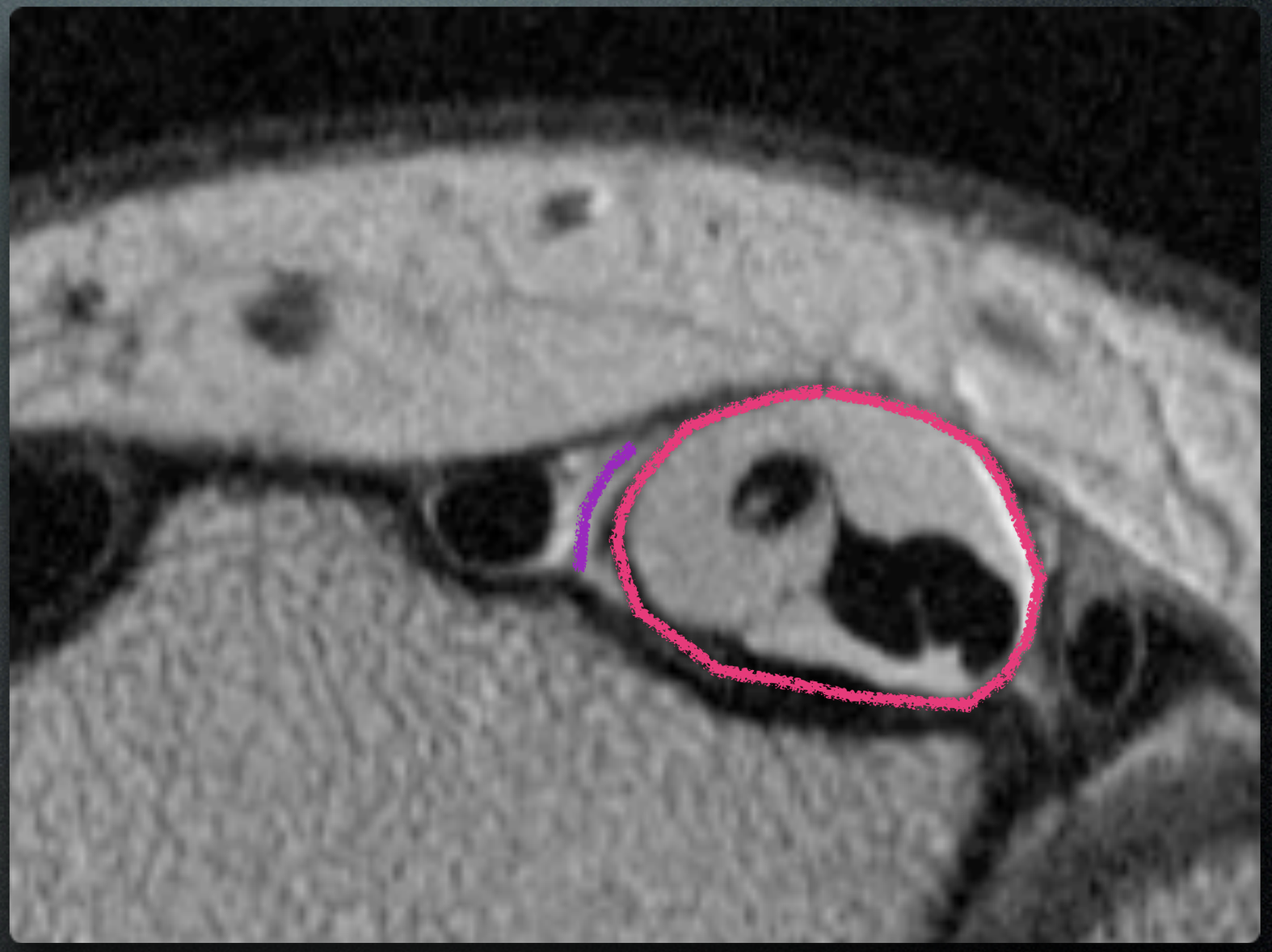
4th extensor compartment

- Tendons: Extensor digitorum communis (ED)
- 4th septum separates the 3rd and 4th dorsal compartments
- Circular fibers surround the 4th dorsal compartment
- Infratendinous retinaculum is developed at this level

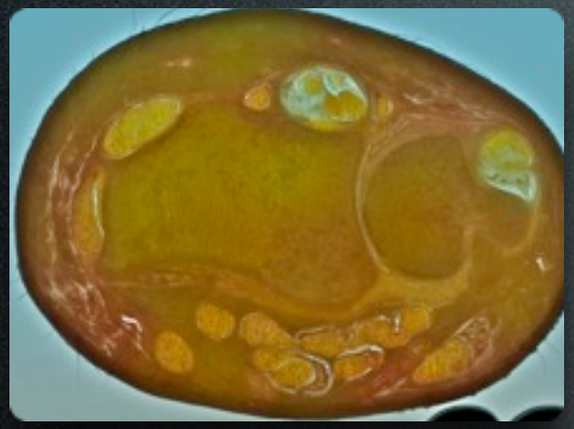


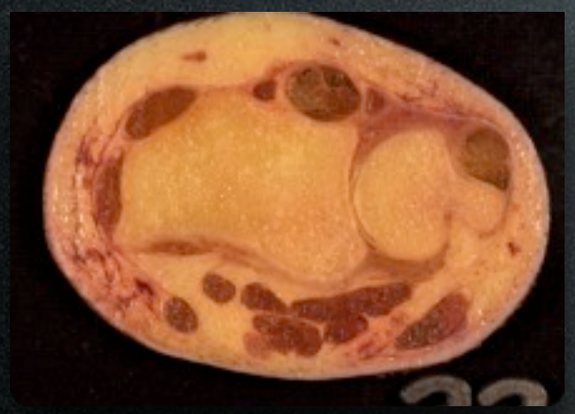


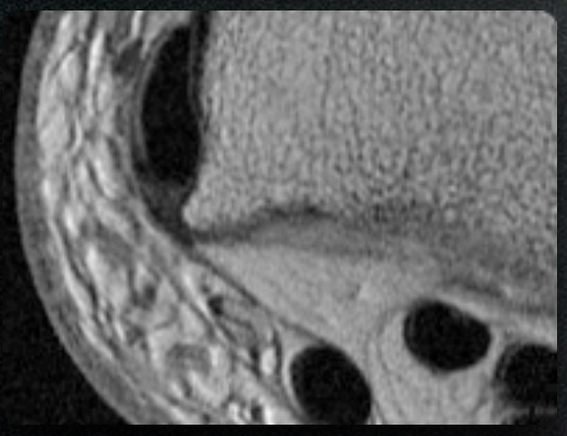


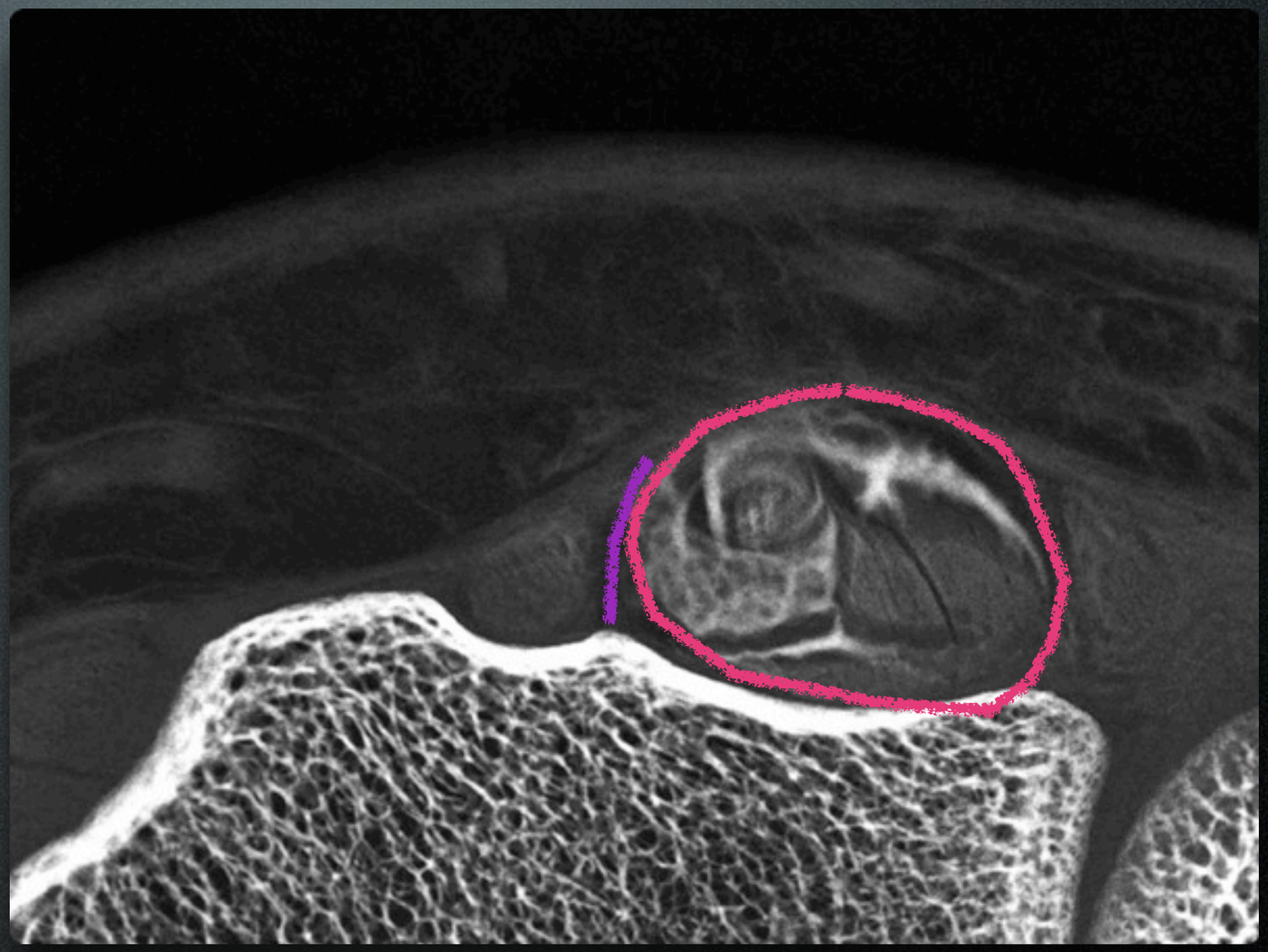


4th extensor septum

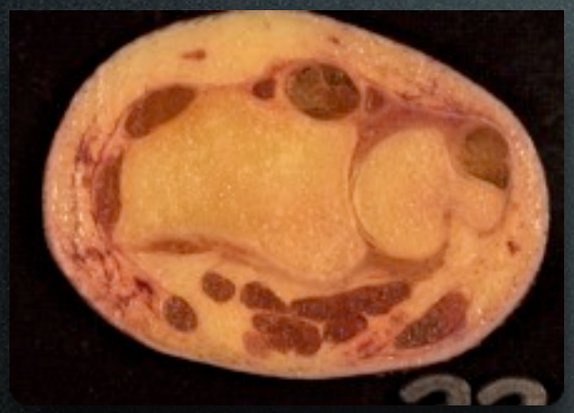


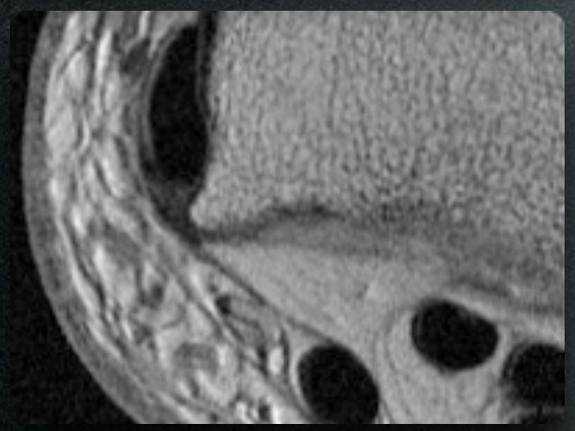


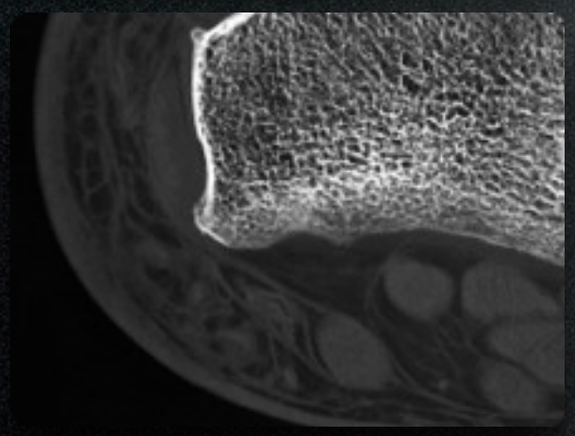


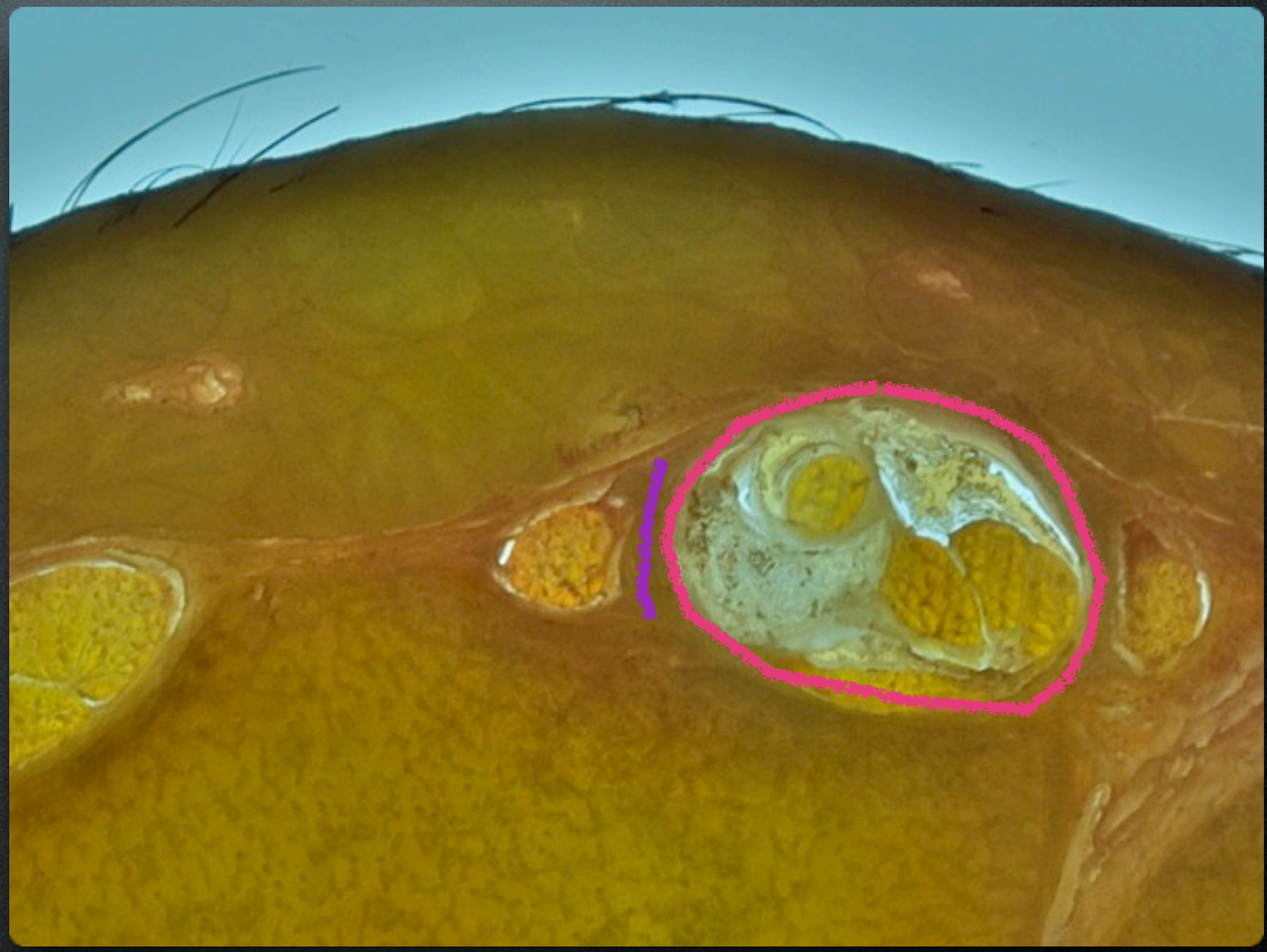


4th extensor septum

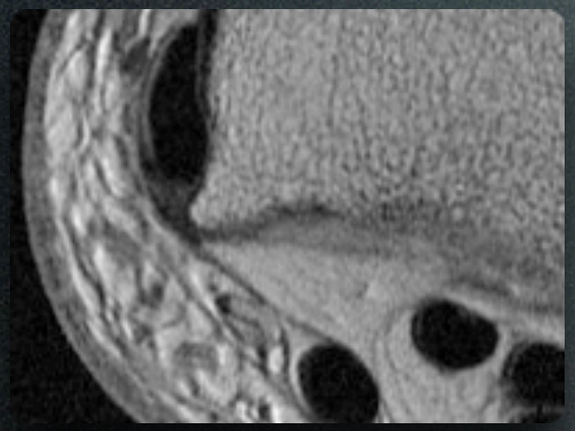


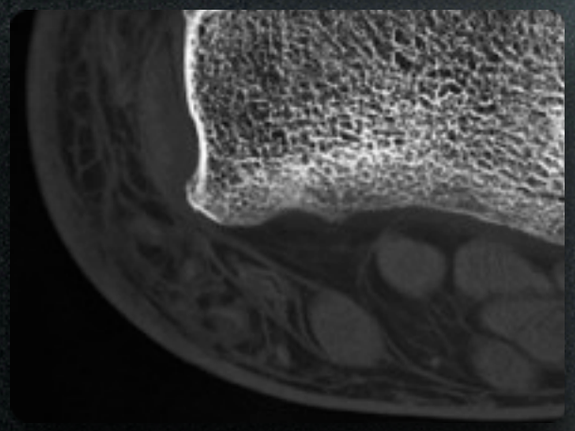


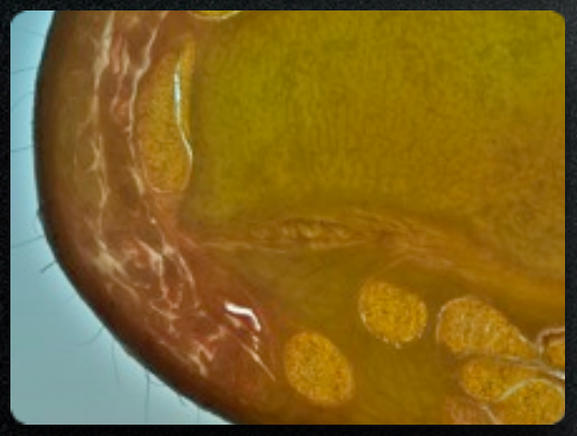




4th extensor septum







4th extensor septum

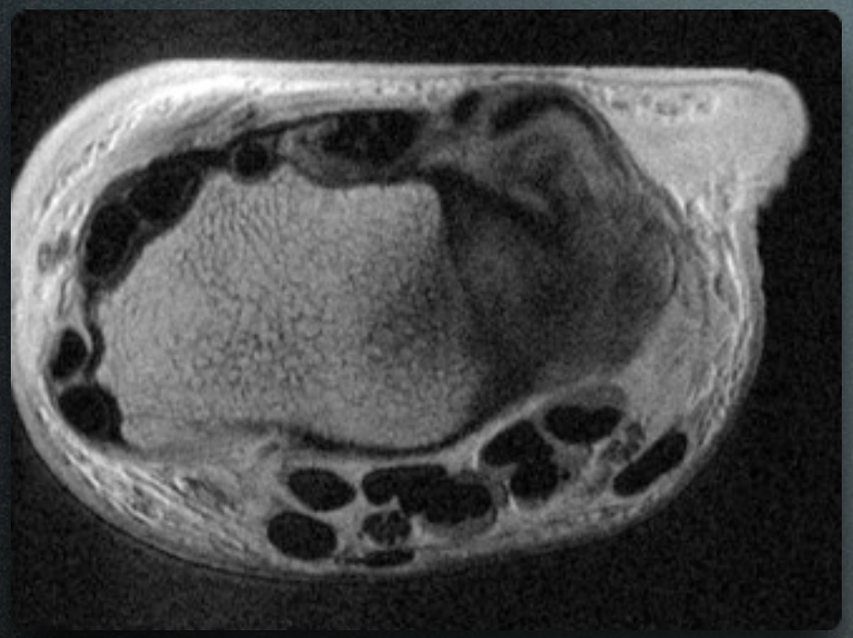
Infratendinous Extensor Retinaculum

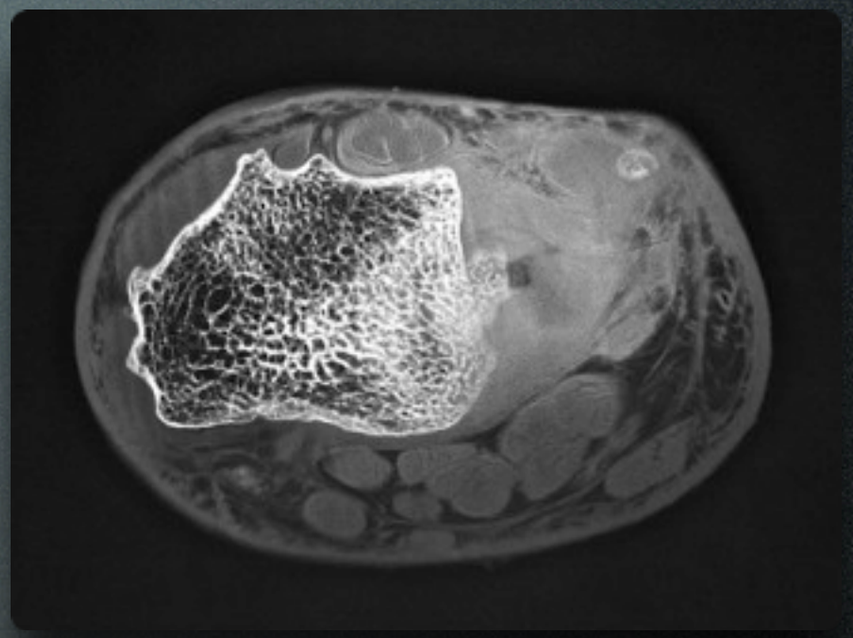
- Narrower than the supratendinous retinaculum
- Parallel fibers that blend with the dorsal wrist capsule
- Deep to 4th and 5th dorsal compartments
- *On ulnar side, deep and superficial extensor retinaculum merge deep to the 6th dorsal compartment

Supratendinous

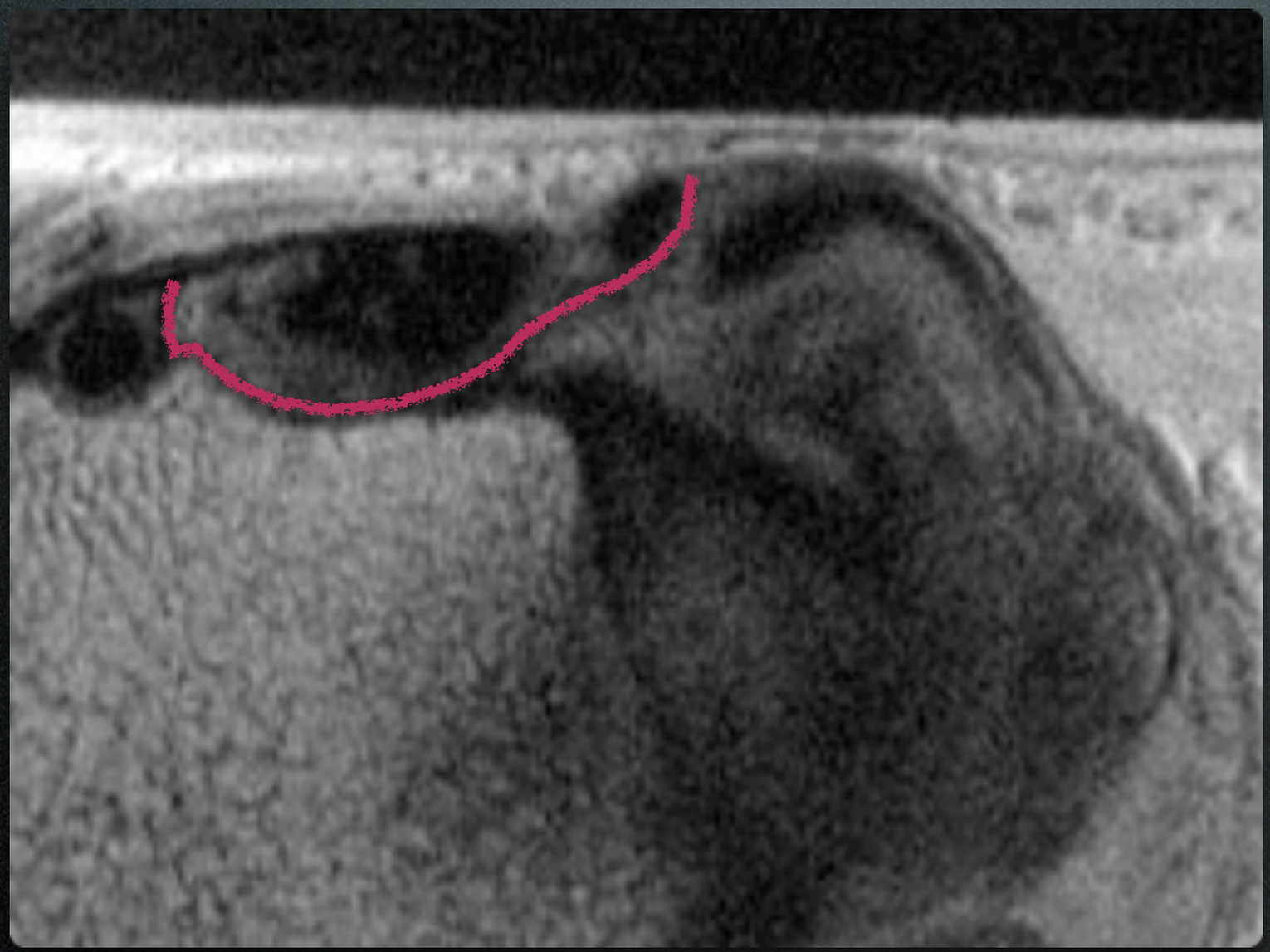
Infratendinous

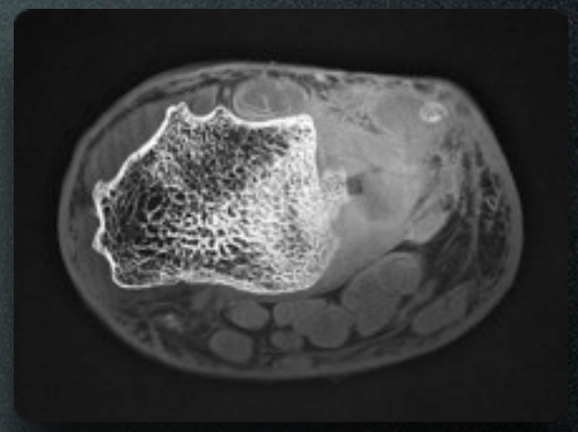
Rohen/Yokochi. Color Atlas of Anatomy. 3rd Ed.



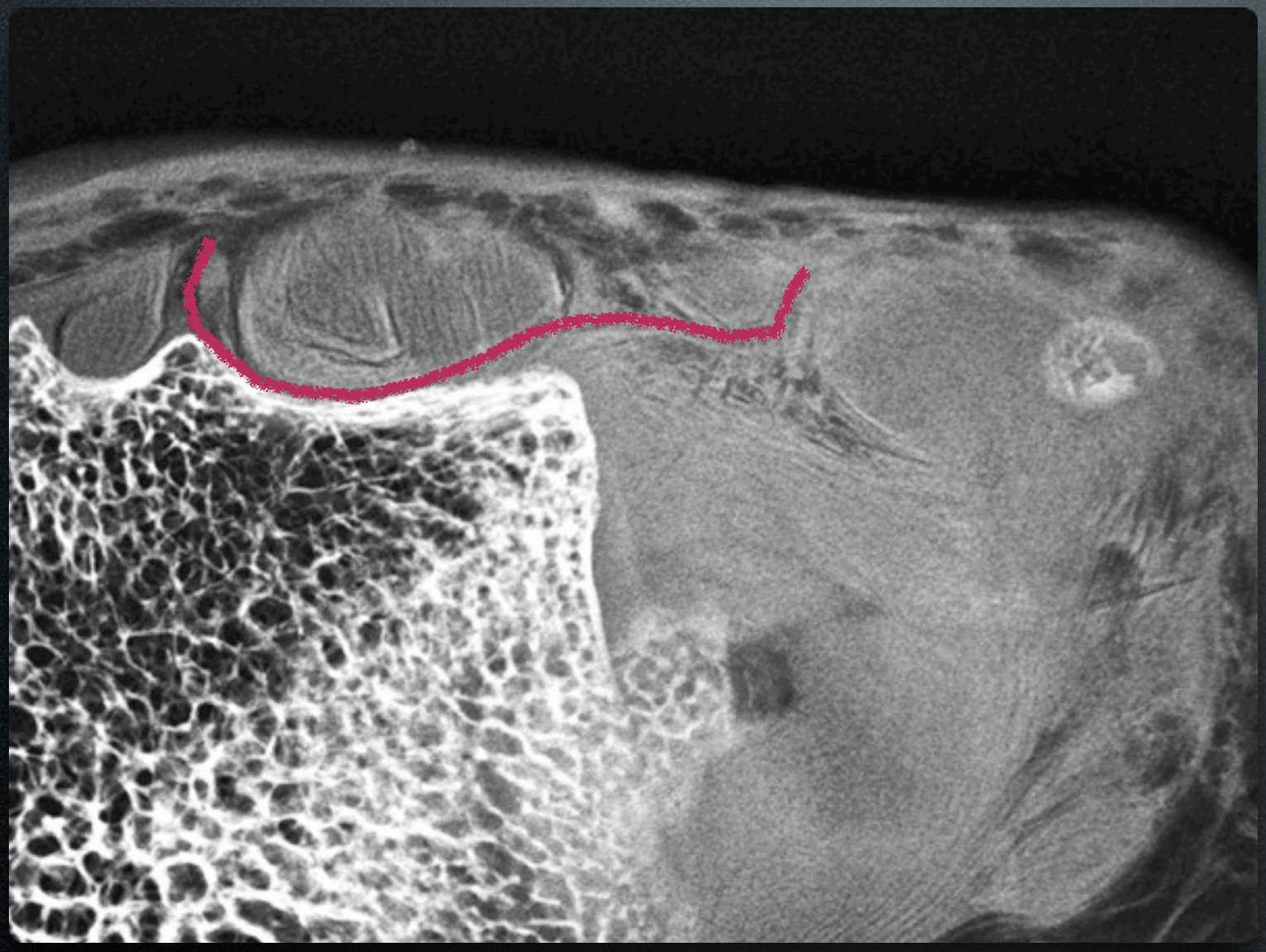


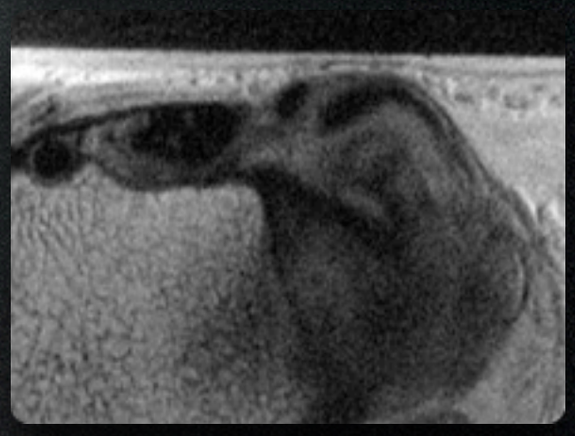
Infratendinous Extensor Retinaculum





Infratendinous Extensor Retinaculum





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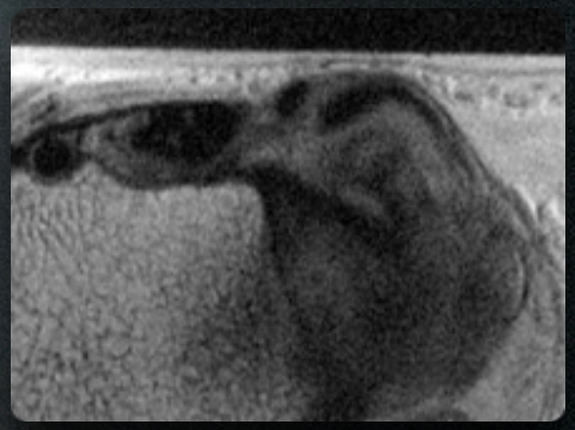
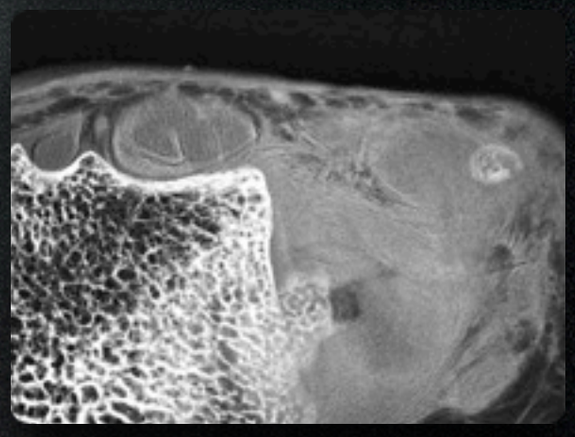
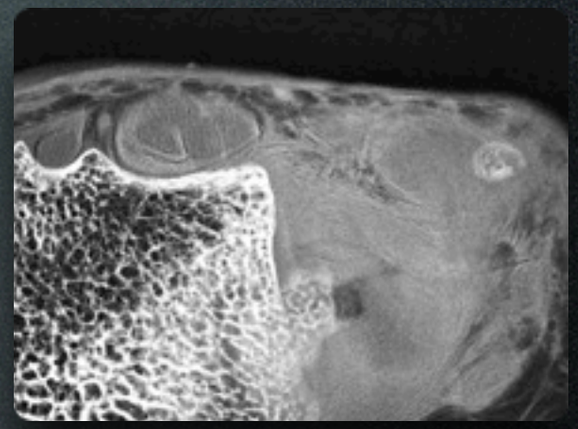
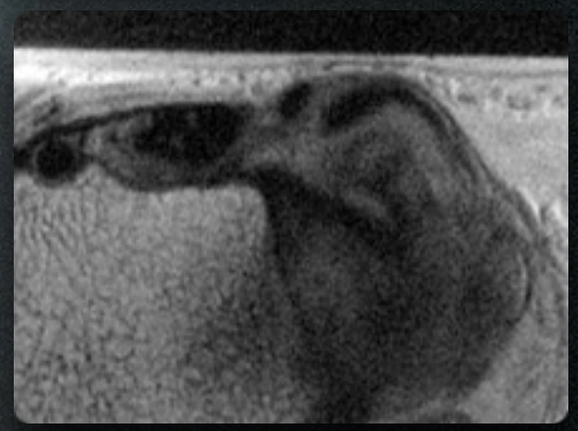
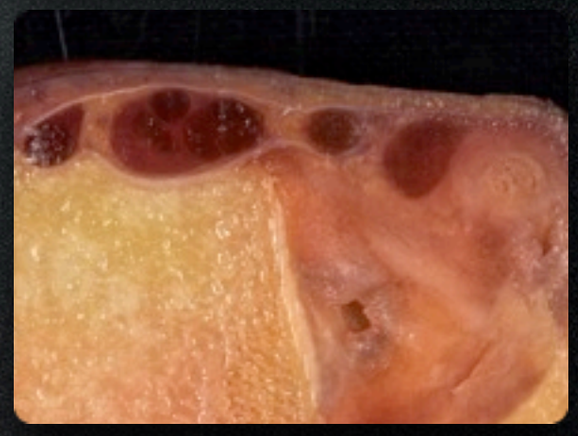




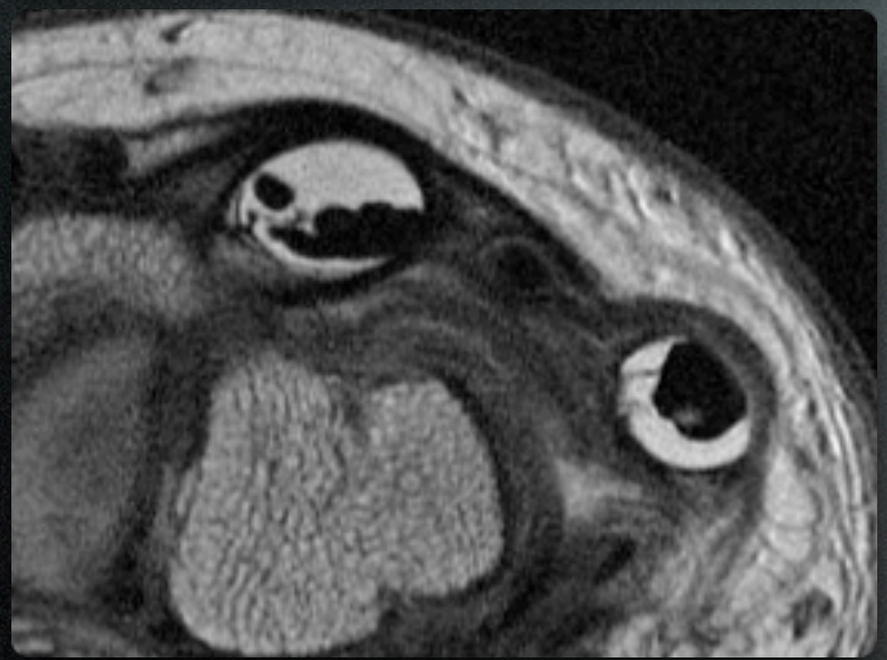
Infratendinous Extensor Retinaculum

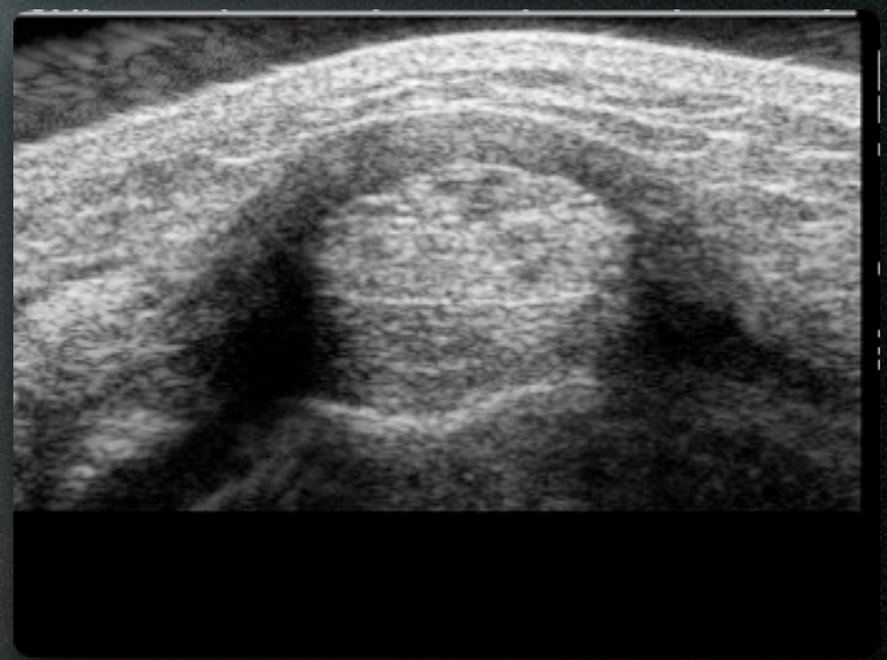






Infratendinous Extensor Retinaculum





Extensor retinaculum overlying 4th compartment

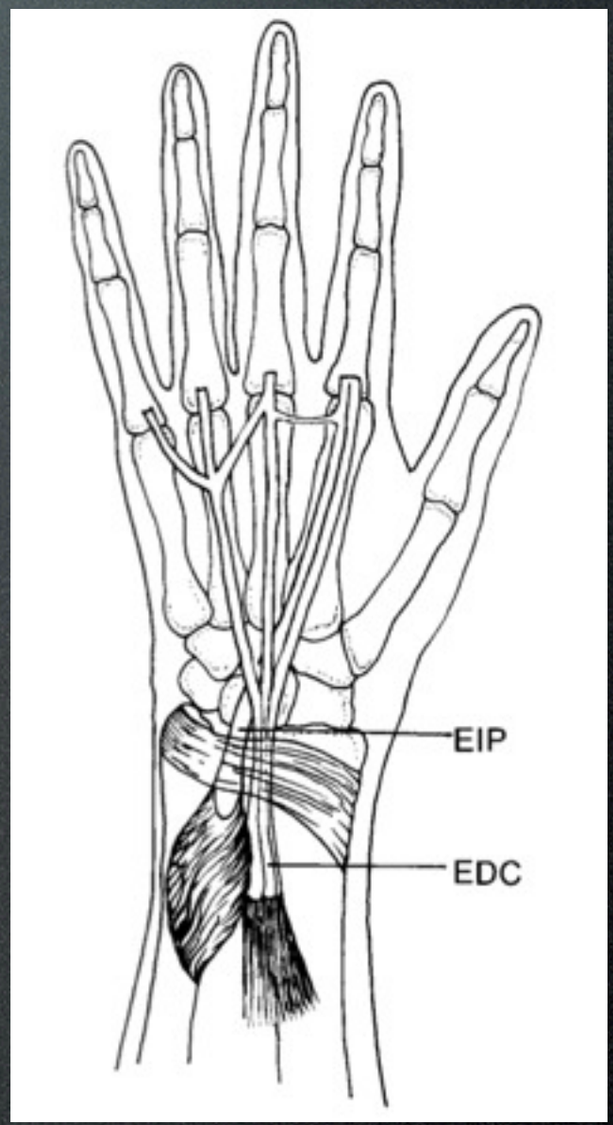
Accessory Extensor Muscles

- Often clinically confused for a ganglion cyst or other mass
- Extensor digitorum brevis manus
    - Incidence of 1-9%
    - Arises from dorsal radiocarpal ligament, not carpal bones
    - May be symptomatic due to impingement by extensor retinaculum

Rodríguez-Niedenführ et al, Clin Anat 2002 / Hanel et al, Clin Anat 201[illegible]

Accessory Extensor Muscles

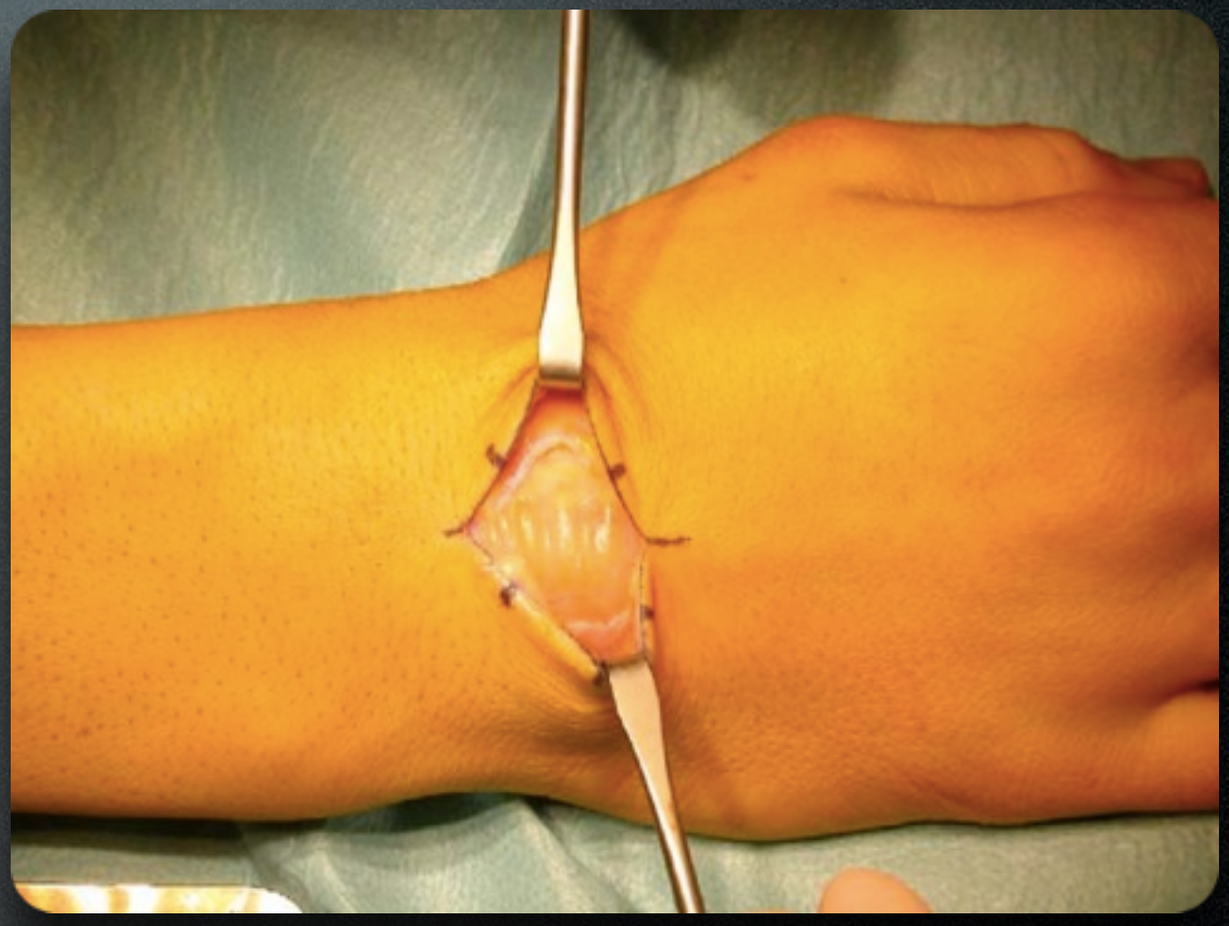
- Anomalous extensor indicis proprius
  - Muscle extends distal to the extensor retinaculum on wrist flexion
  - Pain elicited with finger extension while in wrist flexion
- Extensor medii proprius
- Extensor indicis et medii communis



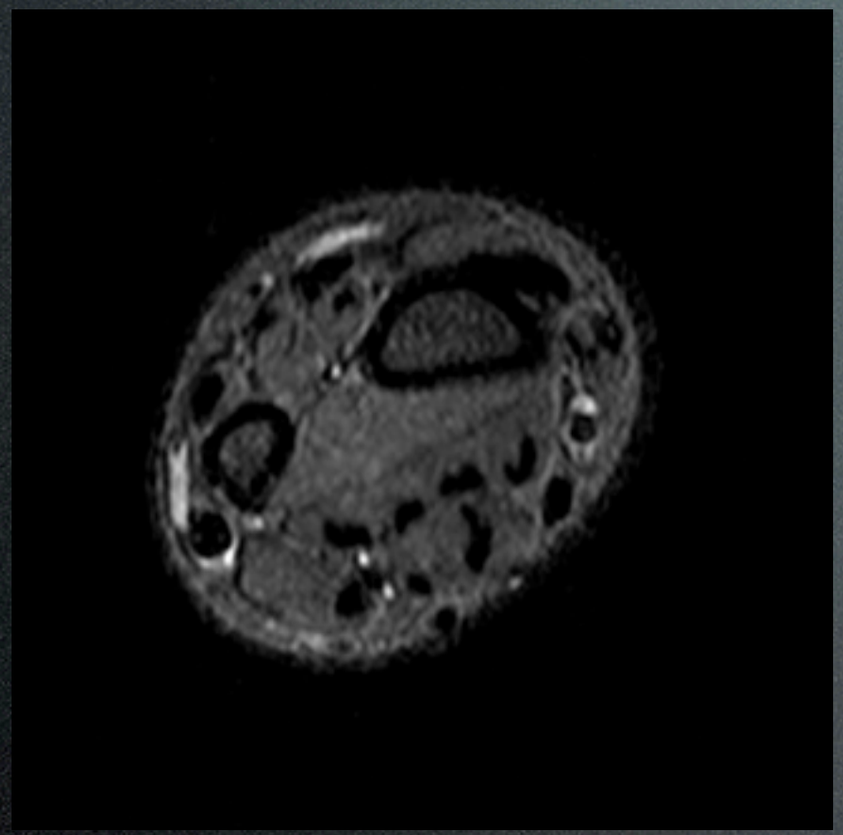
Tan et al, J Hand Surg 1999

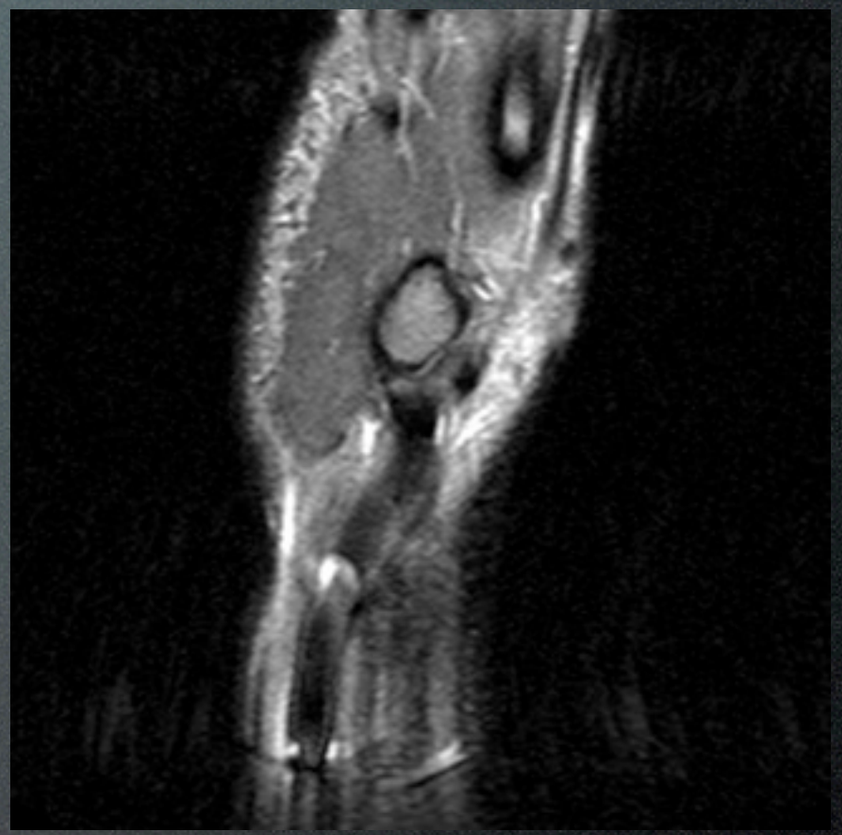
Extensor Retinacular Impingement

- Thick fibrous band
- Can cause impingement of the extensor tendons in recurrent extreme hyperextension
  - gymnasts
  - platform diver
  - shot putter
- Causes
  - Synovitis
  - Fibrous thickening
- Treatment
  - Steroid injection
  - Partial retinacular release and synovectomy



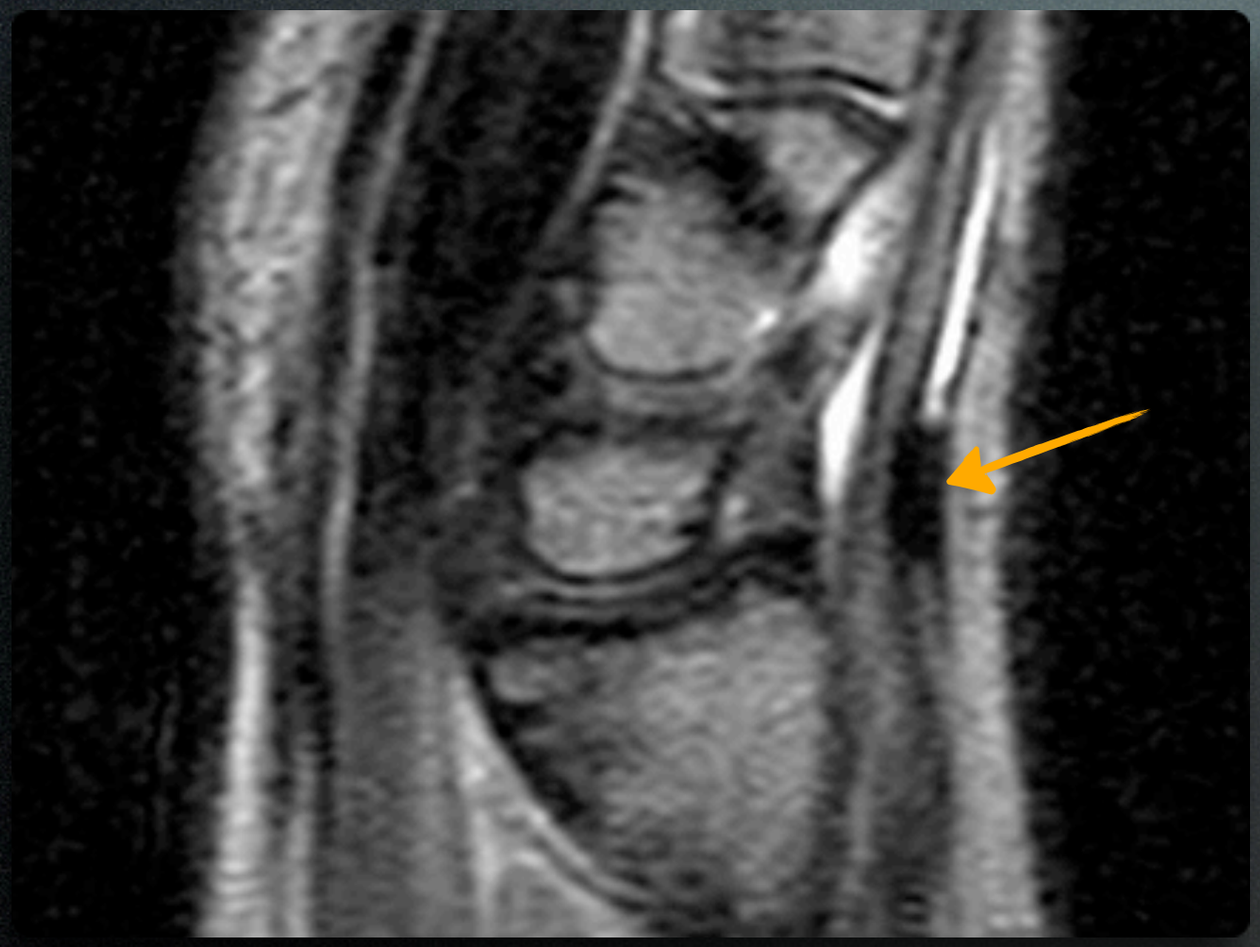
Wilson et al, J Hand Surg Br 2006
VanHeest et al, Am J Sports Med 2007

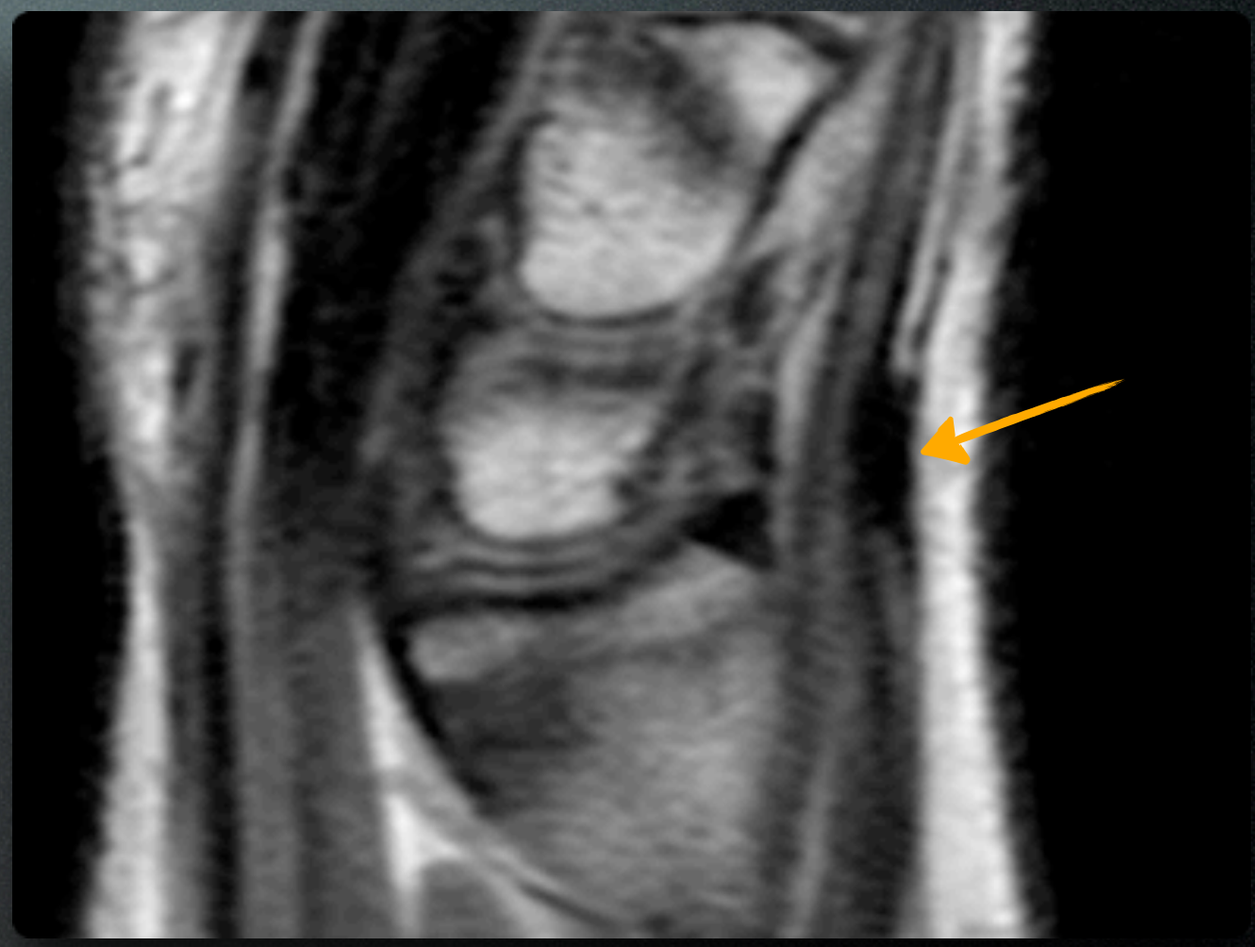




14 yo female gymnast with dorsal wrist pain

Case courtesy of Brady Huang



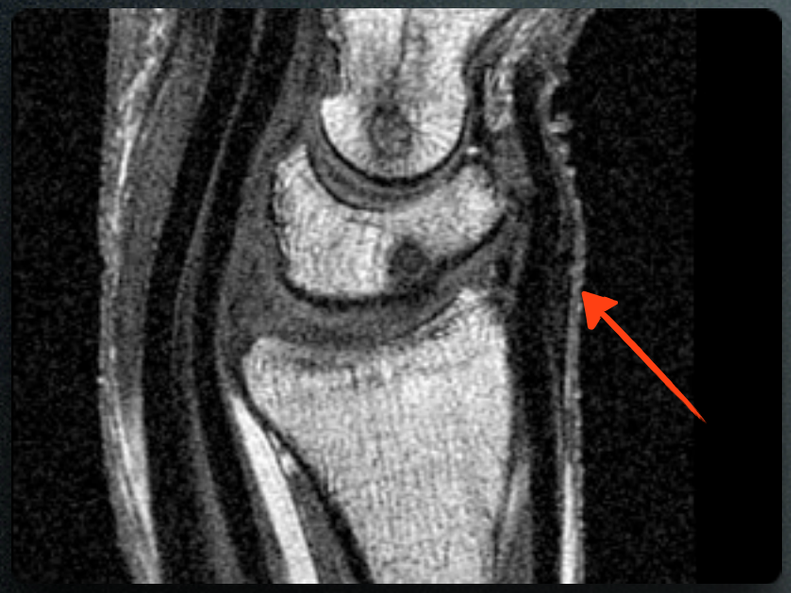


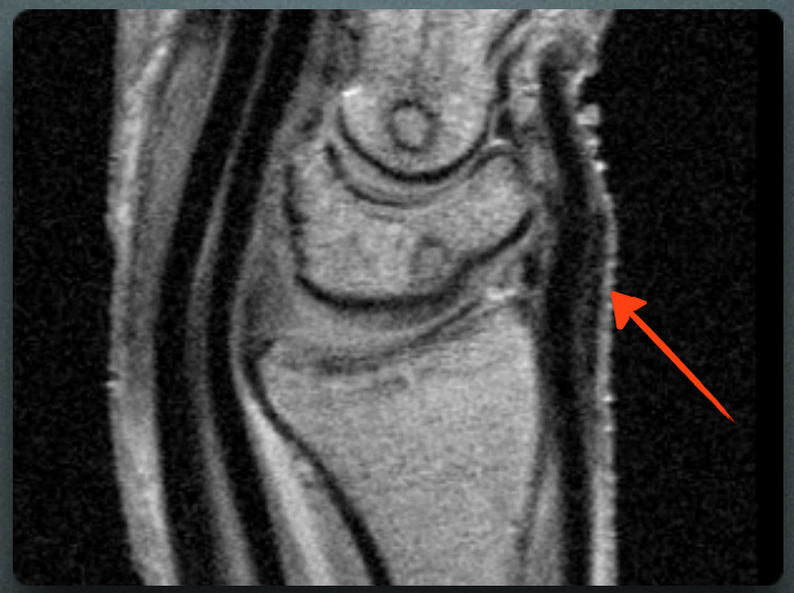
14 yo female gymnast with dorsal wrist pain

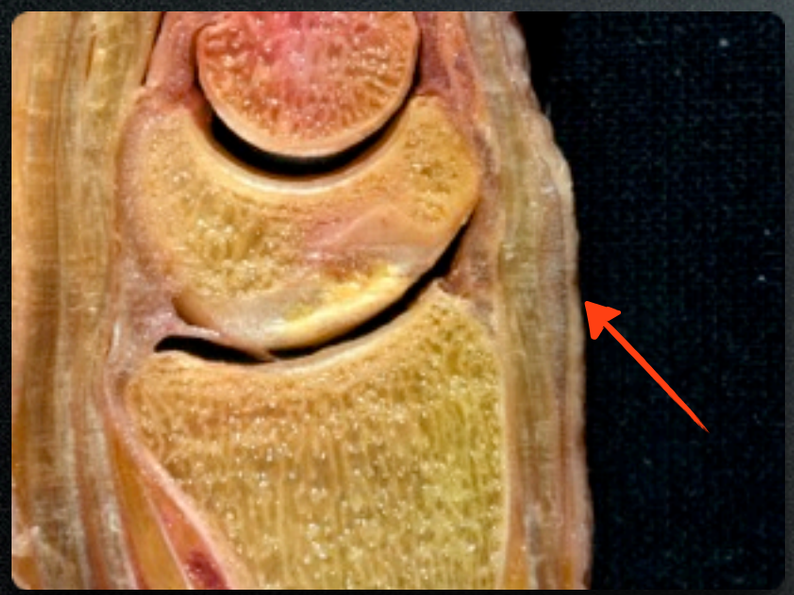
Case courtesy of Brady Huang

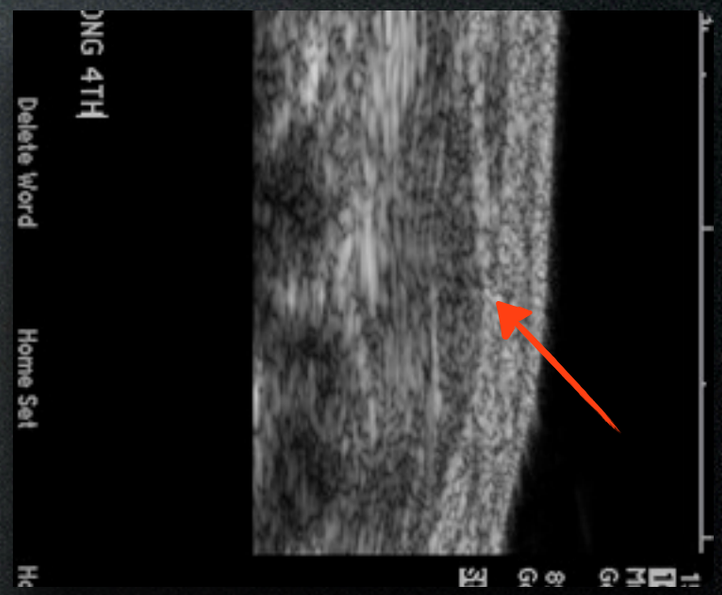
Extensor Retinaculum Project

- Results
  - All 10 samples measured in sagittal plane
    - Neutral and dorsiflexion positions on MR
    - Anterior-posterior thickness and proximal-distal width measured at middle section of 4th dorsal compartment
  - Neutral
    - Width: 10.1 - 20.1 mm (mean ± SD, 13.56 ± 3.08 mm)
    - Thickness: 1.1 – 2.4 mm (mean ± SD, 1.67 ± 0.39 mm)
  - Dorsiflexion
    - Width: 4.4 - 14.3 mm (mean ± SD, 8.68 ± 2.93 mm)
    - Thickness: 1.6 – 2.8 mm (mean ± SD, 2.15 ± 0.44 mm)
  - Utilizing two-tailed Student's t test
    - Significant difference in width (p= 0.002) and thickness (p=0.018)

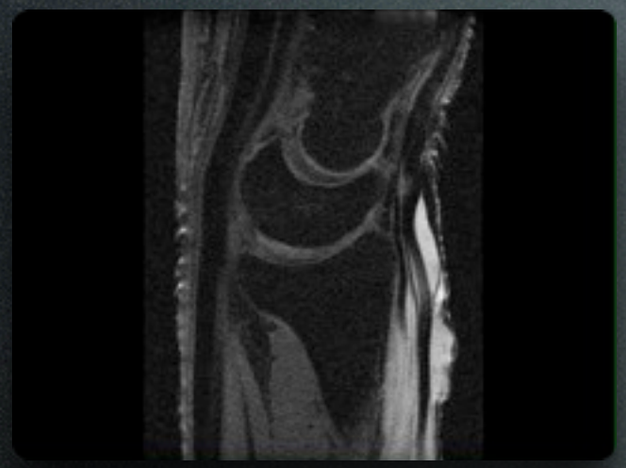


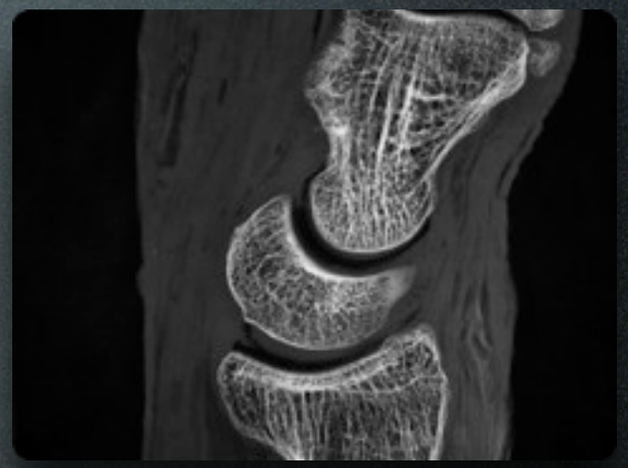




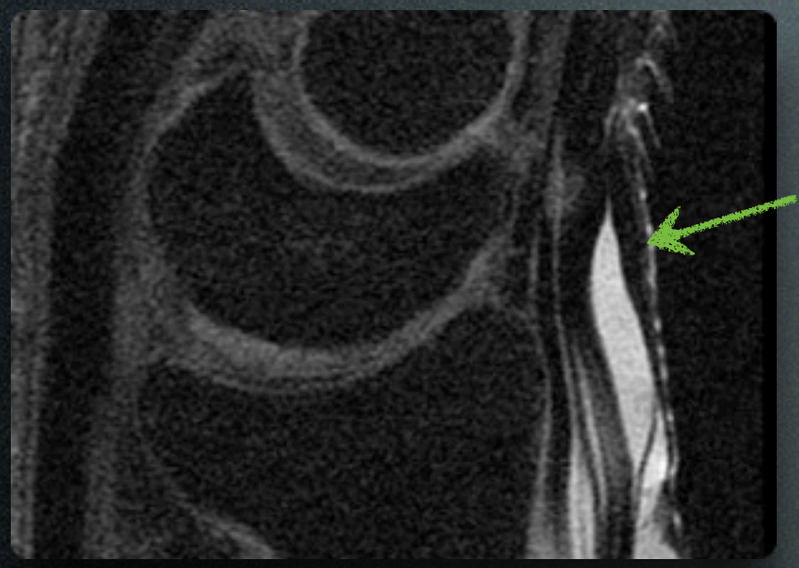


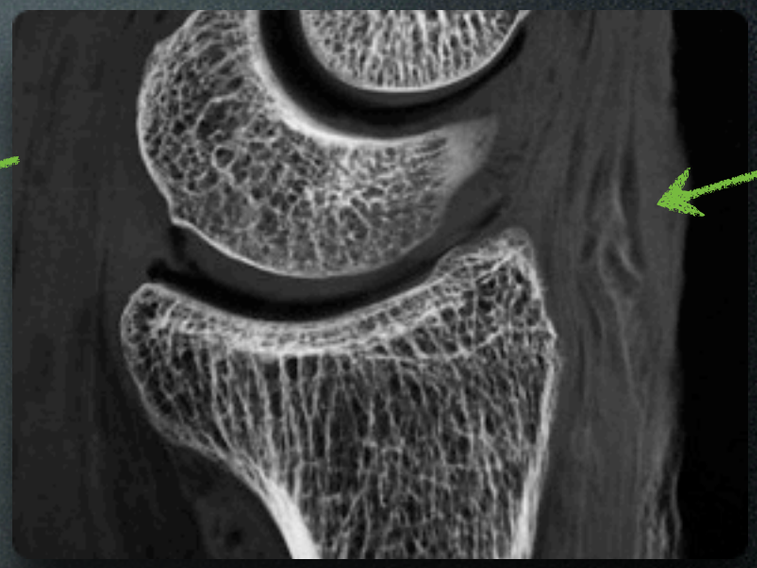
Sagittal Neutral



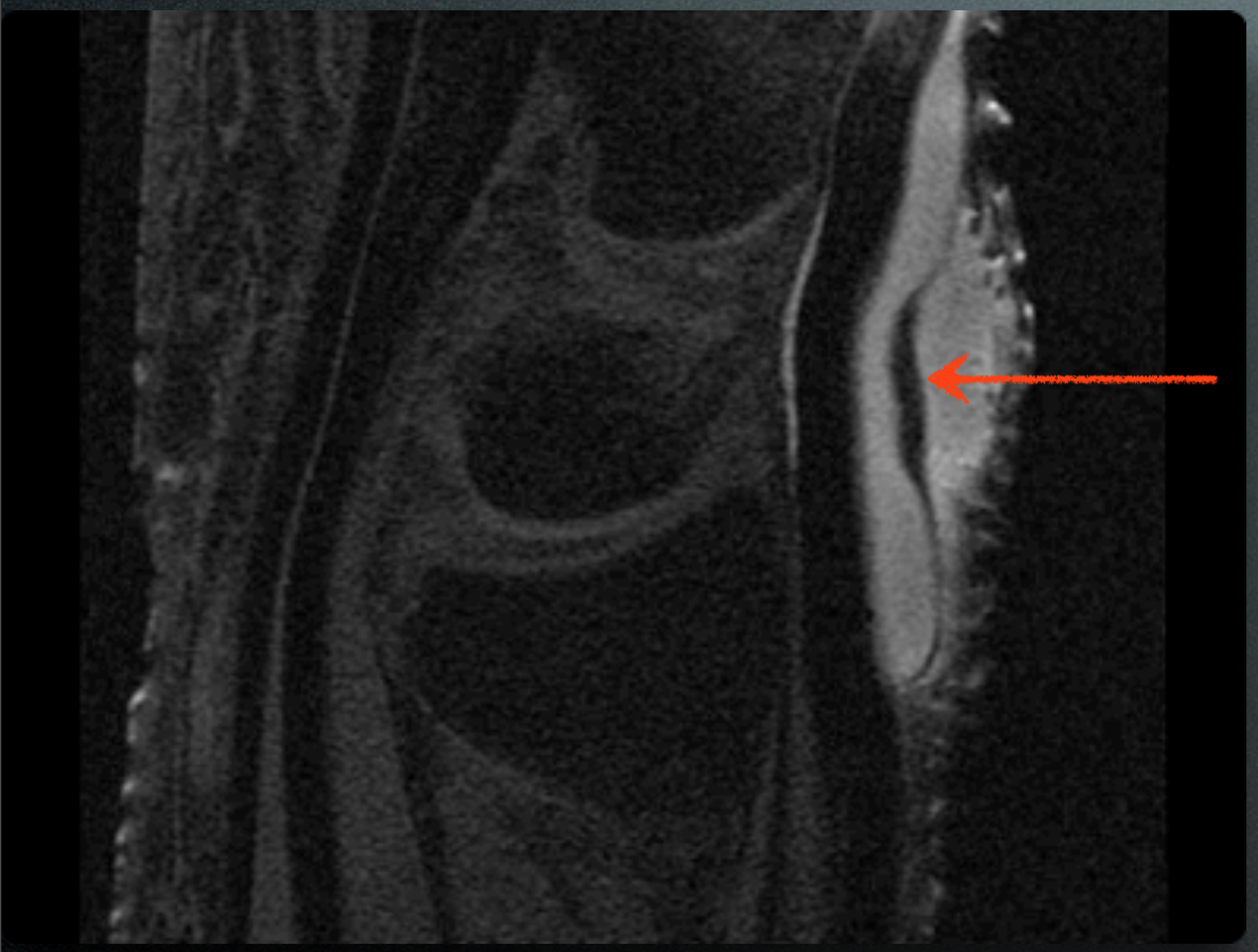


Wrist Extensor Retinaculum
Sagittal Neutral

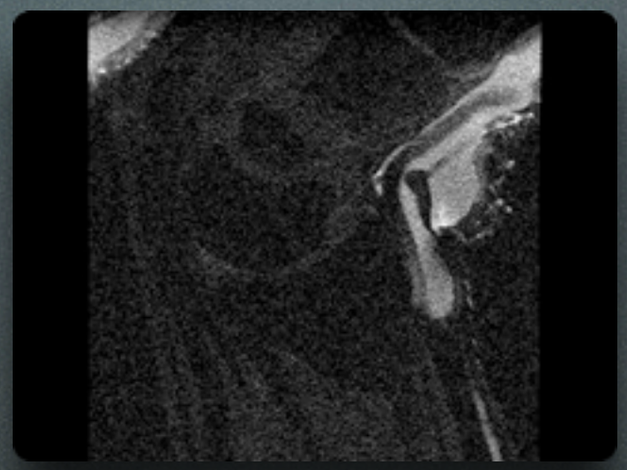


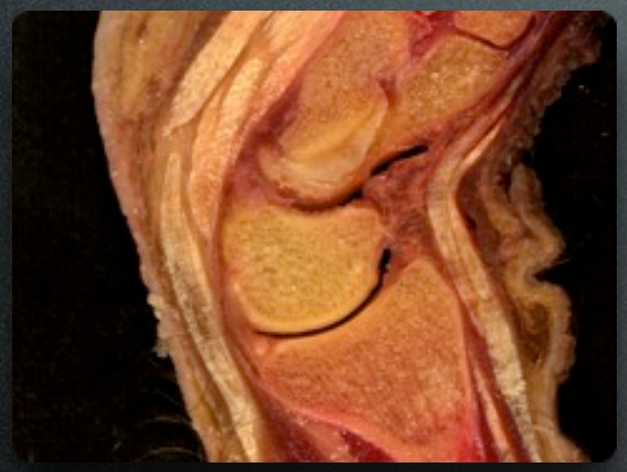
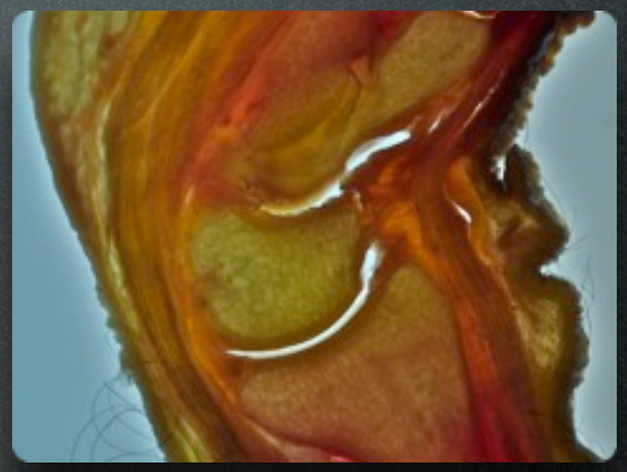


Wrist Extensor Retinaculum
Sagittal Neutral

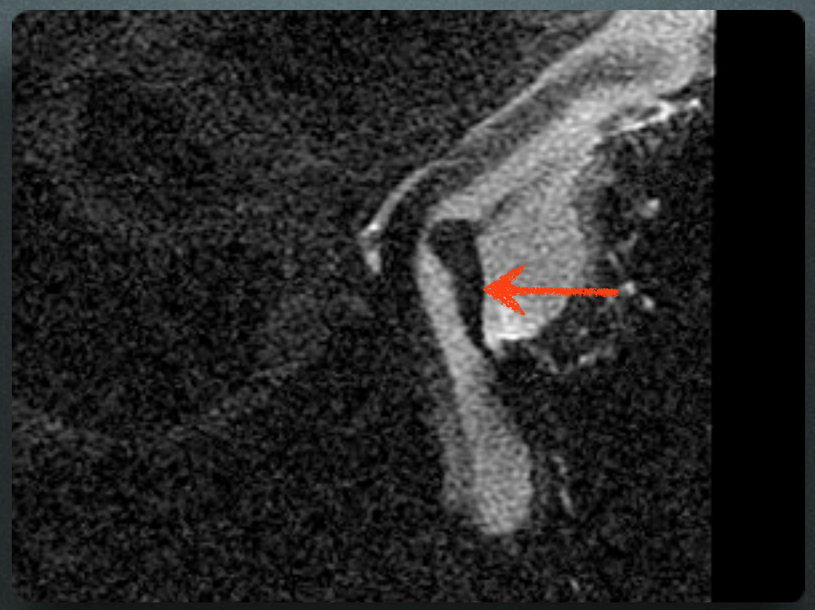


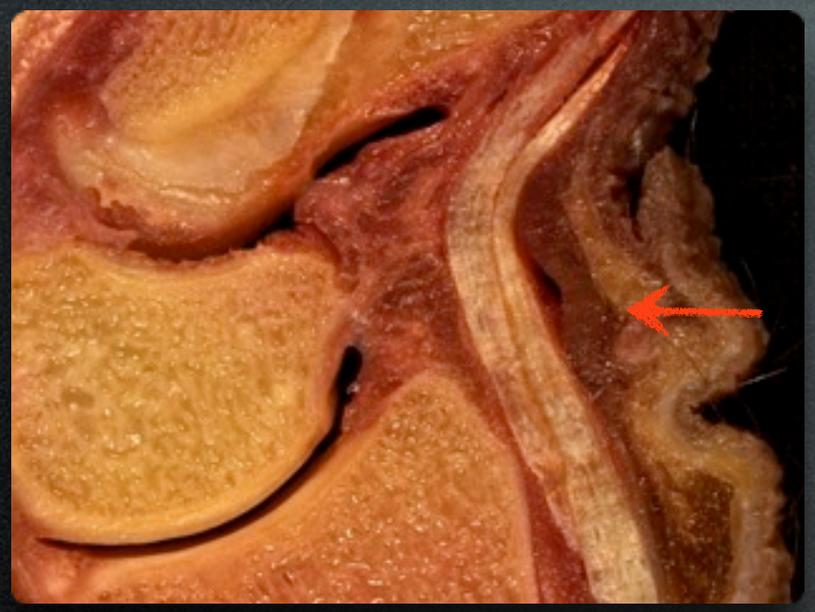
Wrist Extensor Retinaculum
Sagittal Neutral

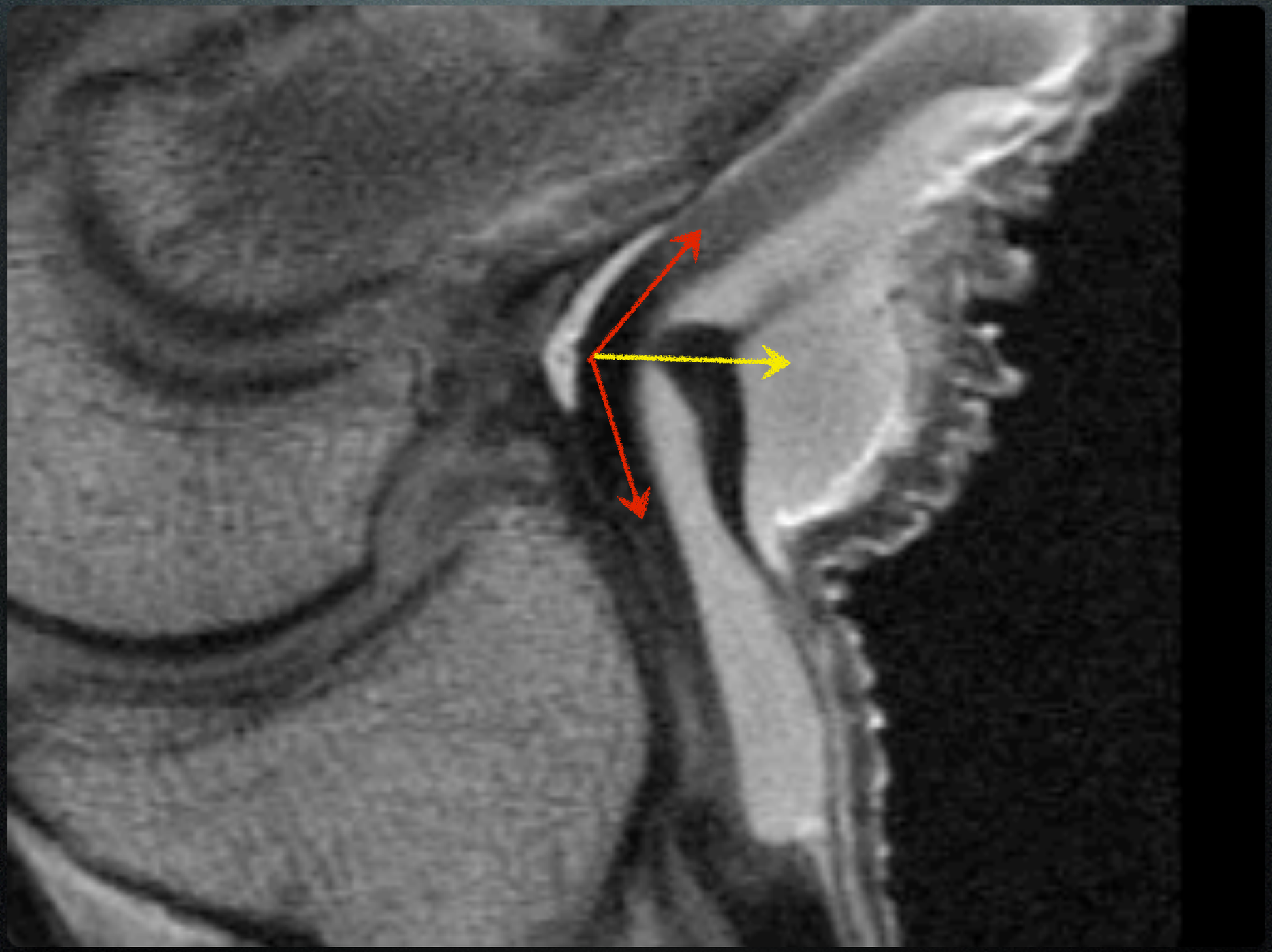



Wrist Extensor Retinaculum Sagittal Dorsiflexion

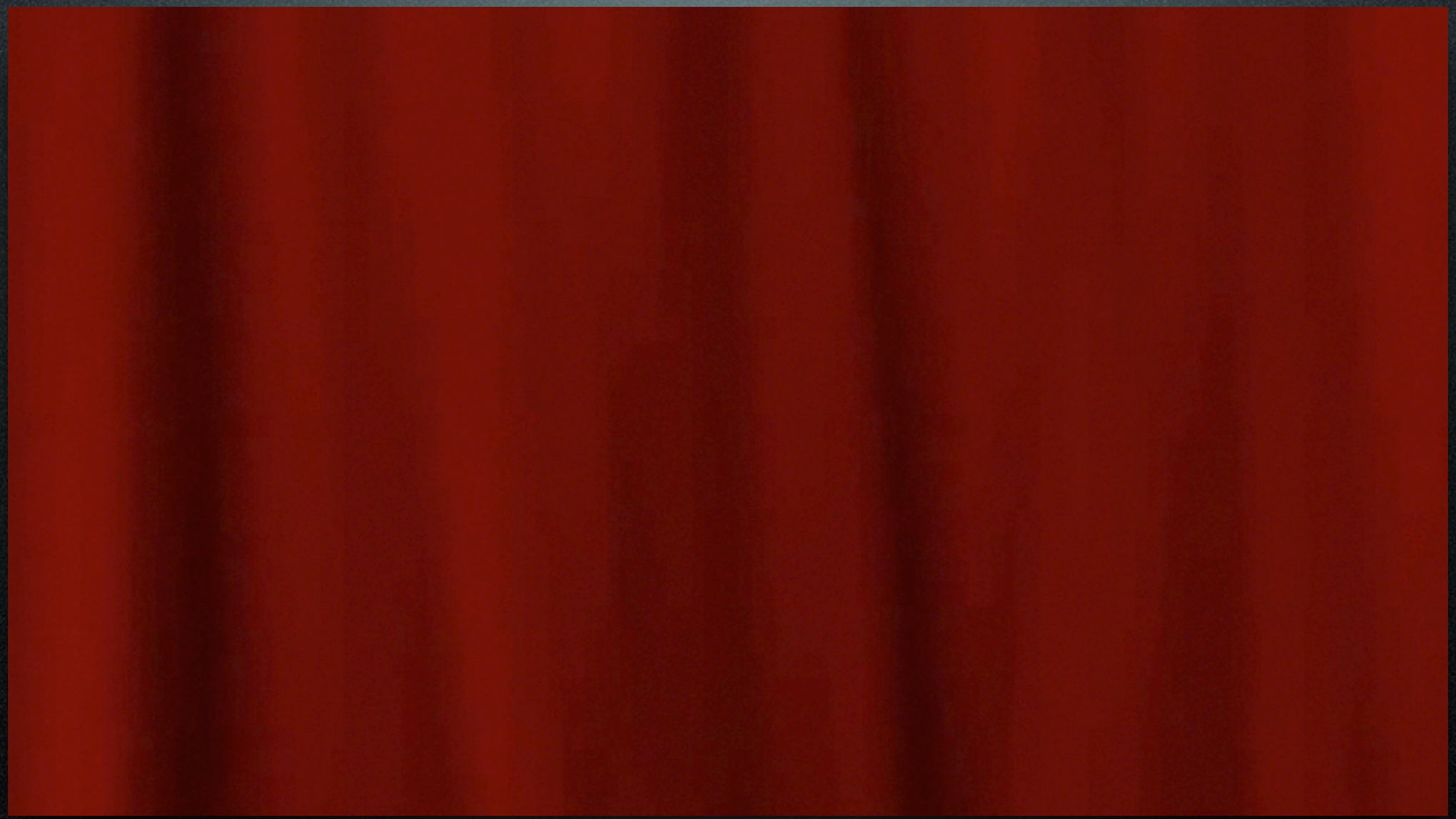




Wrist Extensor Retinaculum
Sagittal Dorsiflexion



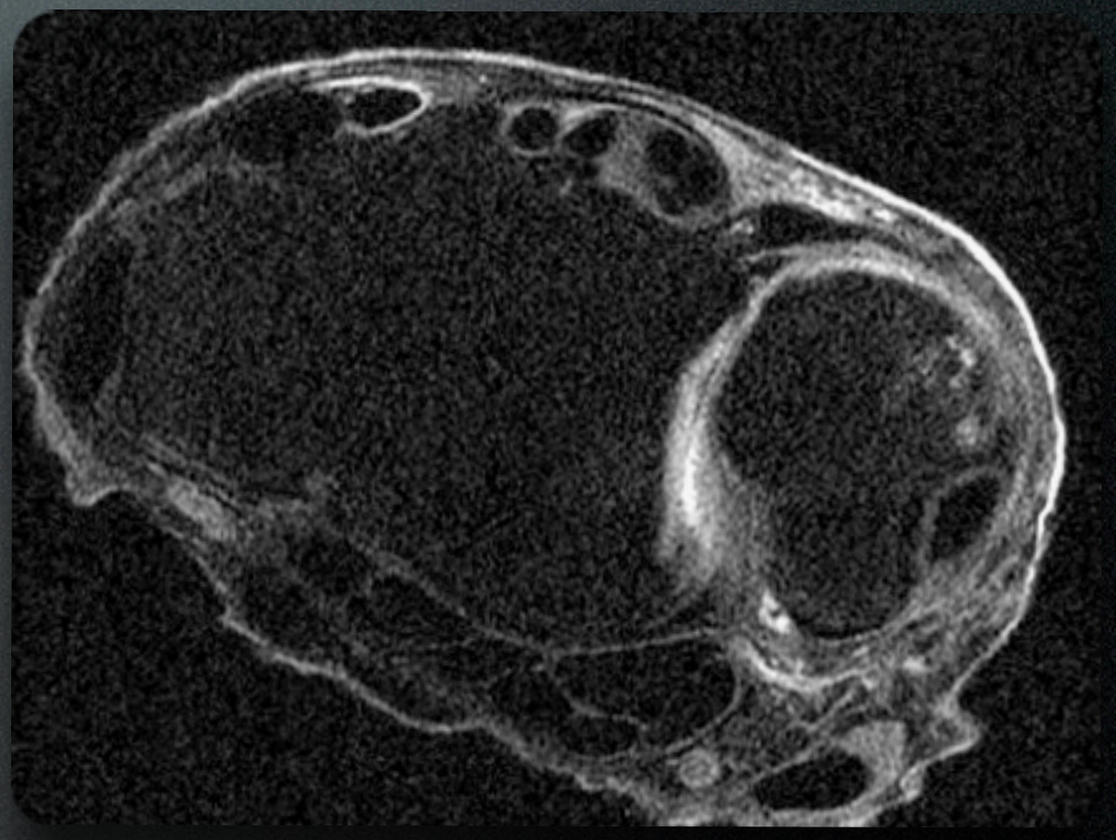
Wrist Extensor Retinaculum
Sagittal Dorsiflexion

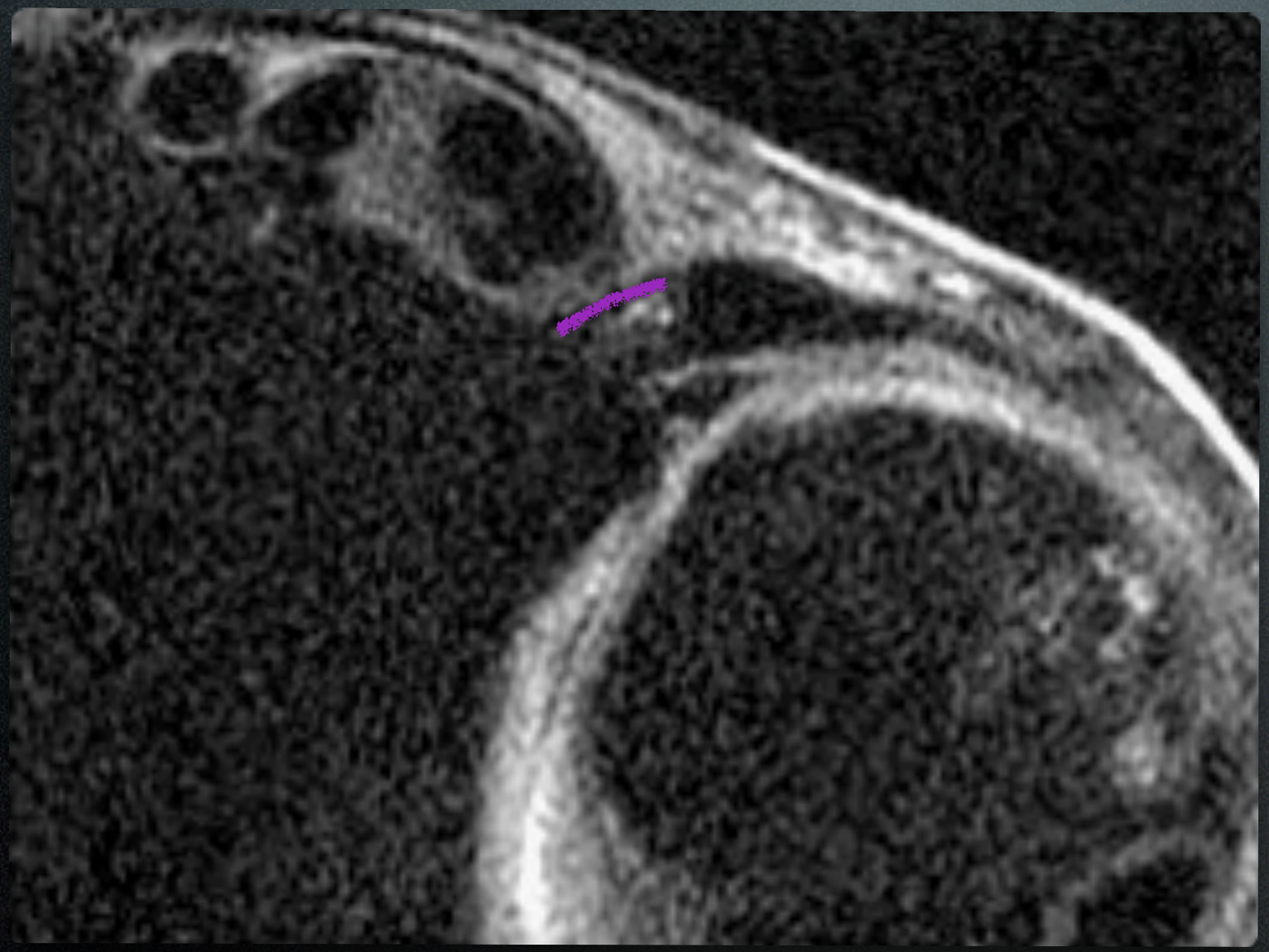


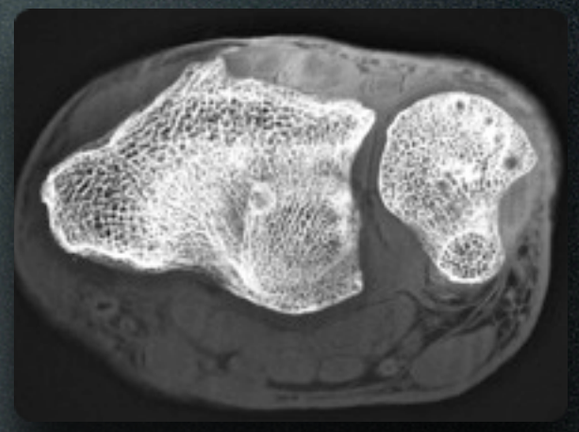
Sectioning Step 4
Setup slice thickness

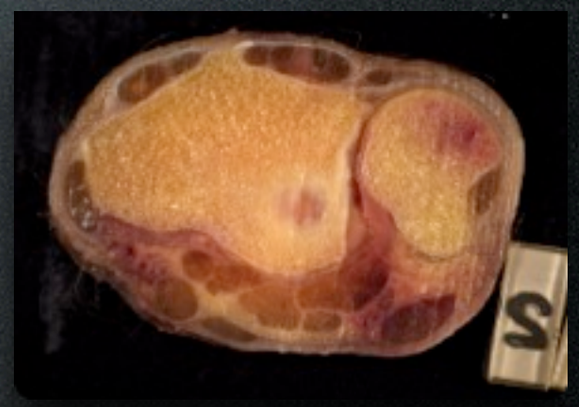
5th extensor compartment

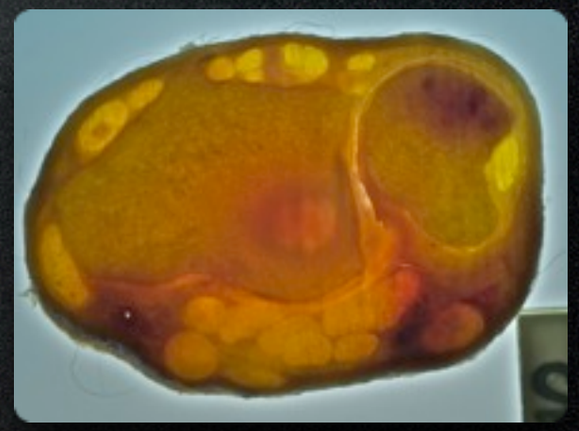
- Tendons: Extensor digiti minimi (EDM)
- 5th septum separates the 4th and 5th dorsal compartments
- Circular fibers surround the 5th dorsal compartment
- Floor is the infratendinous retinaculum



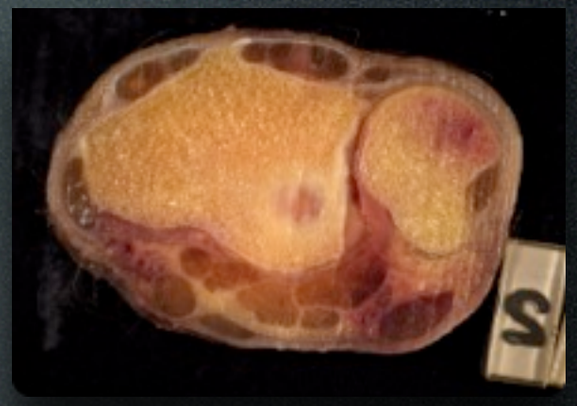


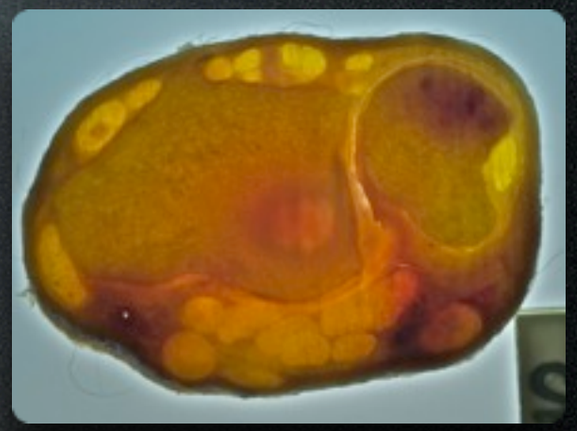


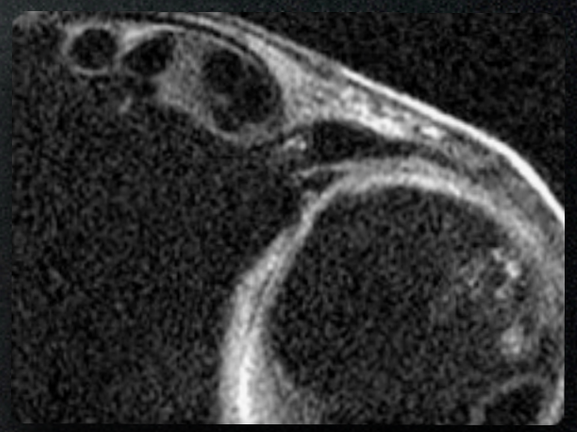




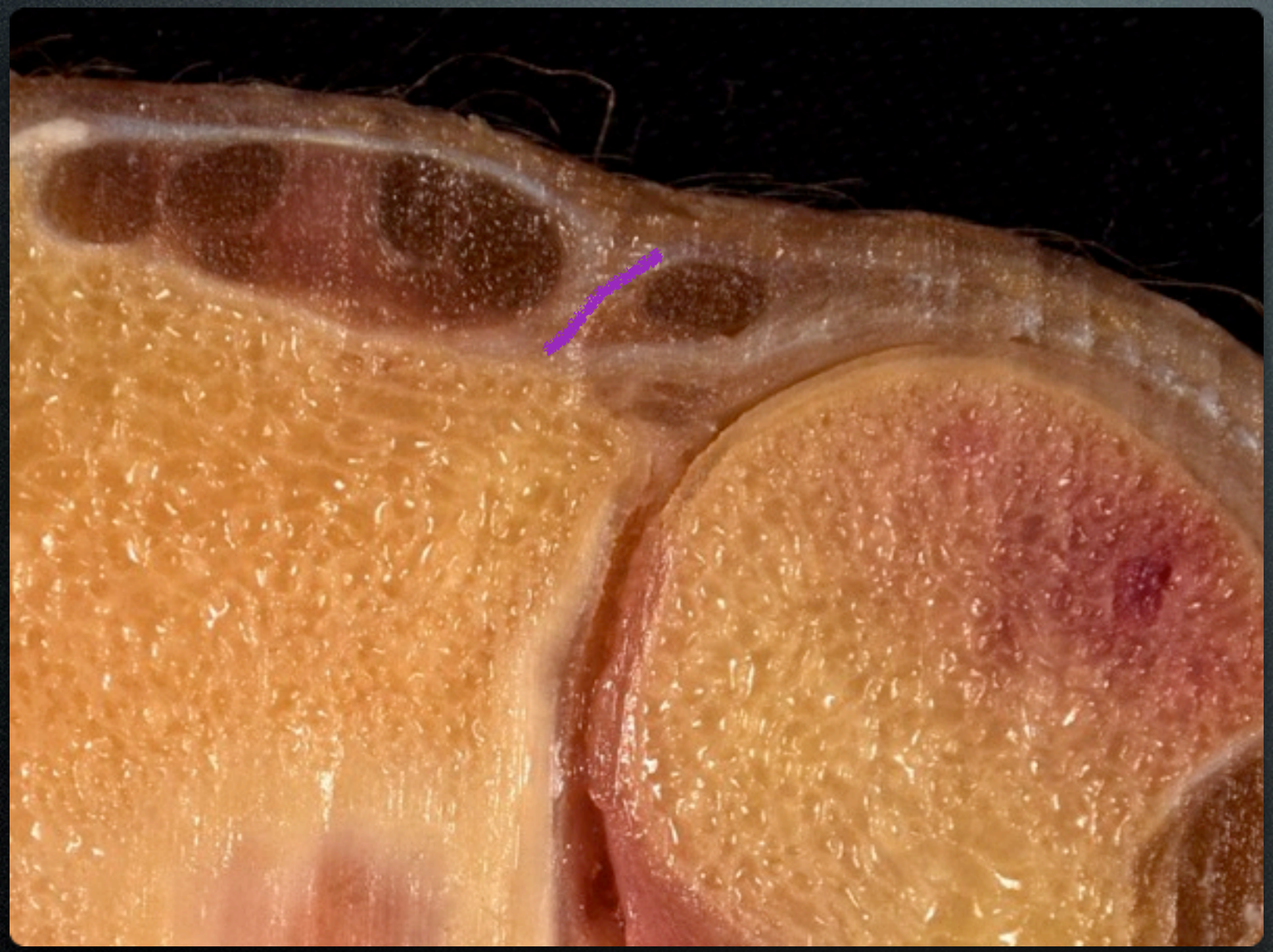
5th extensor septum

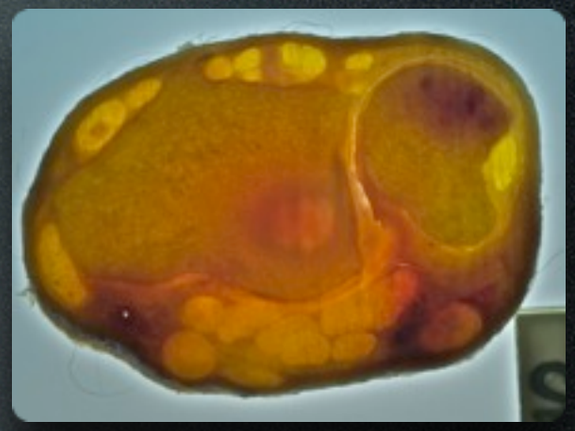


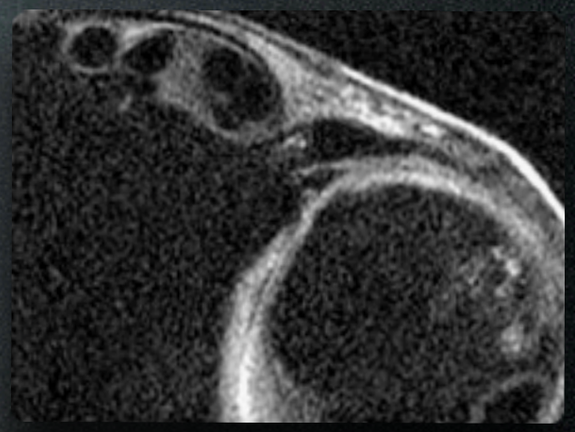


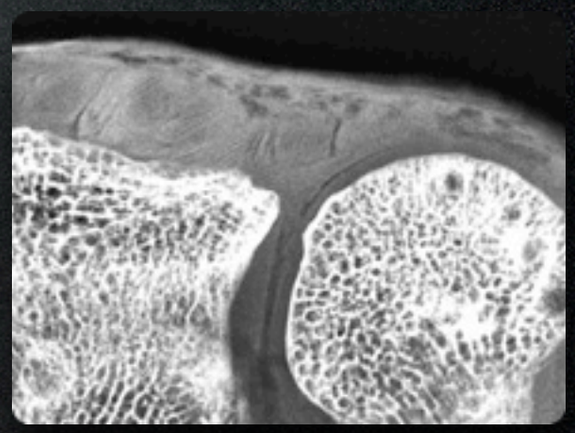


5th extensor septum

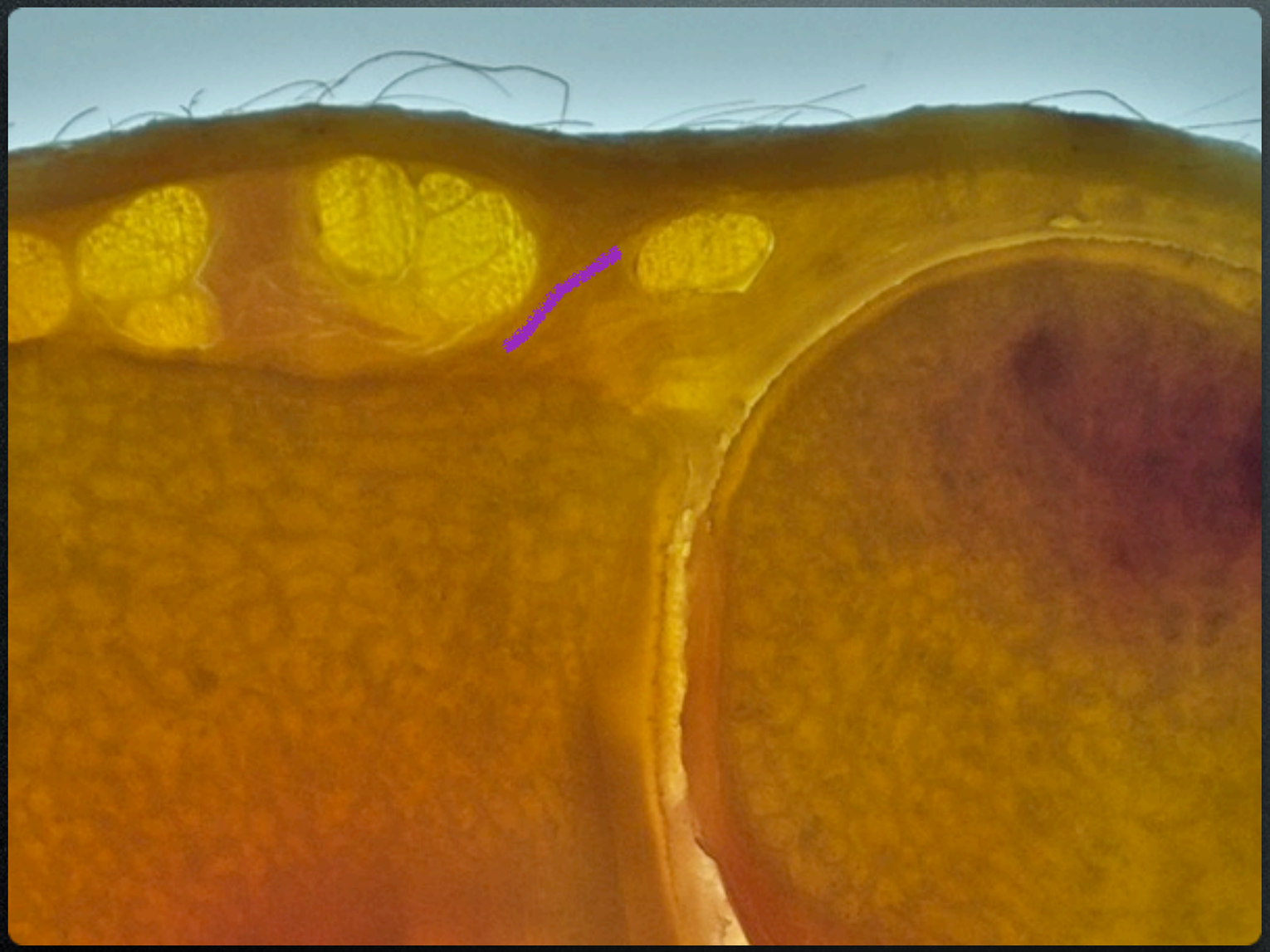


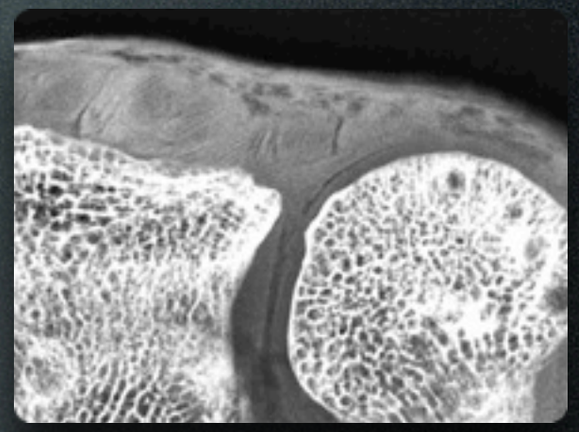


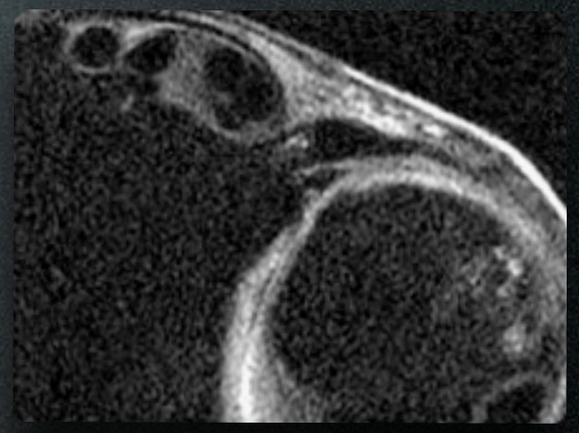




5th extensor septum



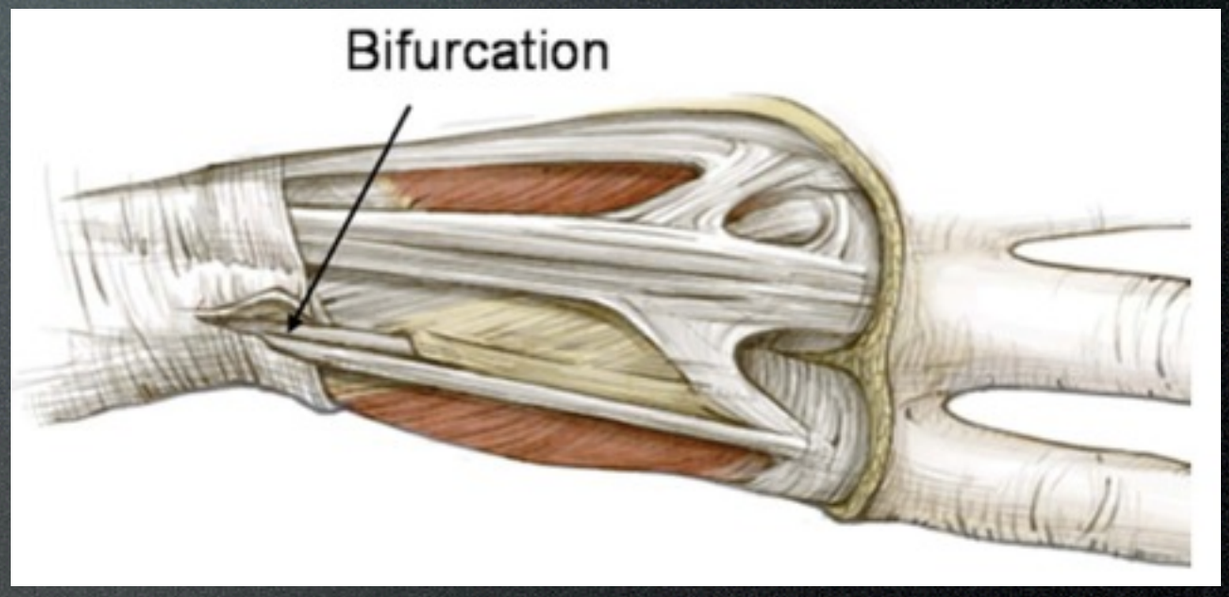




5th extensor septum

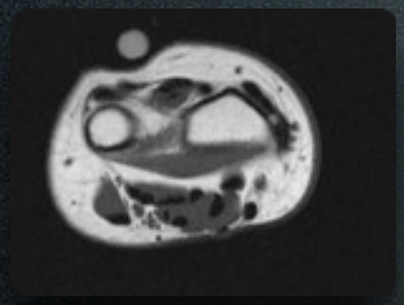
Extensor Digiti Minimi Impingement

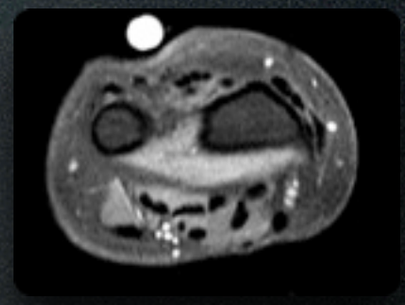
- Tenosynovitis of 5th compartment is uncommon and poorly understood
- Bifurcation of the extensor digiti minimi tendon occurs in 63%-89%
  - Supraretinacular, subretinacular, infraretinacular location of bifurcation
  - Infraretinacular - greater association with impingement on the septum
- Patients clinically present with pain along EDM tendon with full finger flexion during wrist flexion

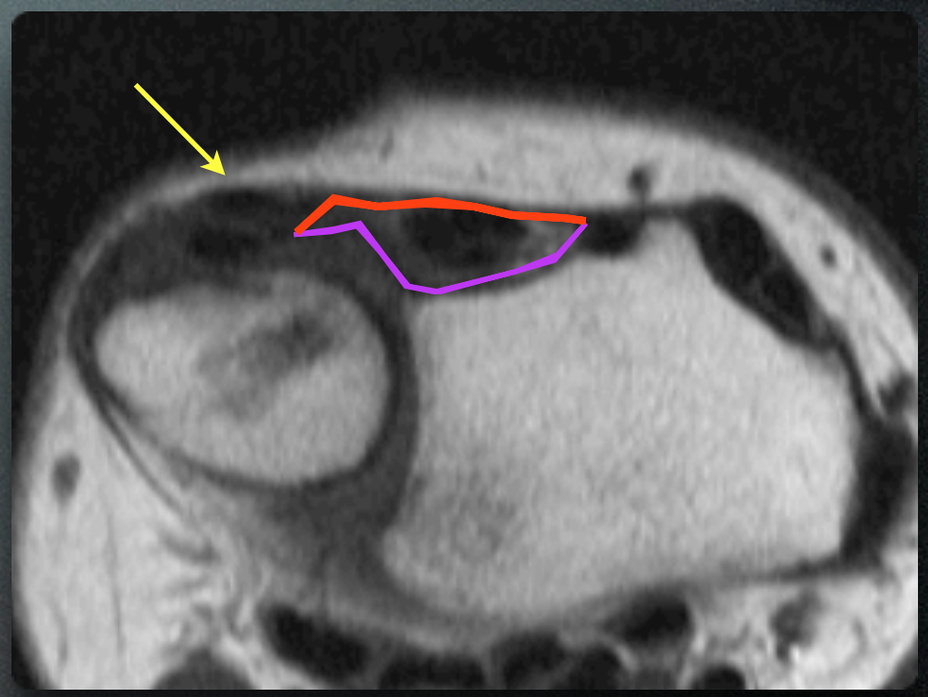


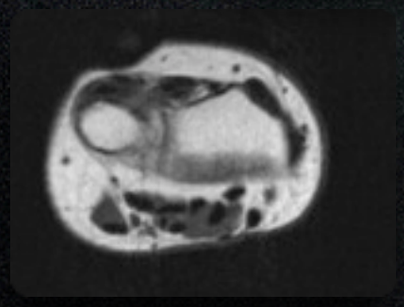
Yoo et al, Clin Anat 2011

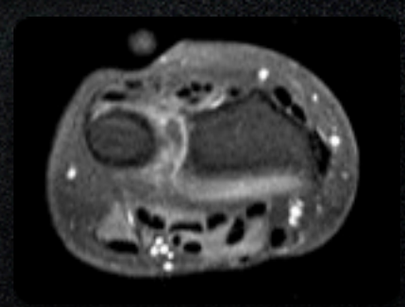
48 yo female - Extensor Digitorum Minimi Subluxation



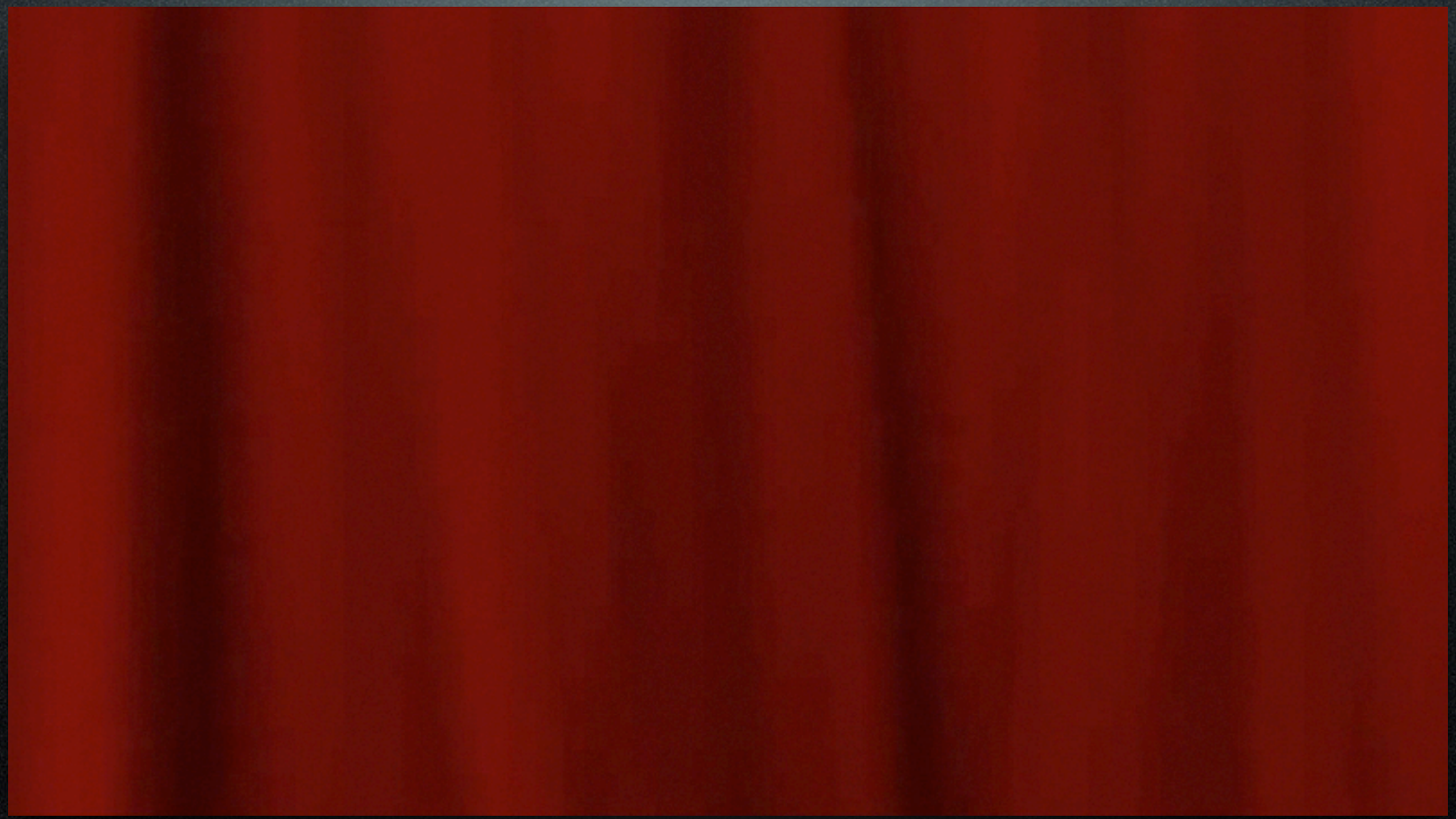








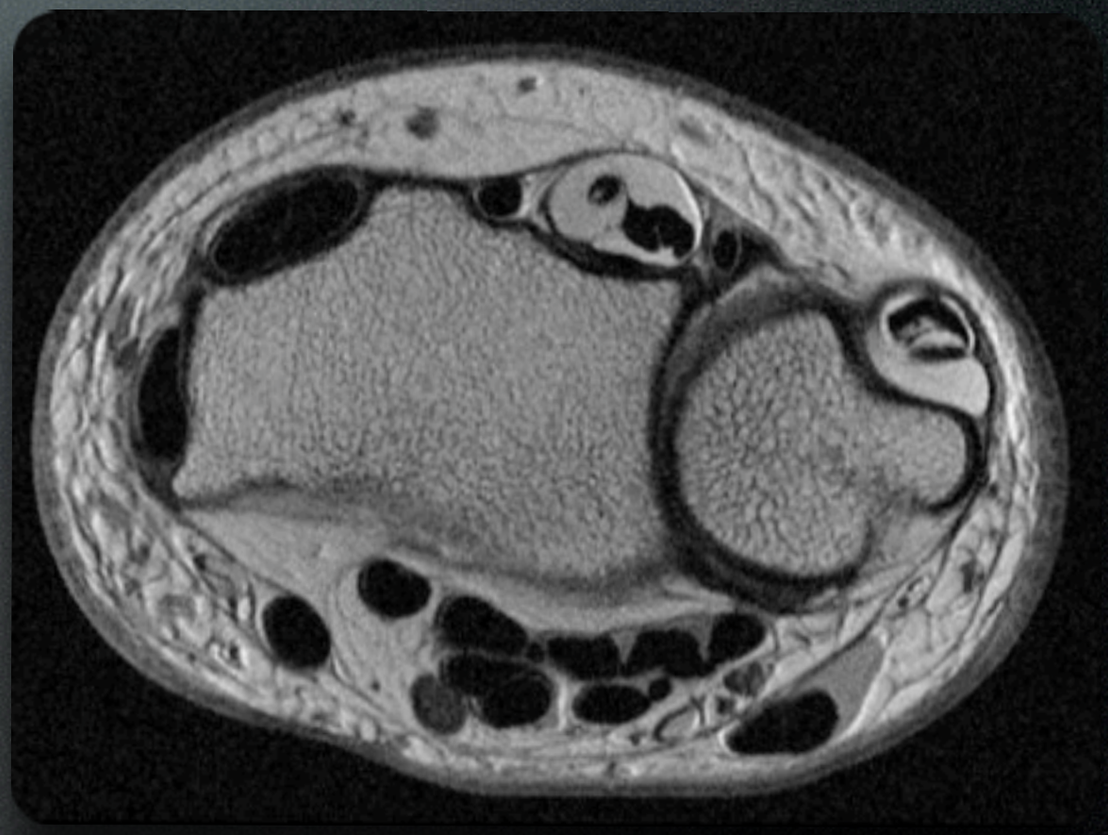
Extensor Digitorum Minimi Subluxation

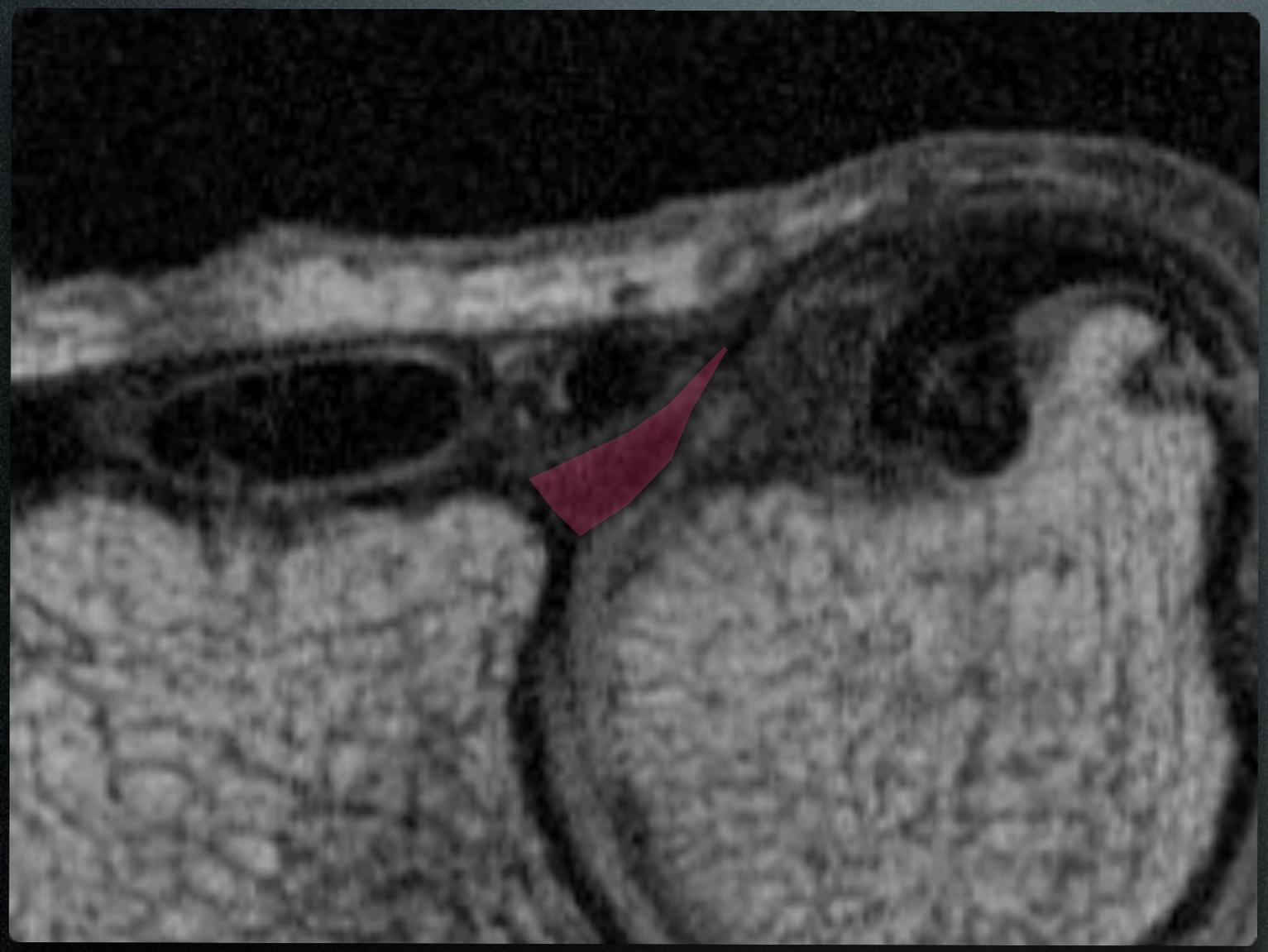


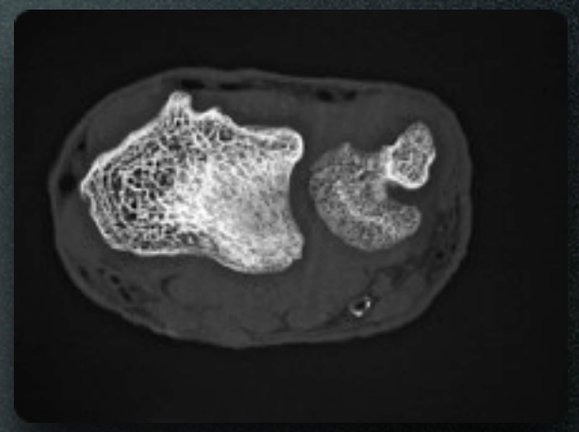
Sectioning Step 5
Cut Section Slices

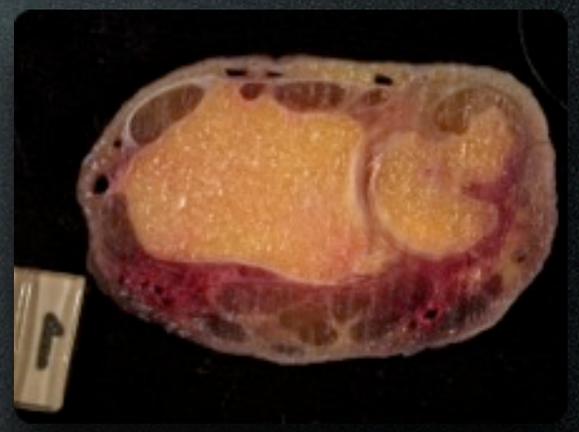
6th extensor compartment

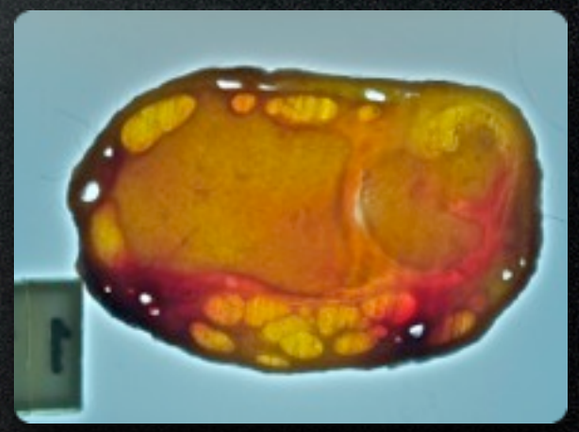
- 6th septum separates the extensor digiti minimi tendon from the extensor carpi ulnaris tendon
  - Taleisnik et al: Fibrous septum attaches to the dorsal ulnar corner of the radius proximally
  - Iwamoto et al: Soft tissue attachment of 6th septum
  - Werther et al: No bony attachment of 5th and 6th compartments
- Fibrous complex that blends with the distal dorsal intercarpal ligament distally
- Extensor carpi ulnaris tendon is stabilized in the sheath by a subsheath



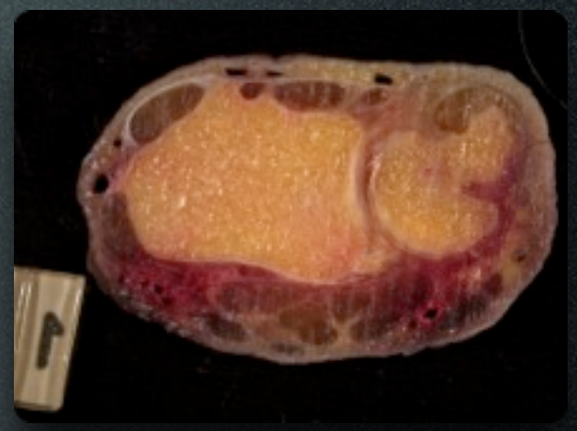


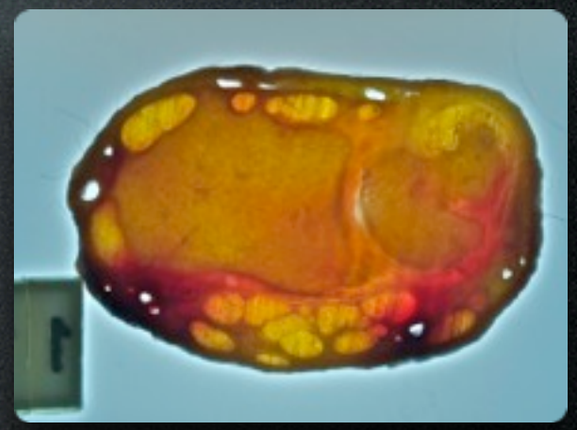


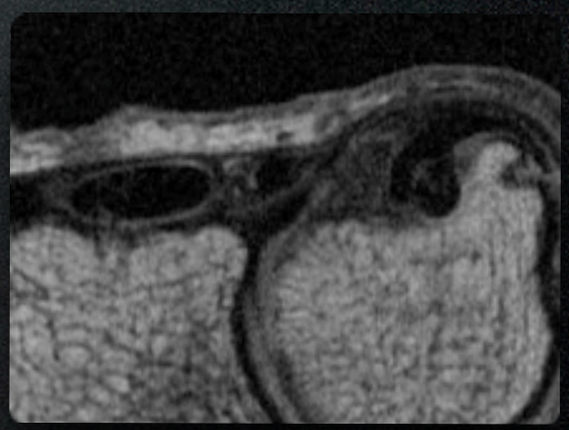




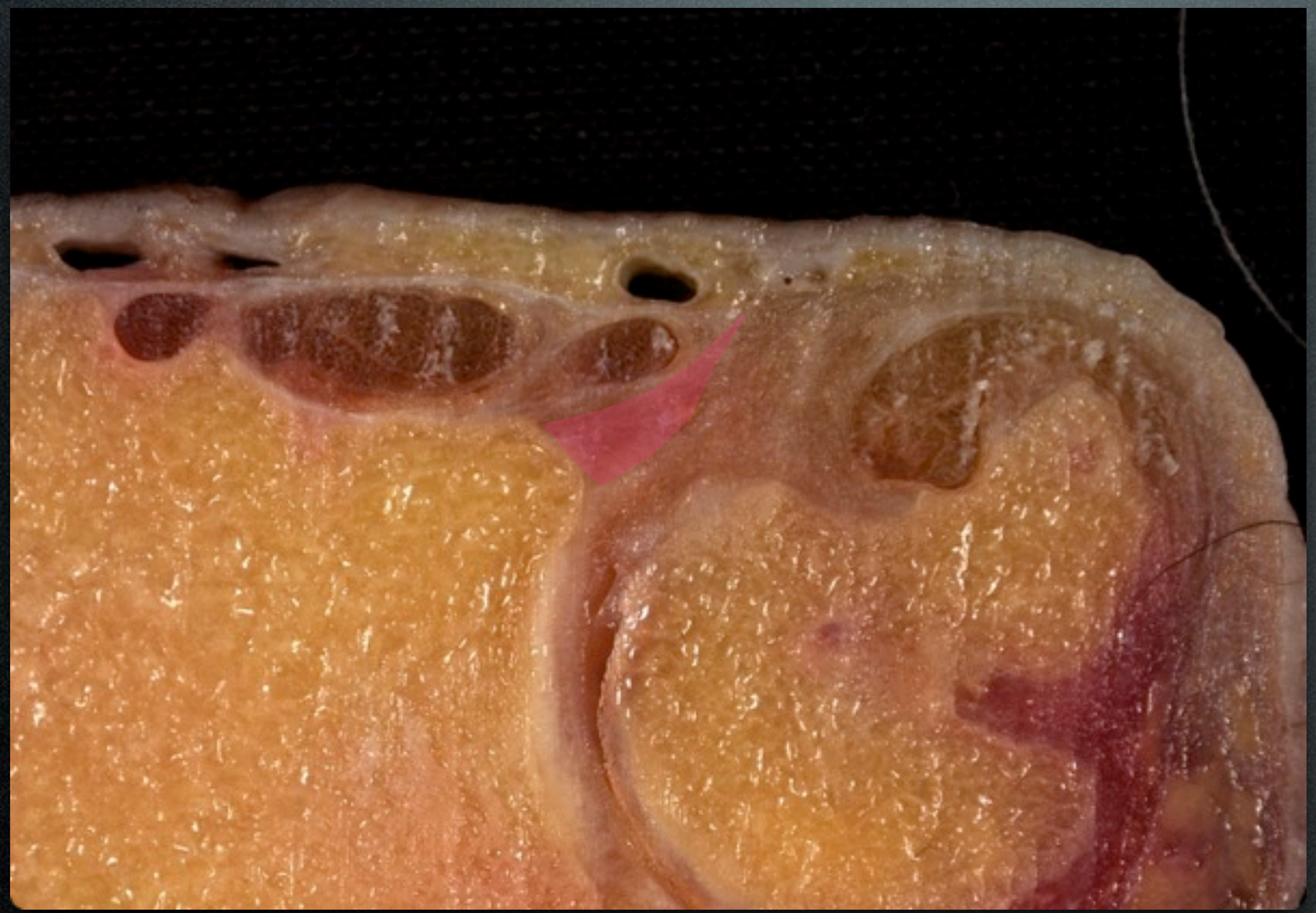
6th extensor septum - separate attachment

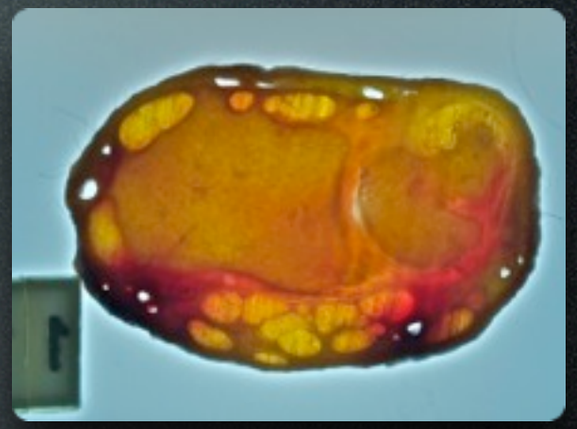


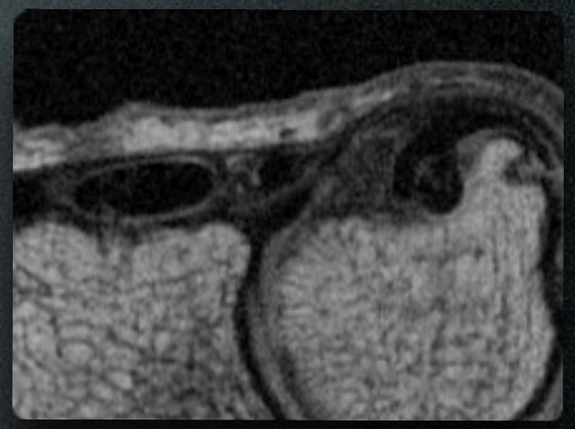


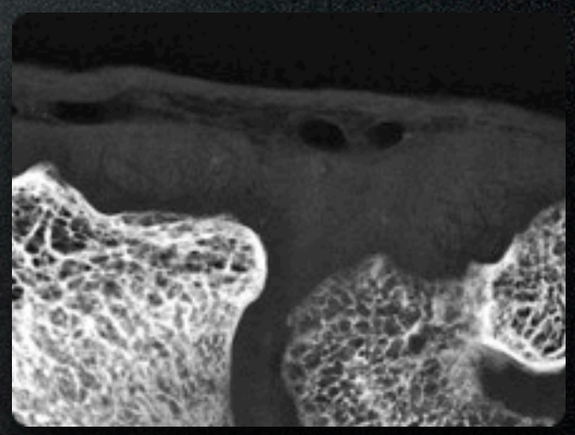


6th extensor septum - separate attachment

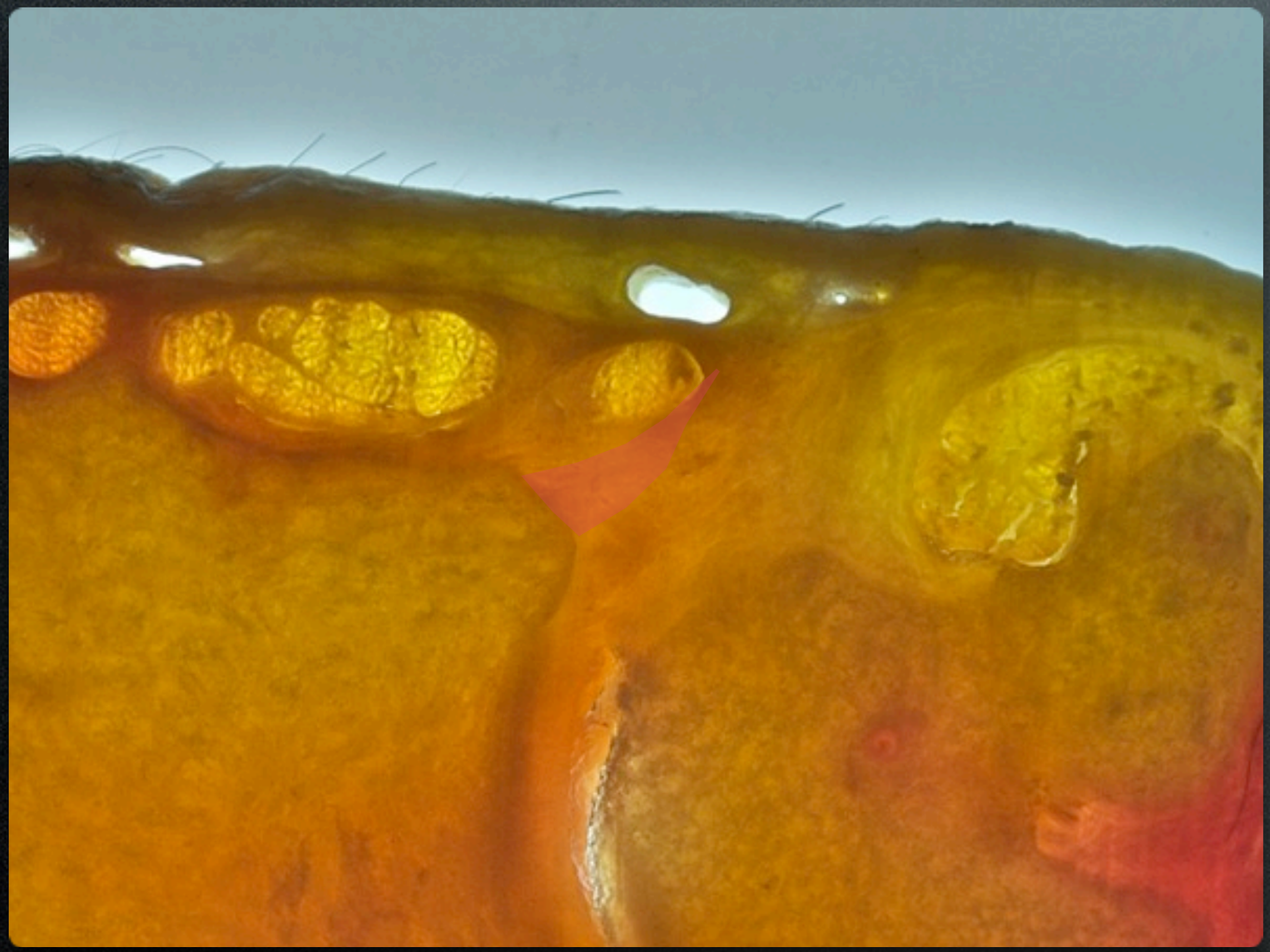


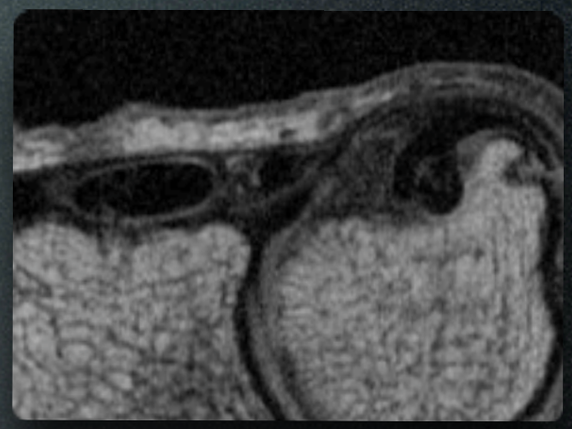


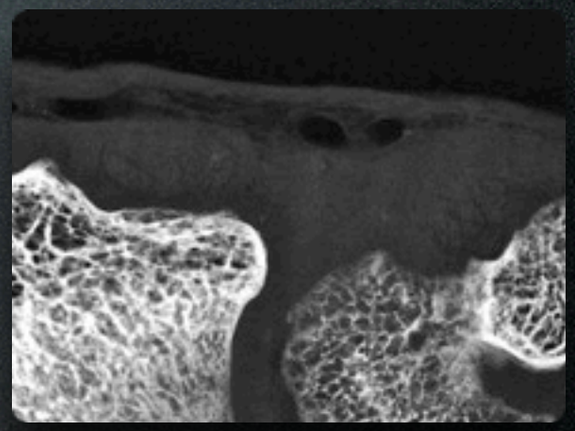




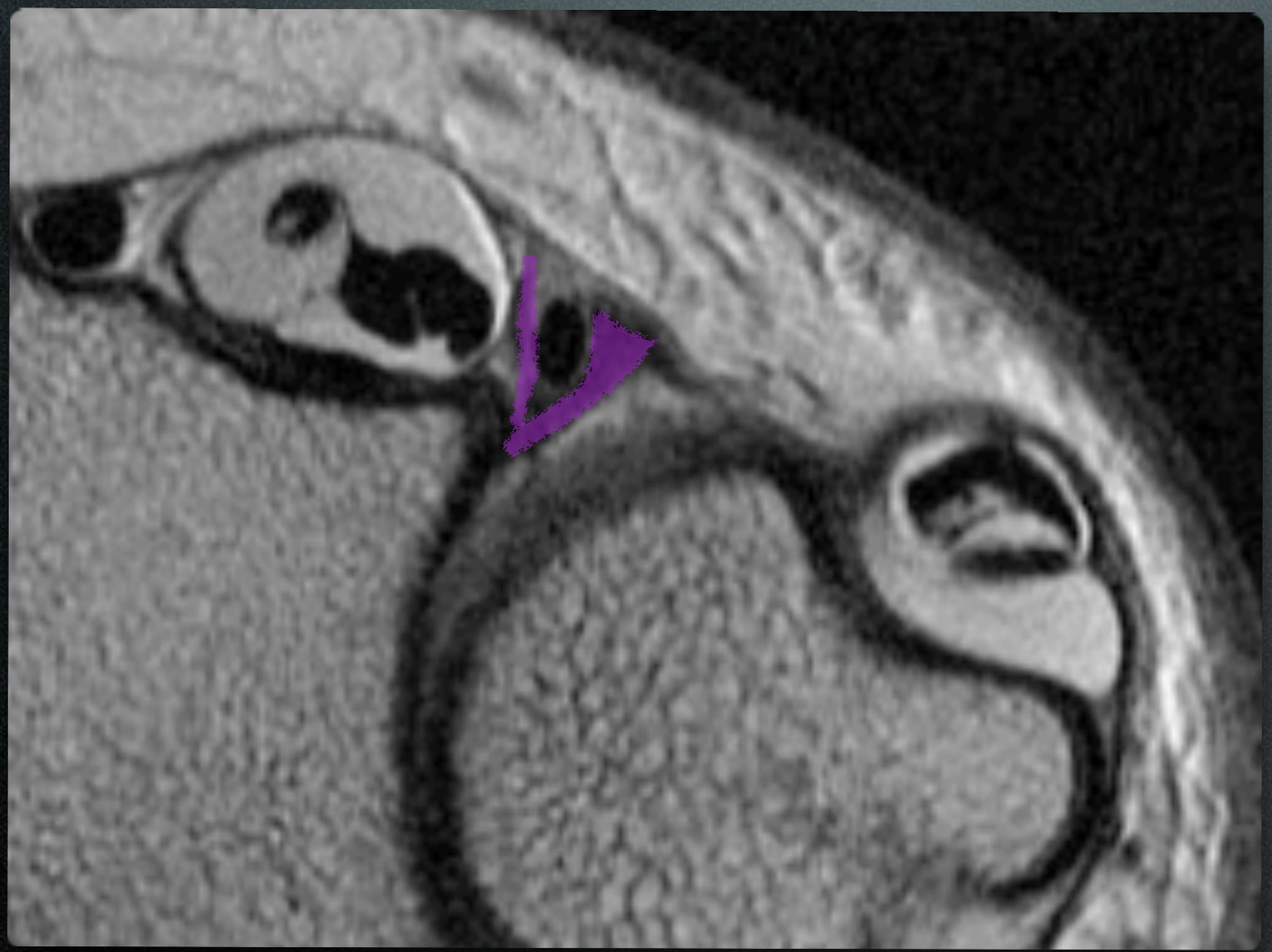
6th extensor septum - separate attachment

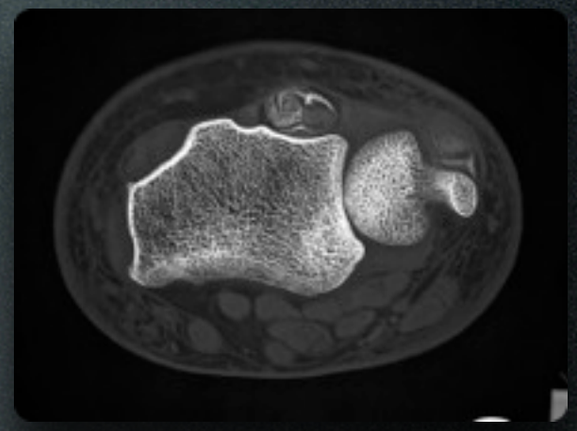


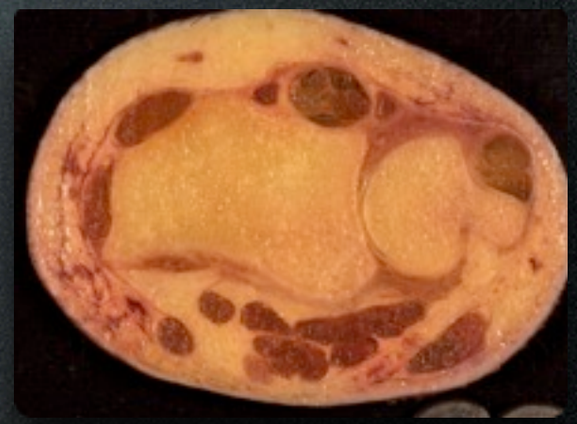


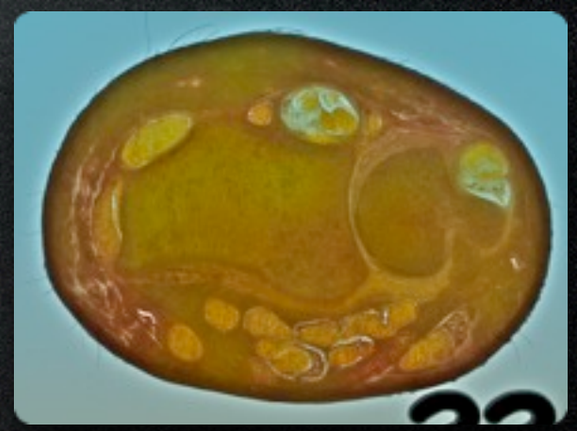


6th extensor septum - separate attachment

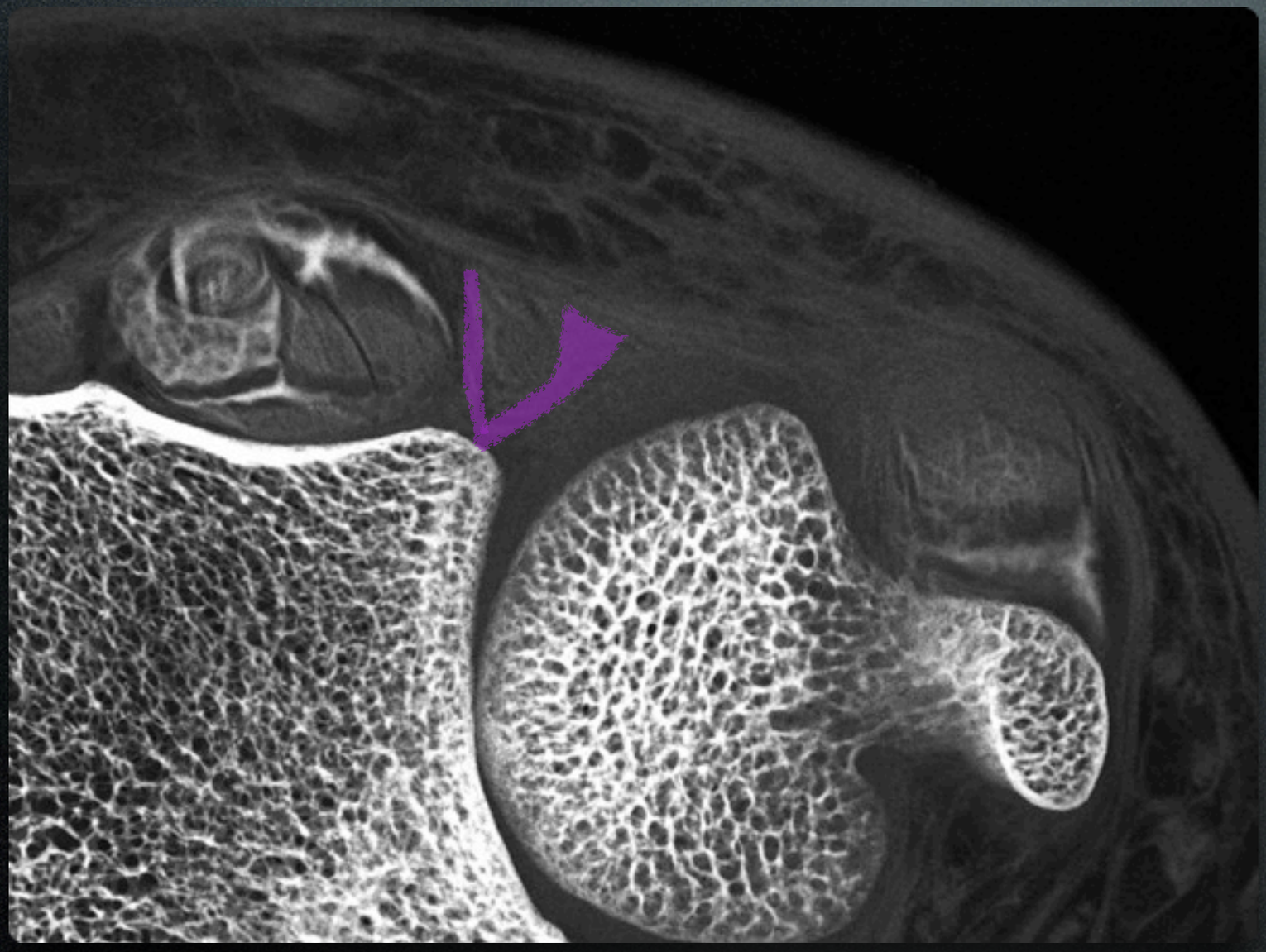


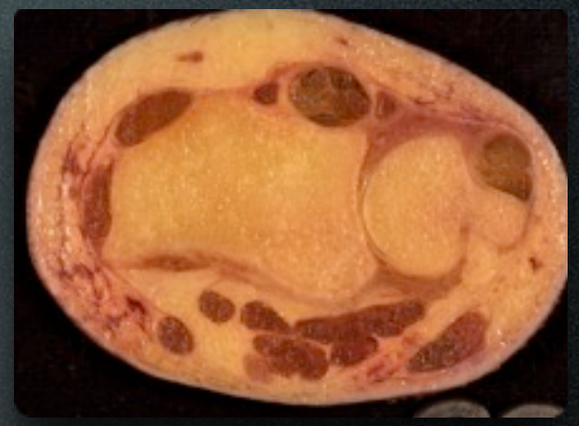


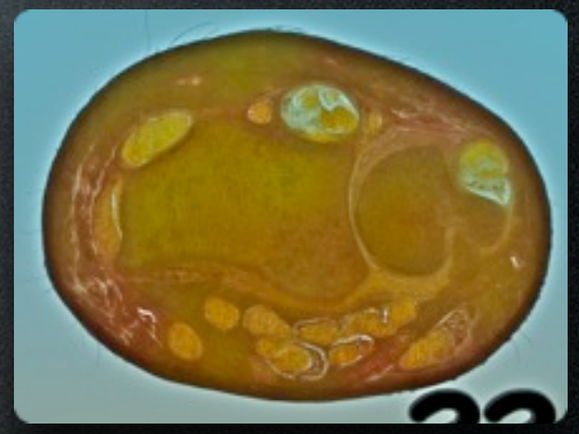




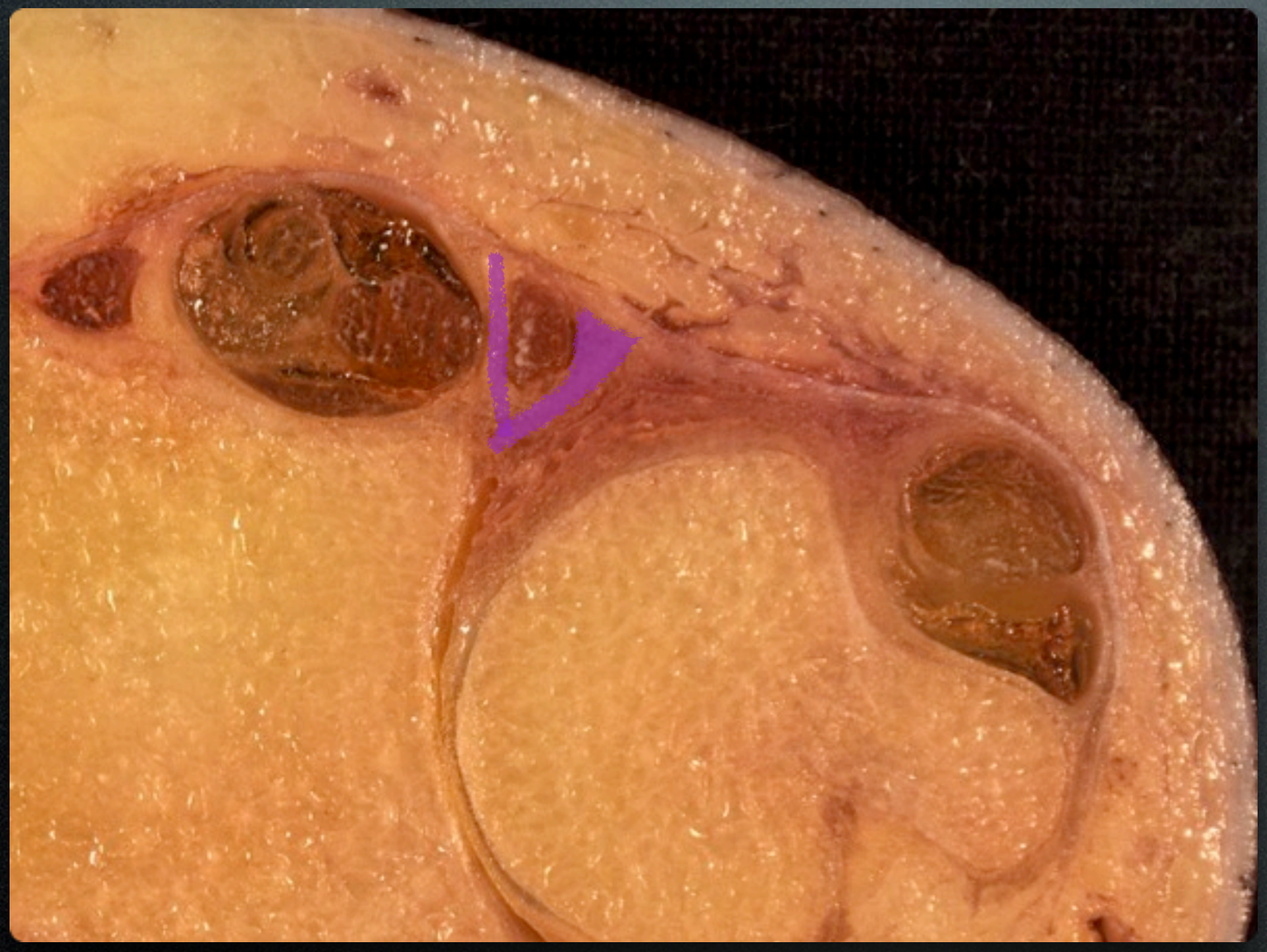
6th extensor septum - conjoined attachment with 5th septum

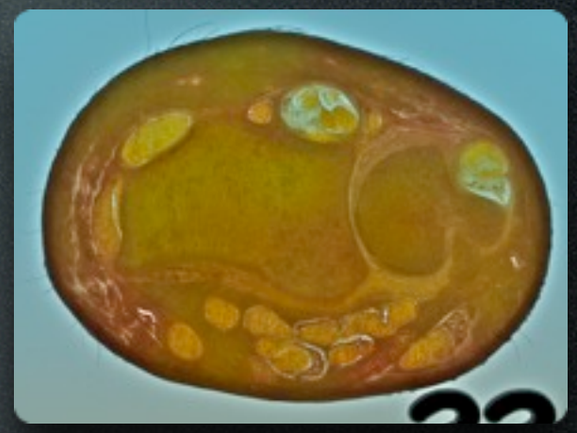


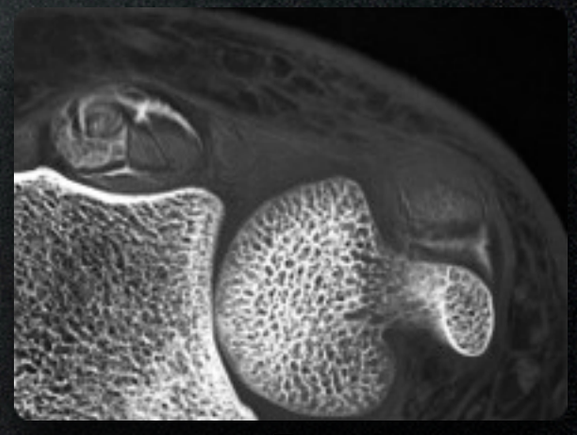




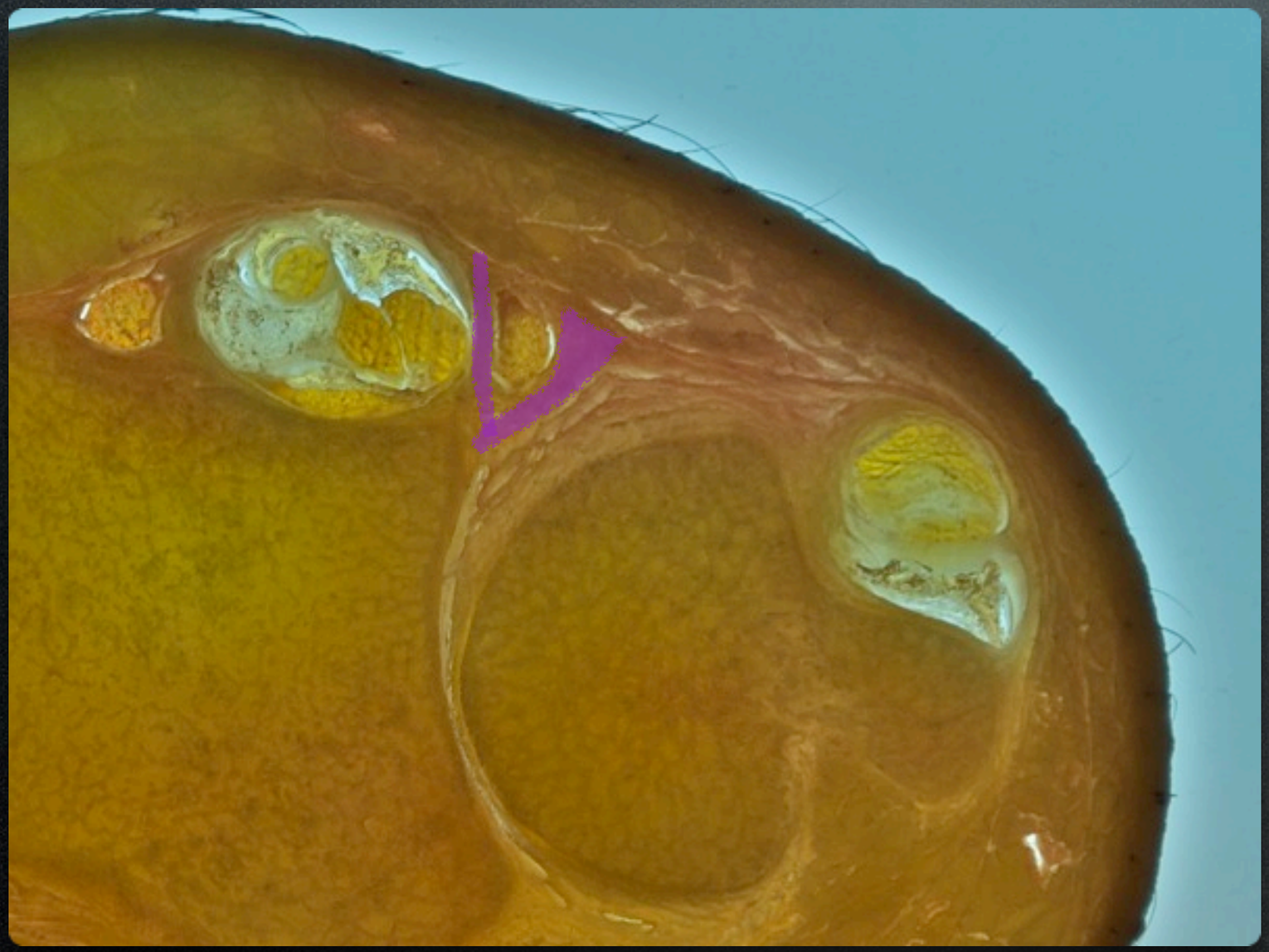
6th extensor septum - conjoined attachment with 5th septum

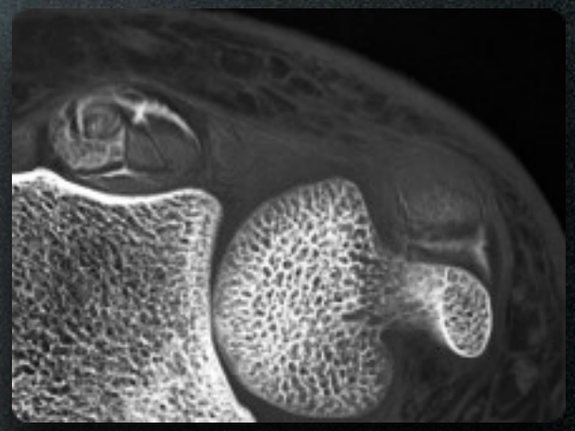


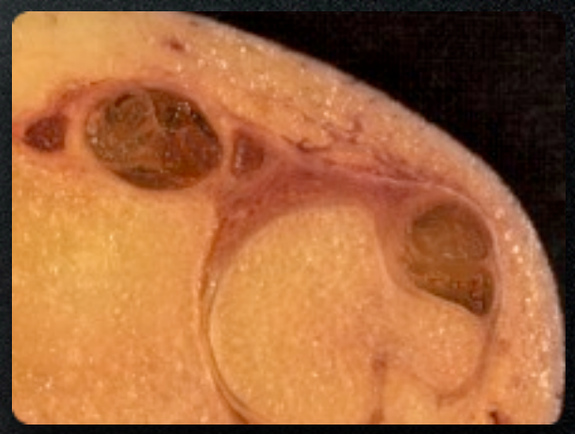




6th extensor septum - conjoined attachment with 5th septum



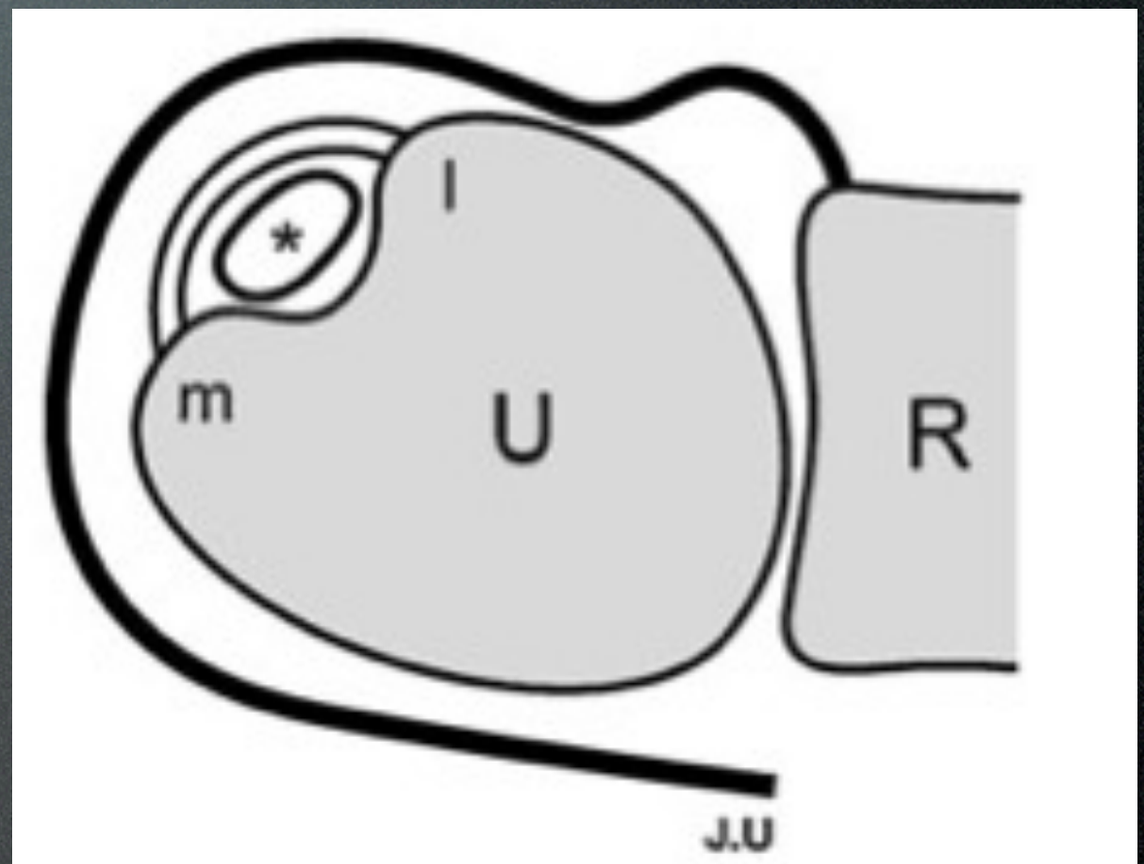




6th extensor septum - conjoined attachment with 5th septum

6th extensor compartment

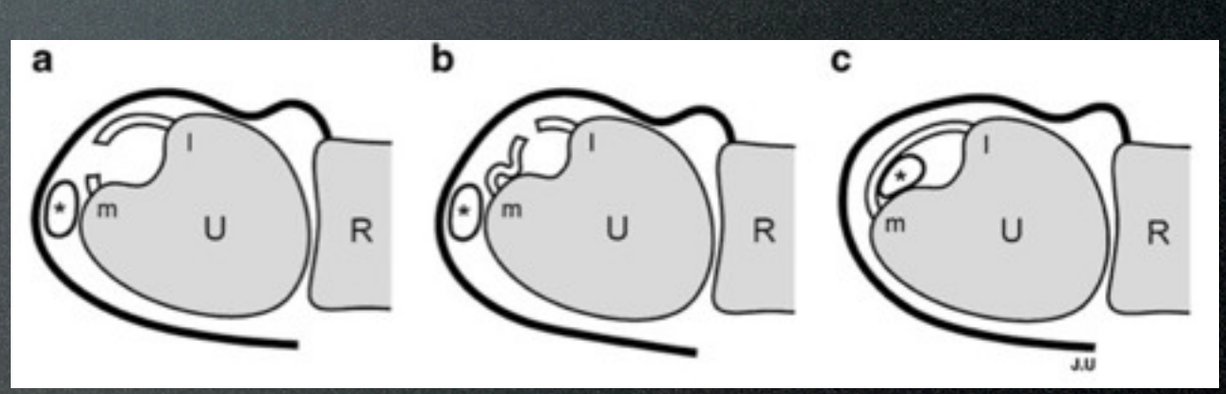
- Extensor carpi ulnaris tendon enclosed in a separate fibro-osseous tunnel peripherally bordered by a subsheath on distal 1.5 to 2 cm of ulna which is not attached to the extensor retinaculum
- Transverse fibers arise from medial wall and become confluent with the epimysium of the ECU tendon
- During pronation, the ECU tendon is separated from the EDM tendon
- During supination, the ECU tendon moves closer to the EDM tendon under maximum traction and has to adopt a 30˚ angle



Moritomo et al, J Hand Surg Am 2006

ECU Subsheath Tear

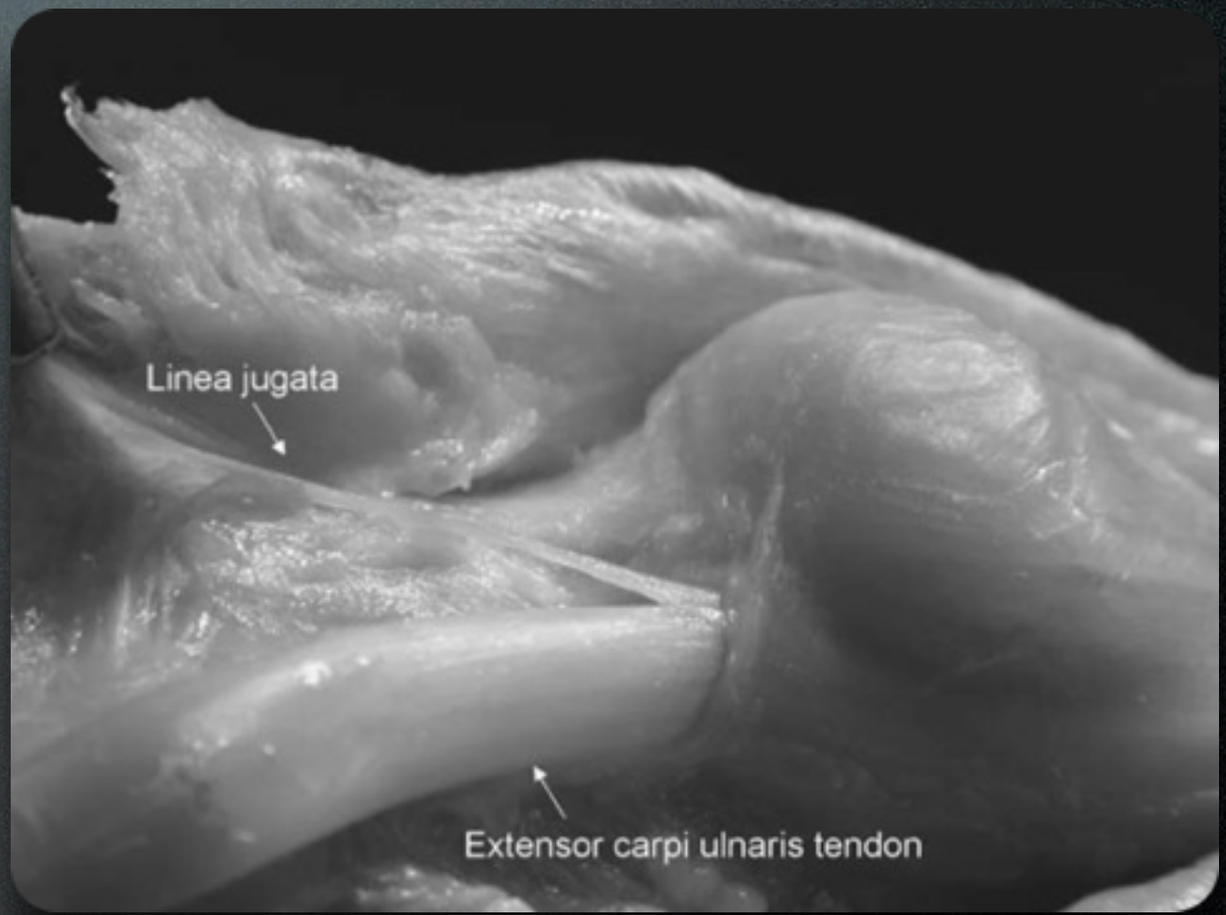
- Subsheath tears result in ECU tendon dislocation
- Type A injuries (56%)
- Type B injuries (38%)
- Type C injuries (6%)
  - Associated pouch in type A & C injuries near a medial sided tear
- Pronation of scaphoid and capitate decrease by 40% and 50% respectively



Salva-Serra et al, J Hand Surg Eur Vol 2011

Linea Jugata

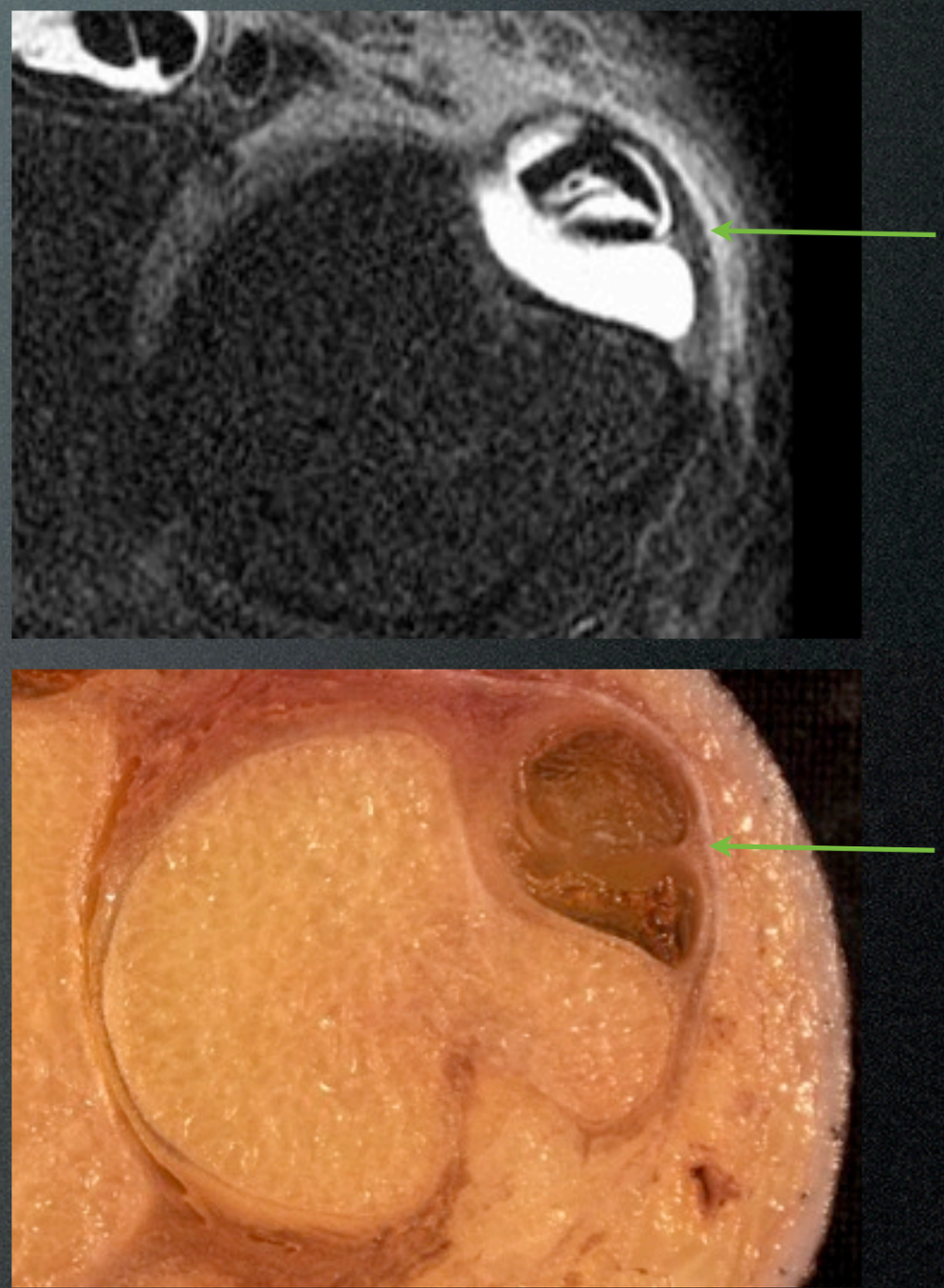
- Longitudinally oriented fibers attached to ulnar styloid and superficial retinaculum
- Superficial support of the ECU tendon to prevent subluxation in supination



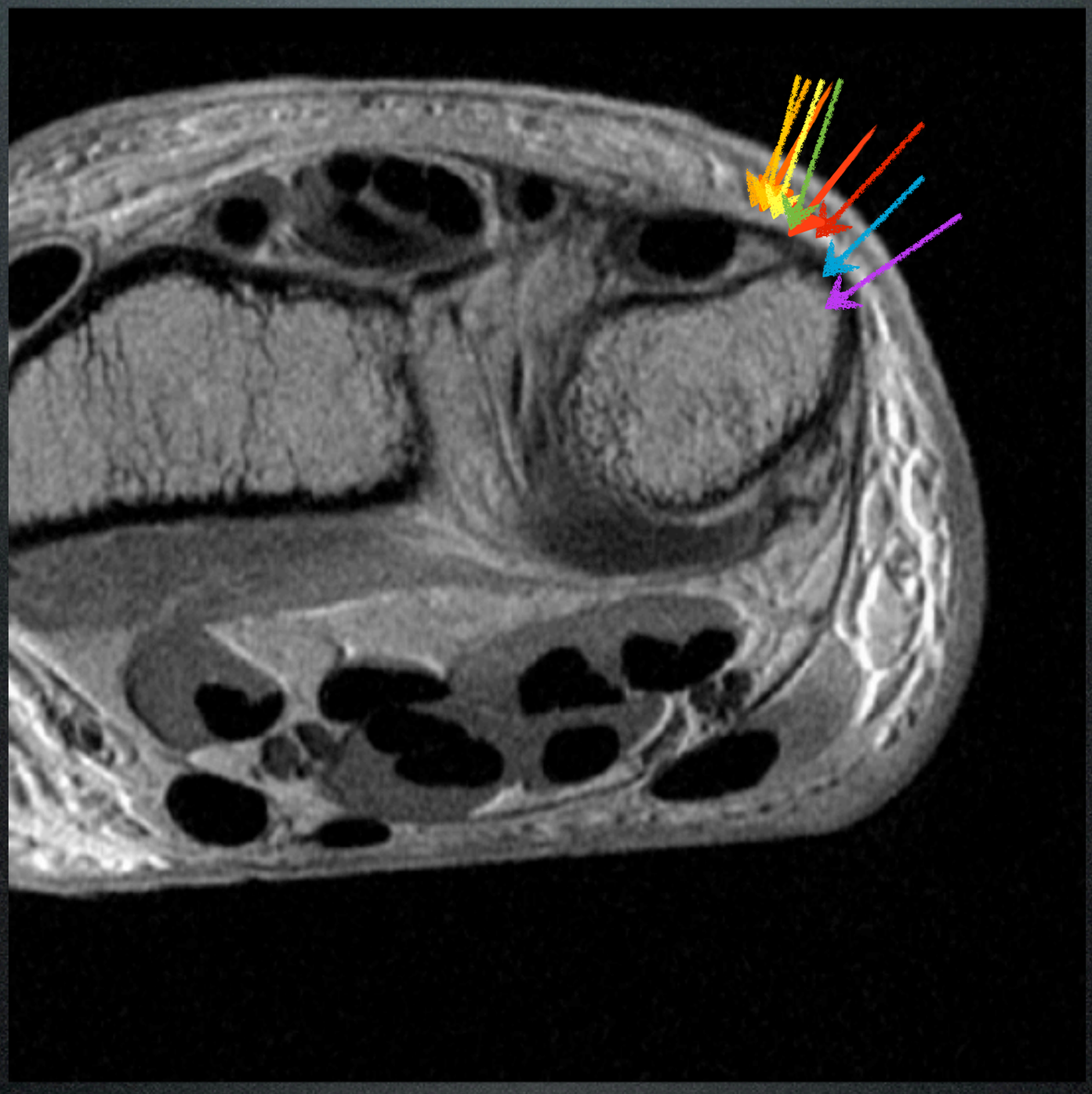
Allende C et al. J Hand Surg Br. 2005

Linea Jugata

- Not routinely seen on standard MR images
- Tenography - subtle longitudinally oriented thickening of the ECU subsheath

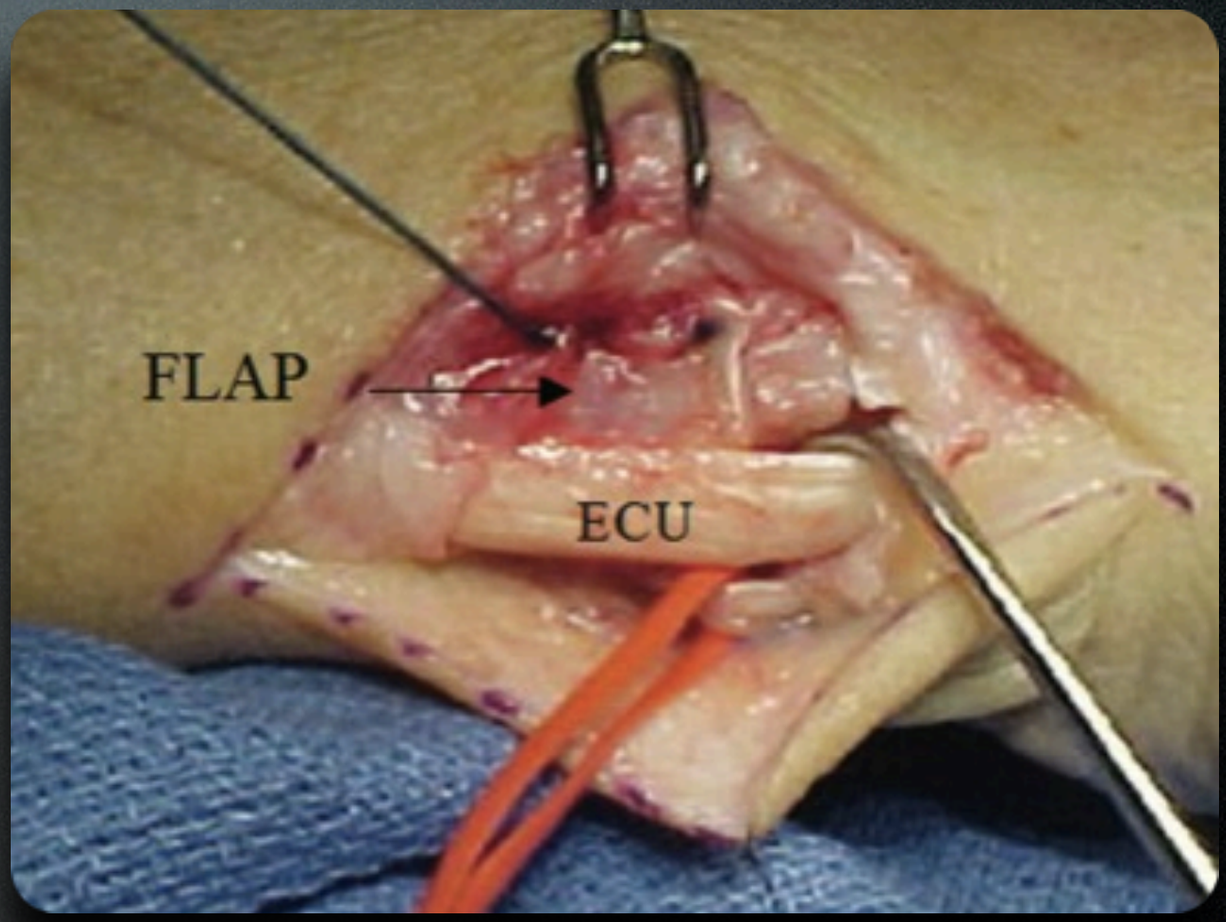


Linea Jugata ?

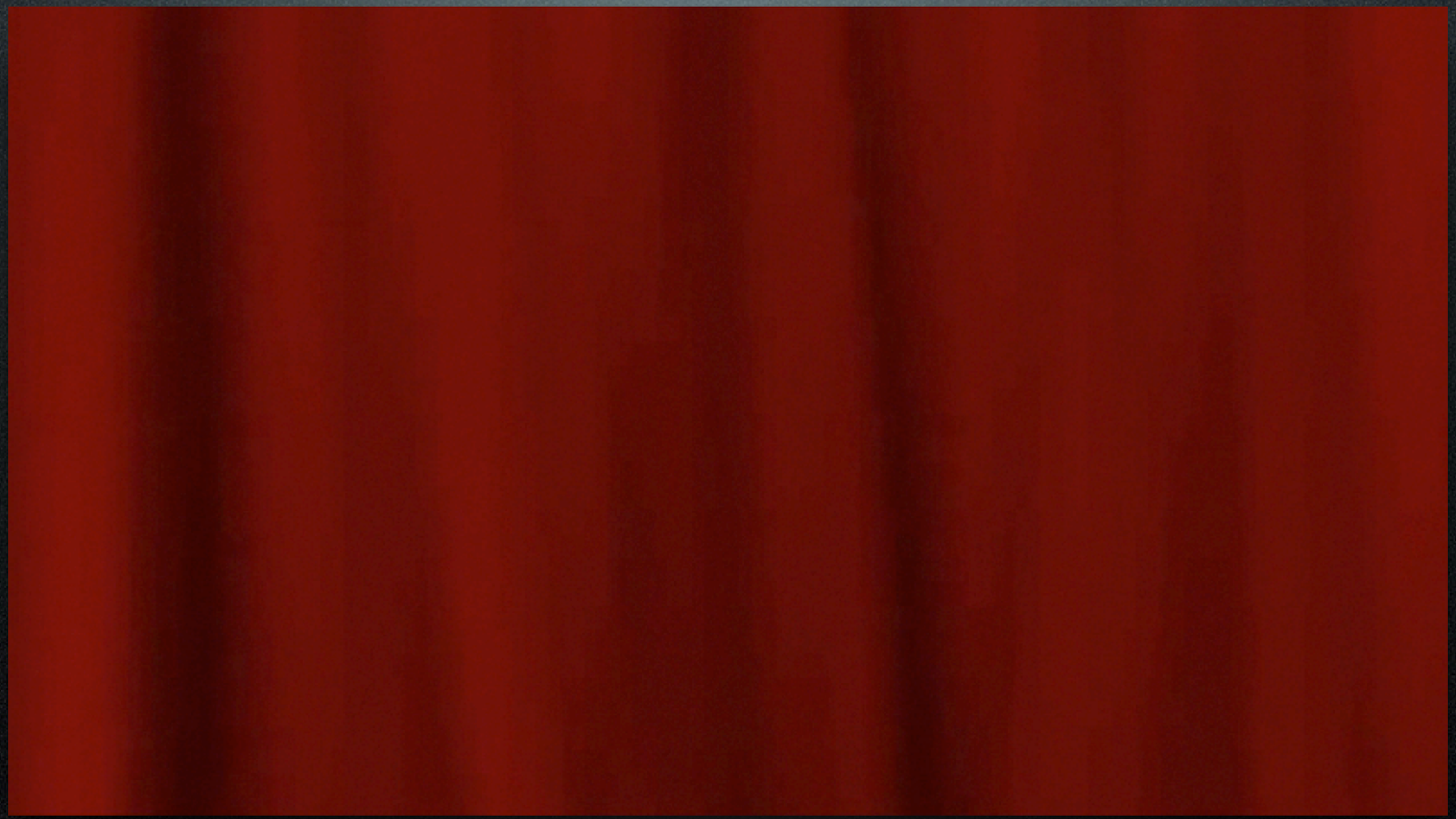


6th compartment erosion

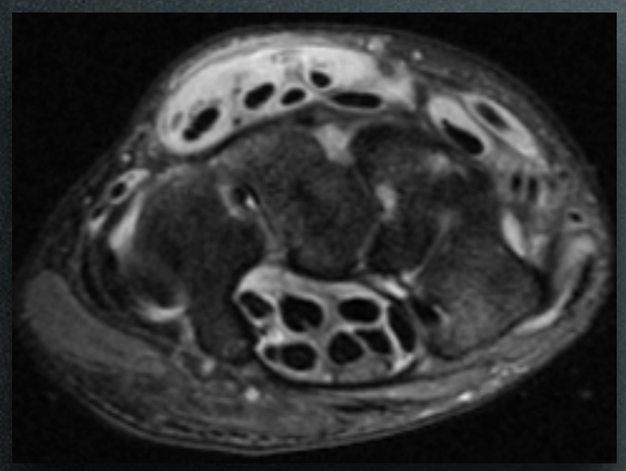
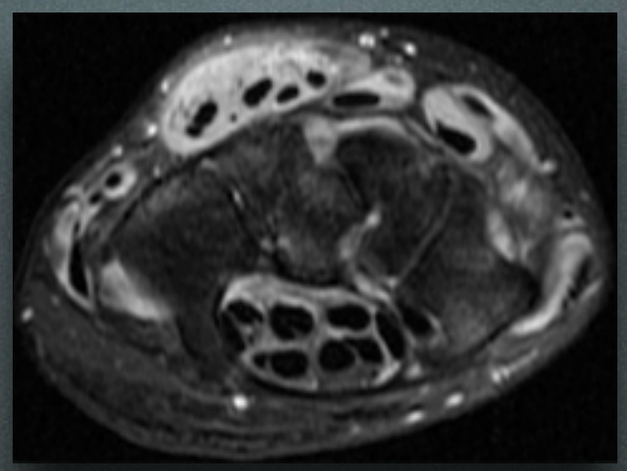
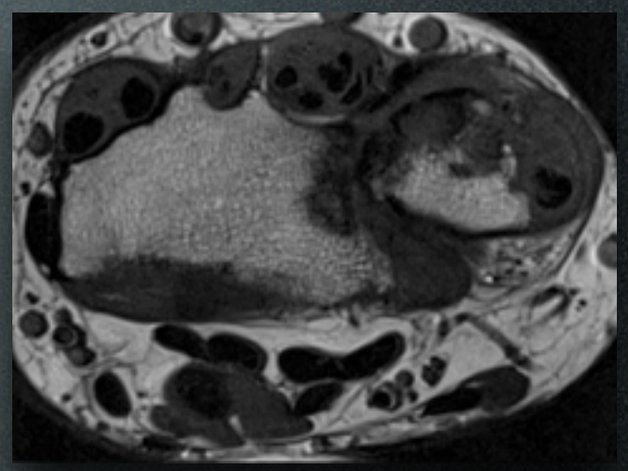
- Retinacular tear, subsheath tear, disruption of linea jugata
- Can result in instability of ECU tendon
- Subsequent erosion of the ulna
- Surgical repair with a flap derived from the extensor retinaculum

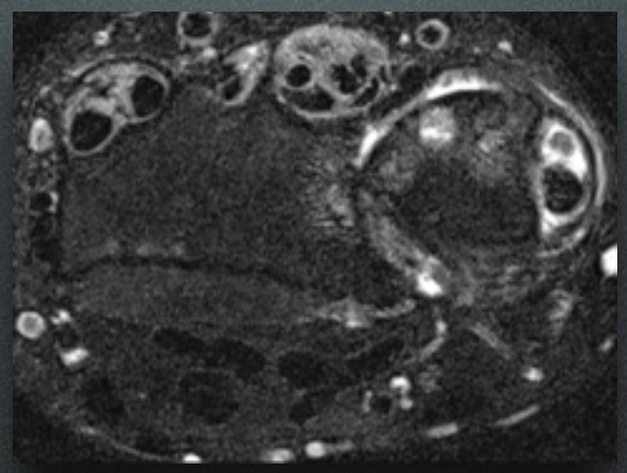
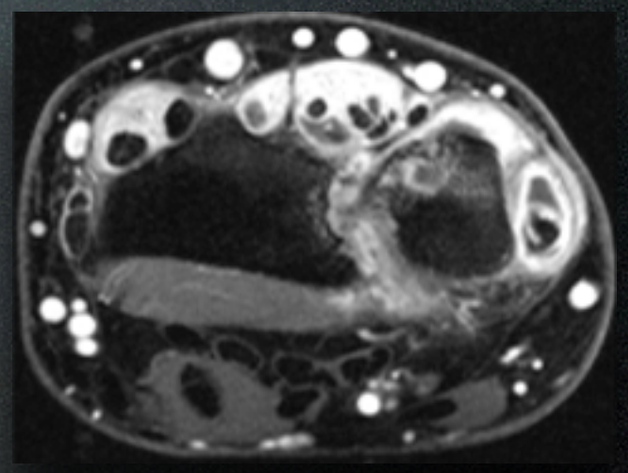


Carneiro et al, Am J Sports Med. 2005



Sectioning Step 6
Label Slices

Case courtesy of Karen Chen

25 yo female with dorsal multi-compartmental tenosynovitis inflammatory arthritis

Wrist Extensor Retinaculum

- Complex layered fascia which maintains extensor tendon function
- Two layers - Supratendinous and infratendinous
- Multiple septal attachments
  - Variable 6th septal attachment
- Dynamic structure which changes shape with dorsiflexion and may cause dorsal wrist impingement

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