WRIST ultrasonography

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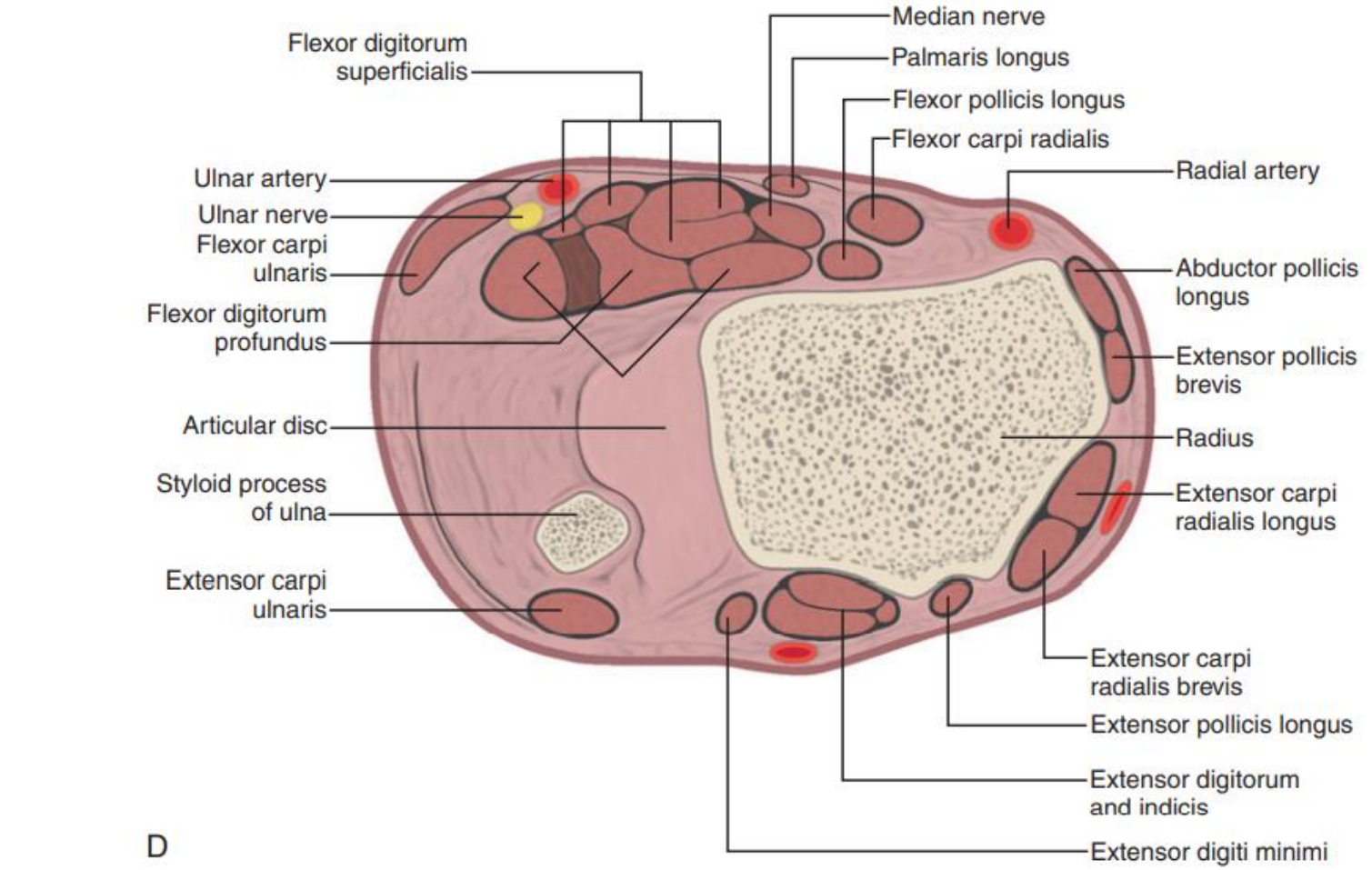
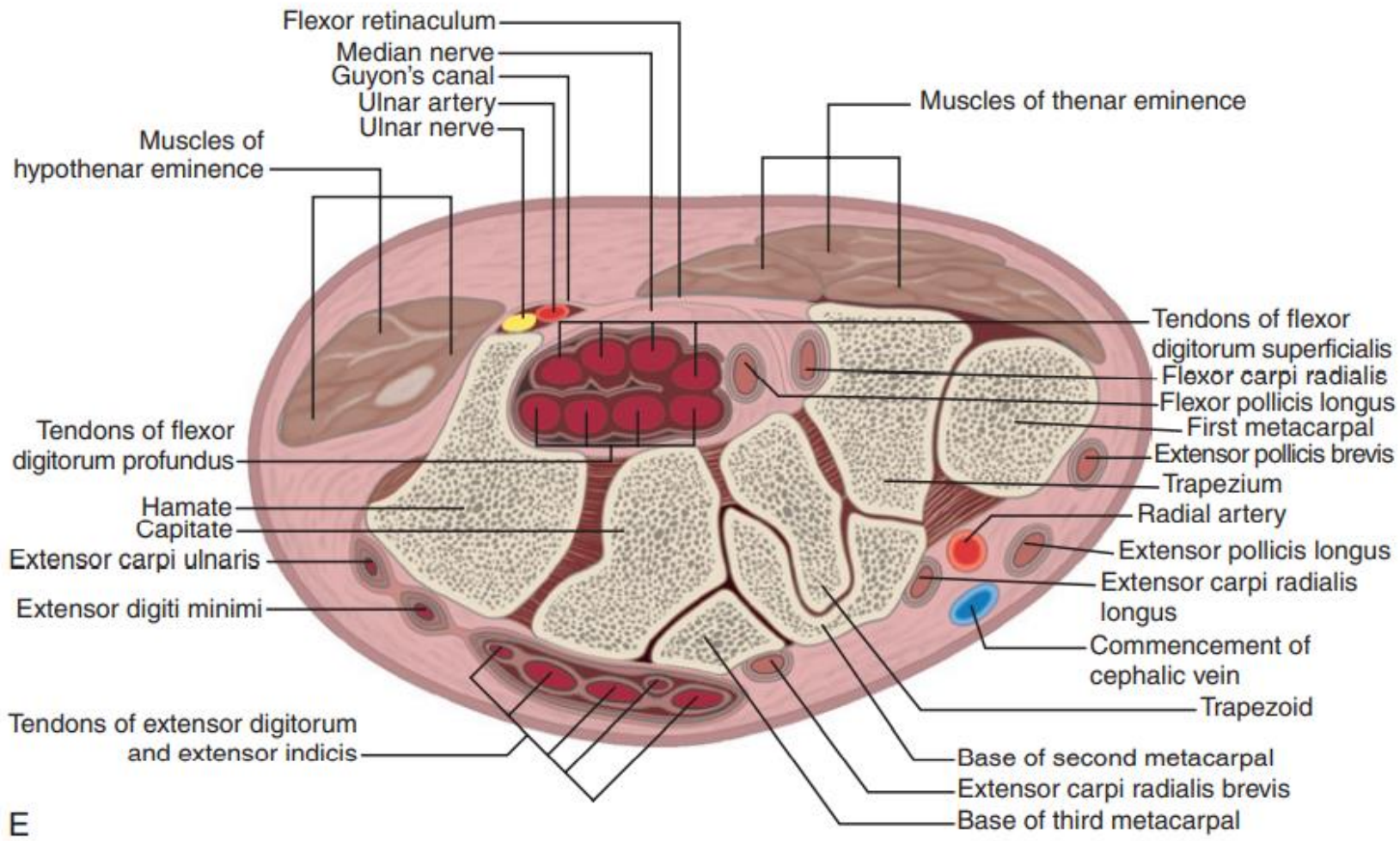
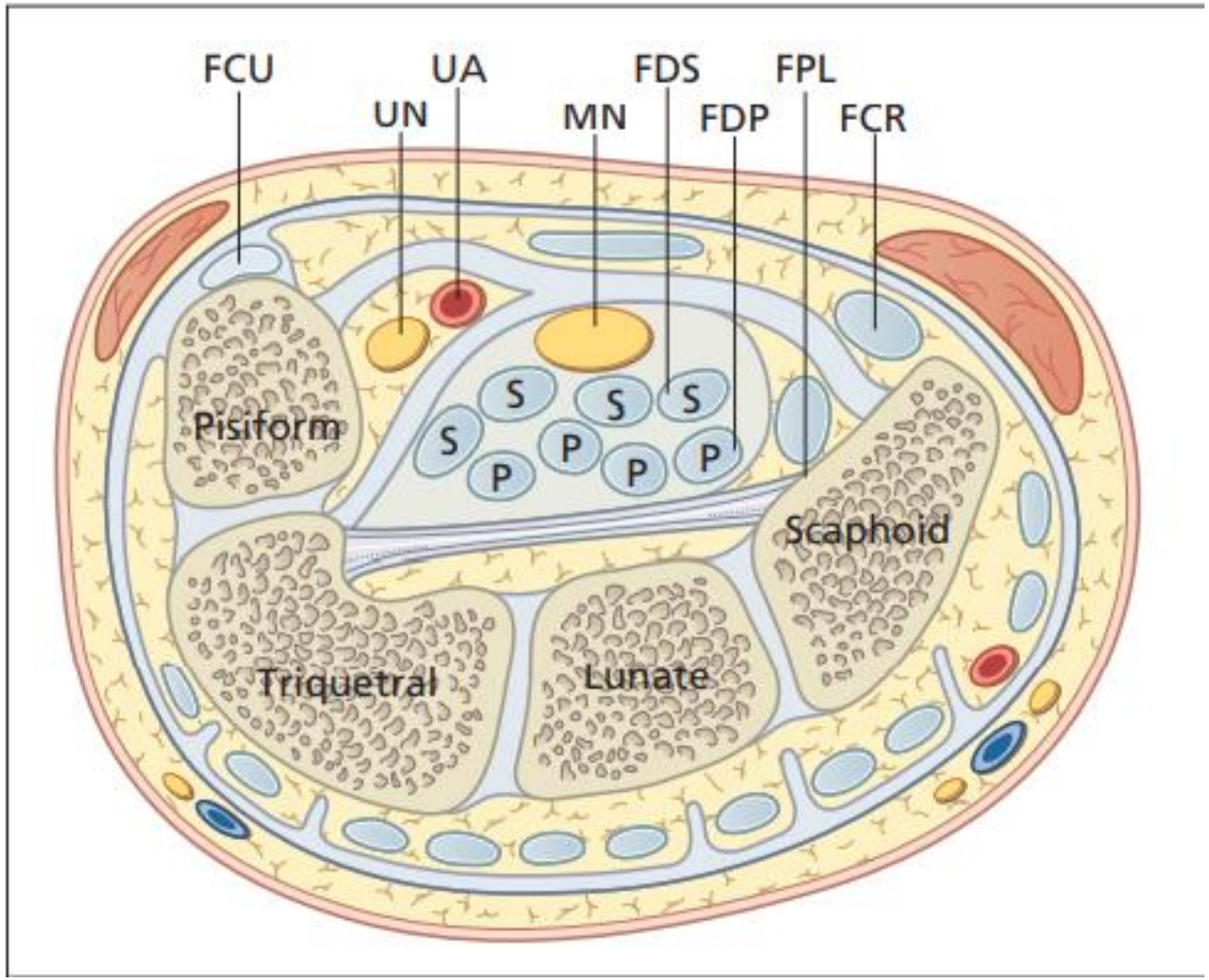
WRIST AND HAND ANATOMY



Transverse section in the level of Hamate bone




FCU
UA
FDS
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FDP
FCR
Pisiform
S
S
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P
Scaphoid
Triquetral
Lunate

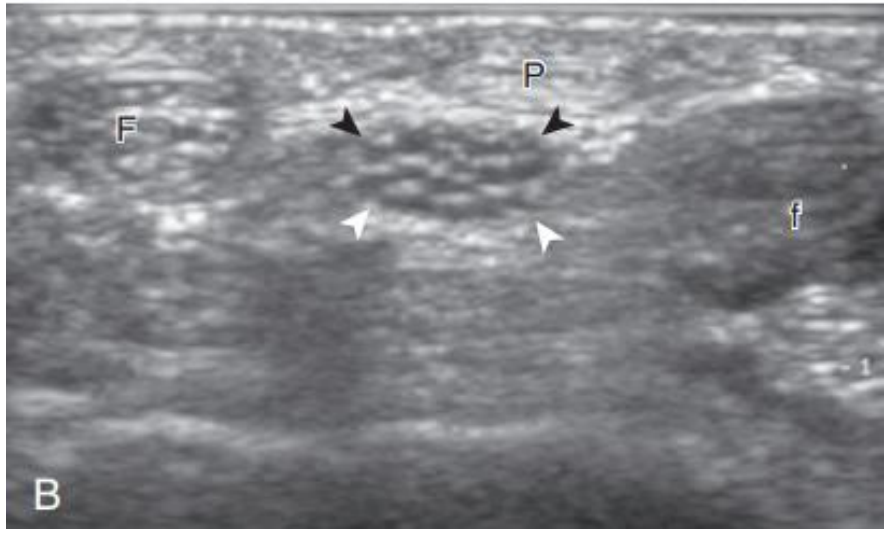
General comments

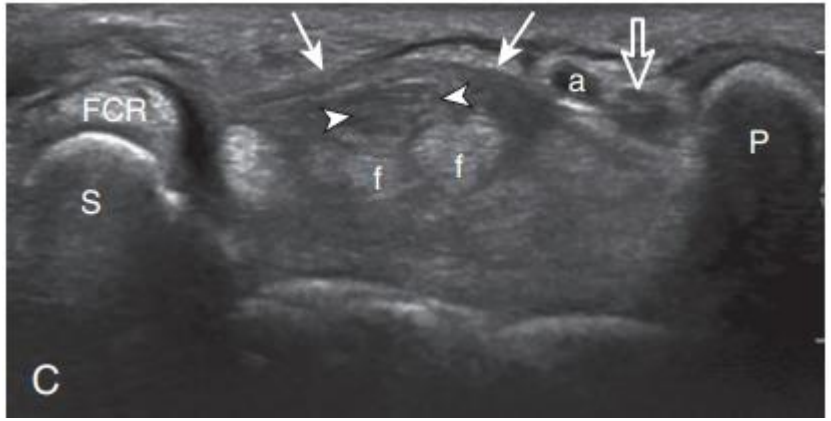
- with the patient sitting and the hand resting on the examination table
- This position allows easy comparison between each side if needed
- A high-frequency transducer of at least 10 MHz is typically used because most of the structures are superficial, and a transducer with a small footprint is often helpful to maintain contact with the soft tissues under examination
- the wrist and hand may be focused over the area that is clinically symptomatic or relevant to the patient's history. Regardless, a complete examination of all areas should always be considered for one to become familiar with normal anatomy and normal variants and to develop an efficient and comprehensive sonographic technique.

TABLE 5.1 Wrist and Hand Ultrasound Examination Checklist

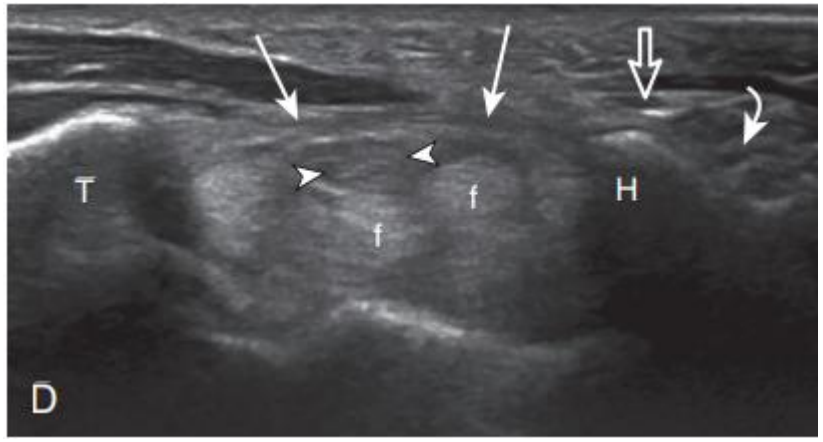
Location	Structures of Interest/ Pathologic Features
Volar (1)	Median nerve
	Flexor tendons
	Volar joint recesses
Volar (2)	Scaphoid
	Flexor carpi radialis
	Radial artery
	Volar ganglion cyst
Volar (3)	Ulnar nerve and artery
Dorsal (1)	Extensor tendons
	Dorsal joint recesses
Dorsal (2)	Scapholunate ligament
	Dorsal ganglion cyst
Dorsal (3)	Triangular fibrocartilage complex

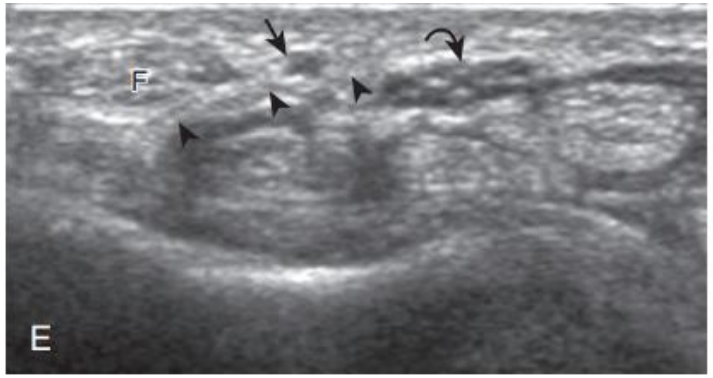
volar evaluation

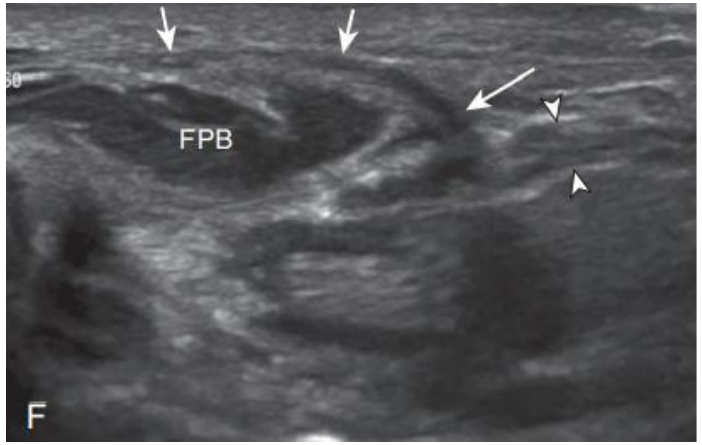




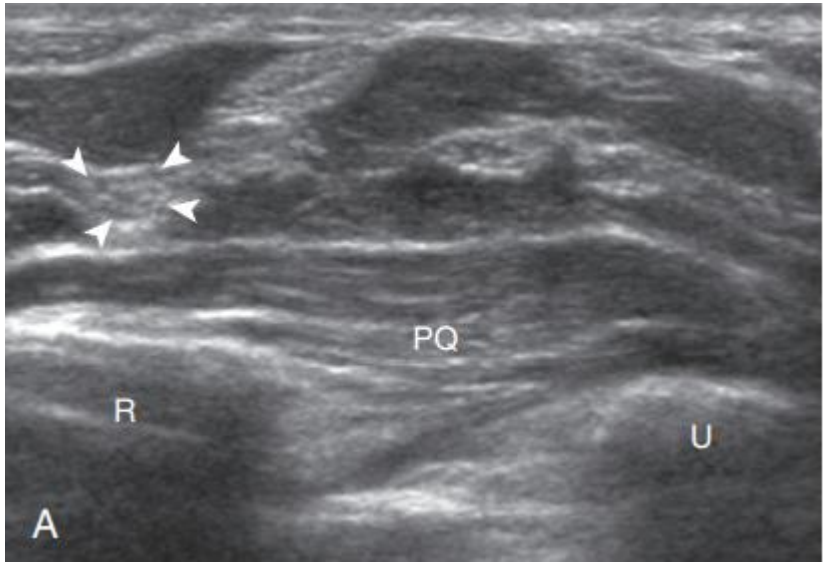
- flexor carpi radialis (F), palmaris longus (P), flexor digitorum tendons (f). Transverse imaging (C) at proximal carpal tunnel shows flexor retinaculum (arrows) and bone landmarks of scaphoid (S) and pisiform (P).

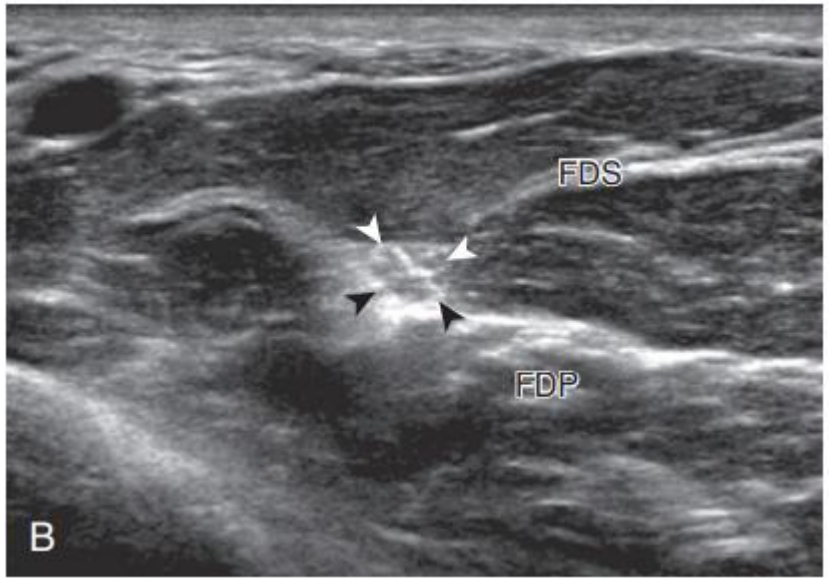




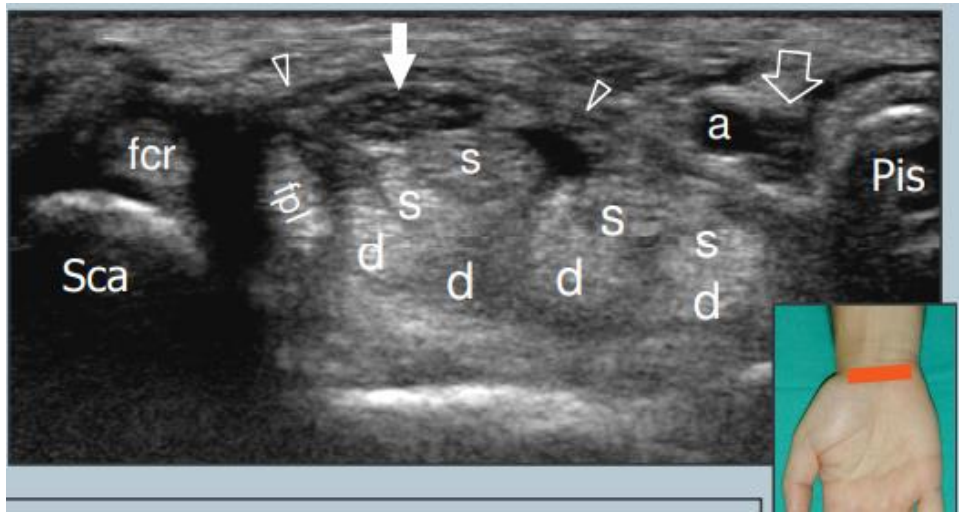


- Transverse imaging at distal carpal tunnel shows flexor retinaculum (arrows) and bone landmarks of trapezium (T) and hamate hook (H). Also note ulnar nerve (open arrow) distal (D) superficial branch (open arrow) and deep branch (curved arrow). Transverse imaging proximal at wrist crease (E) shows the palmar cutaneous branch (arrow) of the median nerve (curved arrow) superficial to the flexor retinaculum (arrowheads). Sagittal-oblique imaging a distal carpal tunnel (F) shows thenar motor branch (arrows) of median nerve (arrowheads) coursing proximal into thenar musculature.





- Sequential transverse ultrasound images (A and B) moving proximal to the volar wrist crease show that the median nerve (arrowheads) moves deep between the flexor digitorum profundus (FDP) and flexor digitorum superficialis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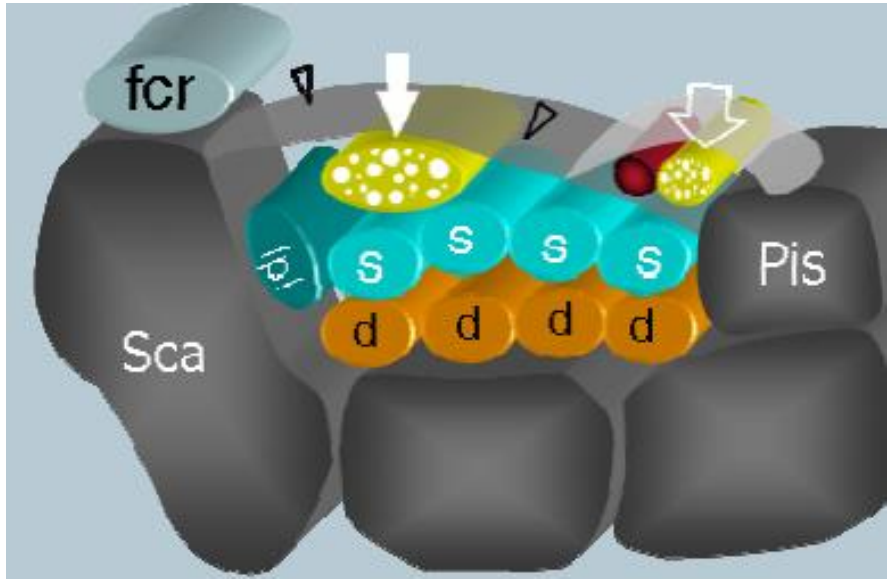
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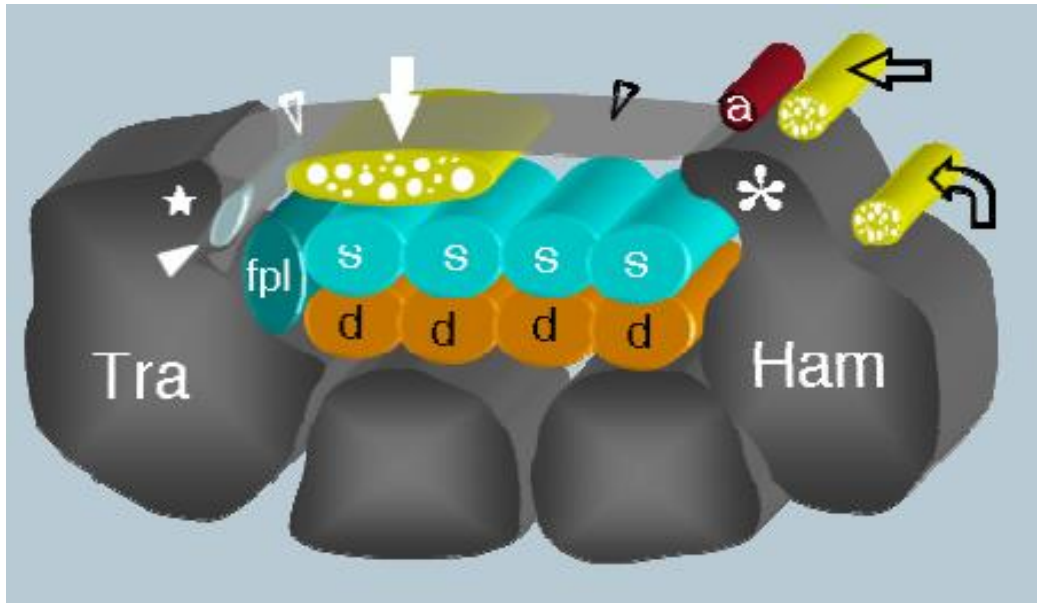
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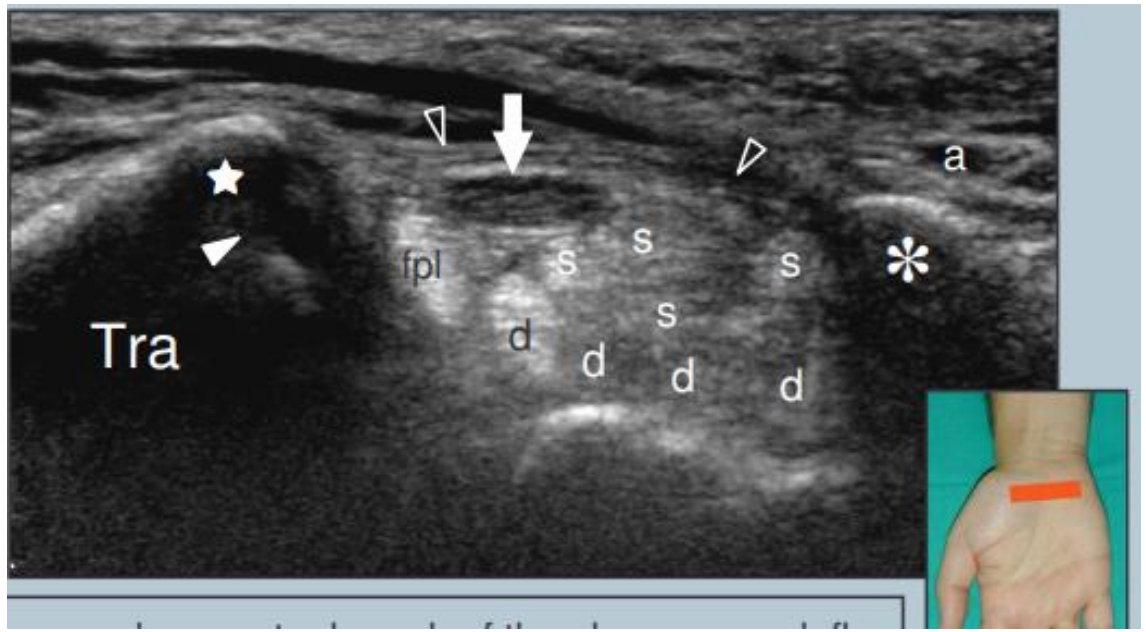
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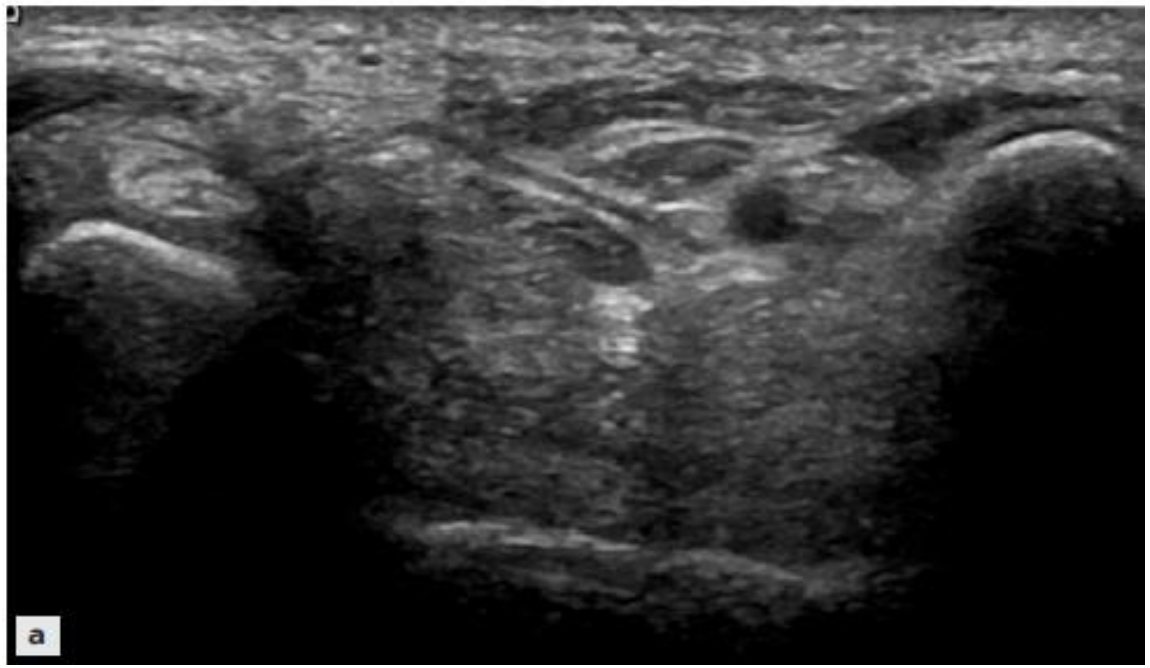
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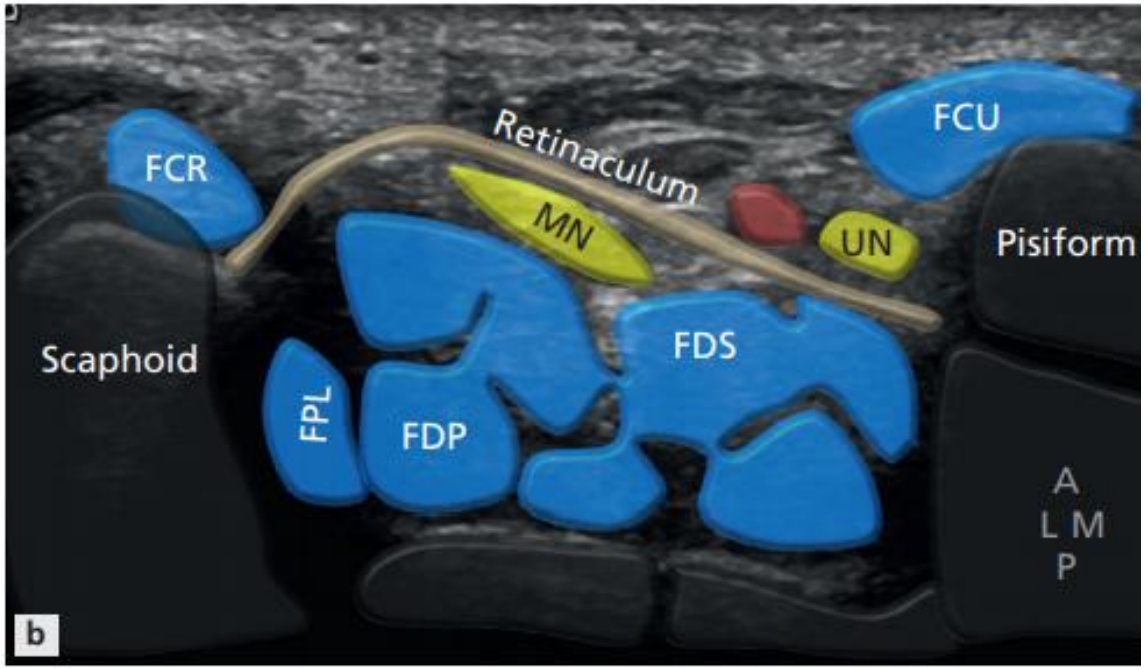
FCR
Retinaculum
FCU
MN
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Pisiform
Scaphoid
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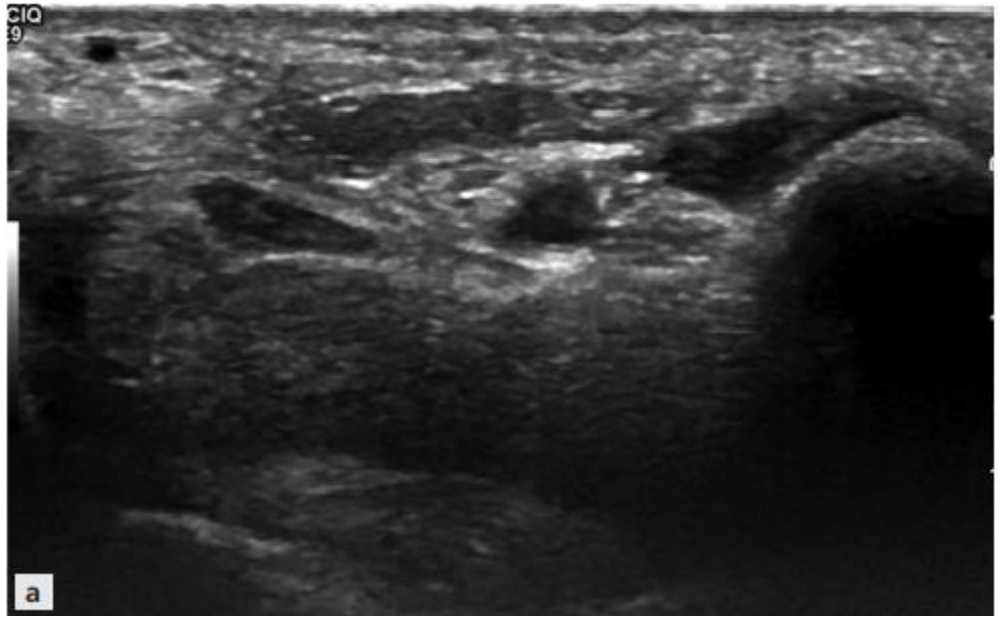
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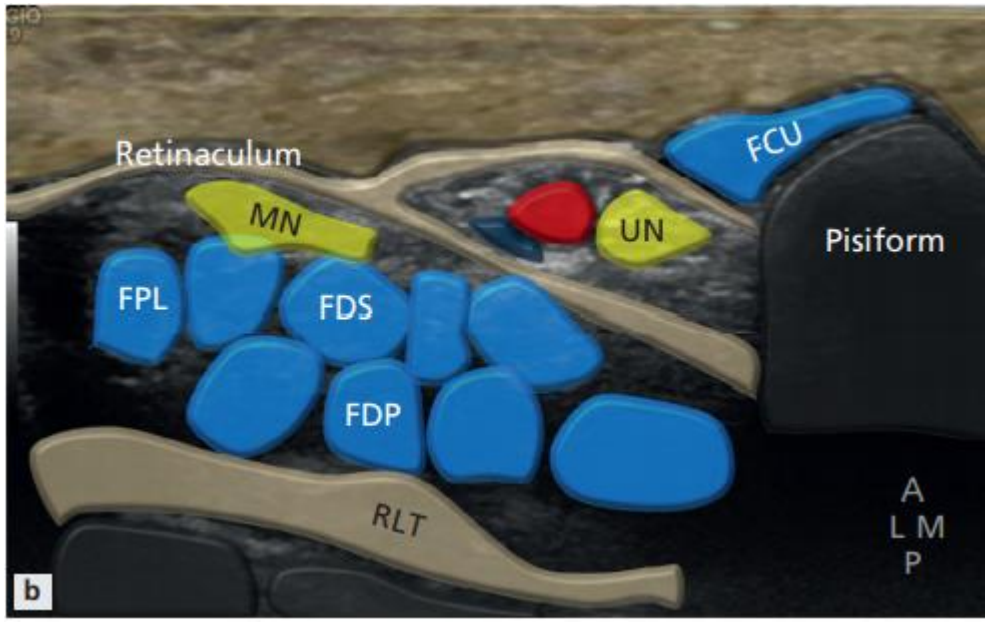
Retinaculum
MN
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FCU
Pisiform
FPL
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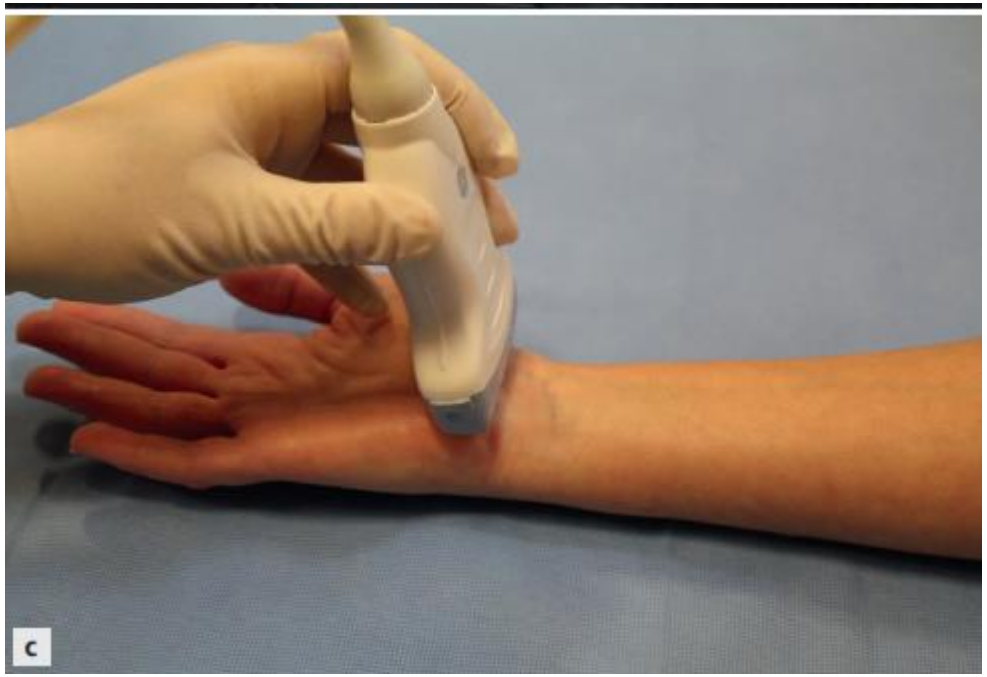
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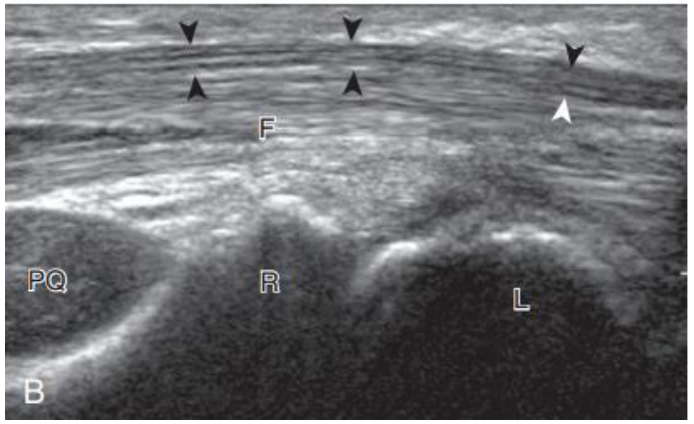
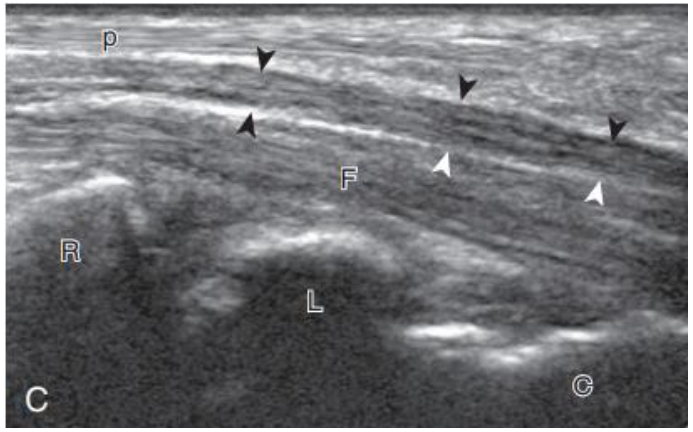
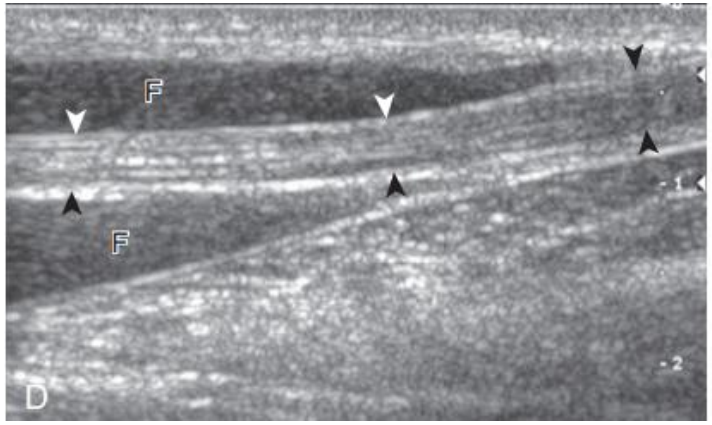
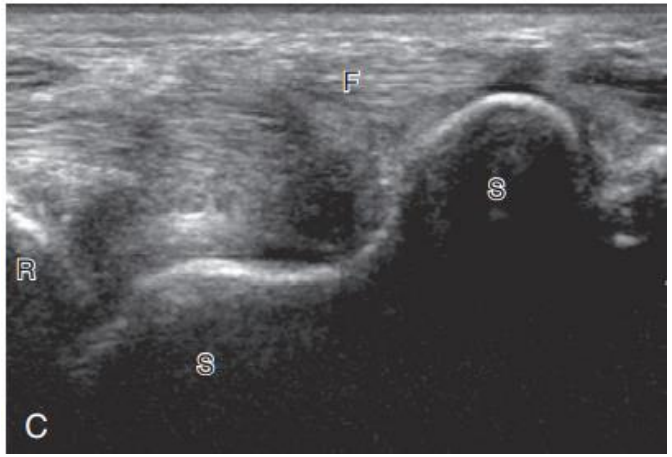




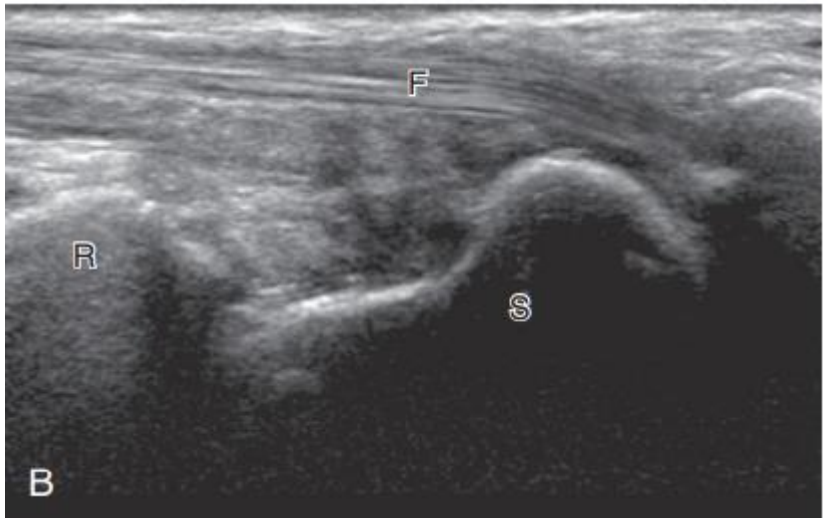


- A, Sagittal imaging over the volar wrist crease shows (B to D) the median nerve (arrowheads), flexor digitorum (F), palmaris longus (p), pronator quadratus (PQ), radius (R), lunate (L), and capitate (C). Note the median nerve proximal to the wrist crease in D, which appears relatively hyperechoic proximally and hypoechoic distally (left side of image is proximal).

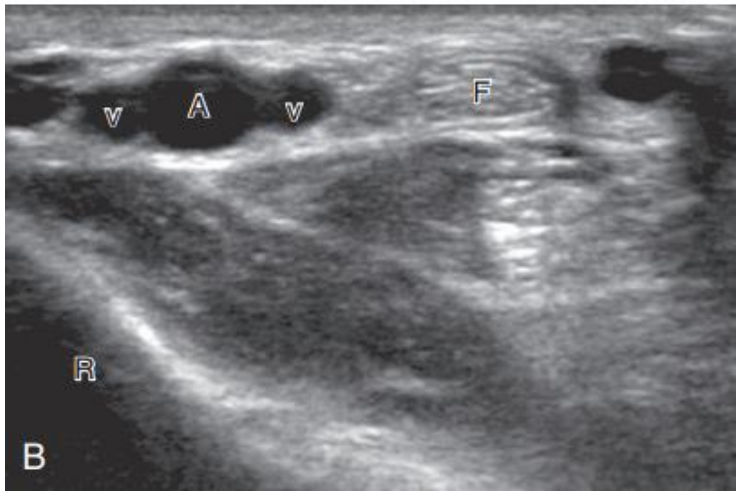
Volar Radial Wrist Evaluation (Longitudinal)



, Sagittal-oblique imaging over the thumb base show the flexor carpi radialis tendon (F) and scaphoid (S)R, Radius.



Volar Radial Wrist Evaluation (Transverse)



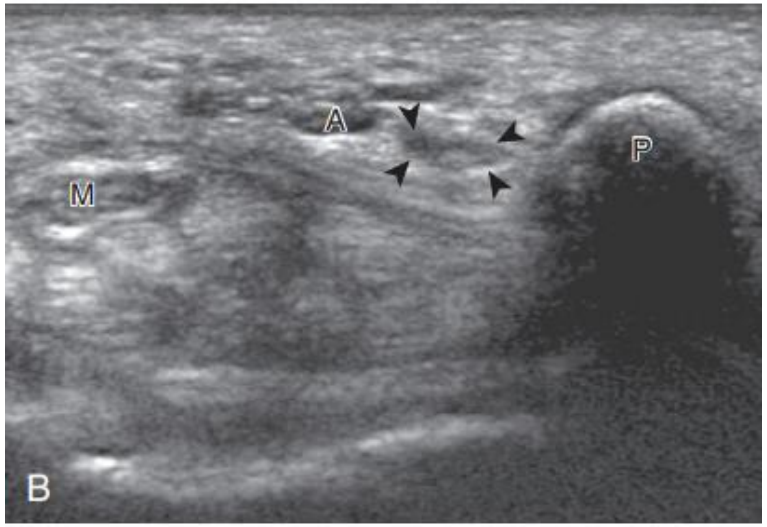
- Transverse imaging shows (B) the flexor carpi radialis tendon (F), radial artery (A), and veins (v).

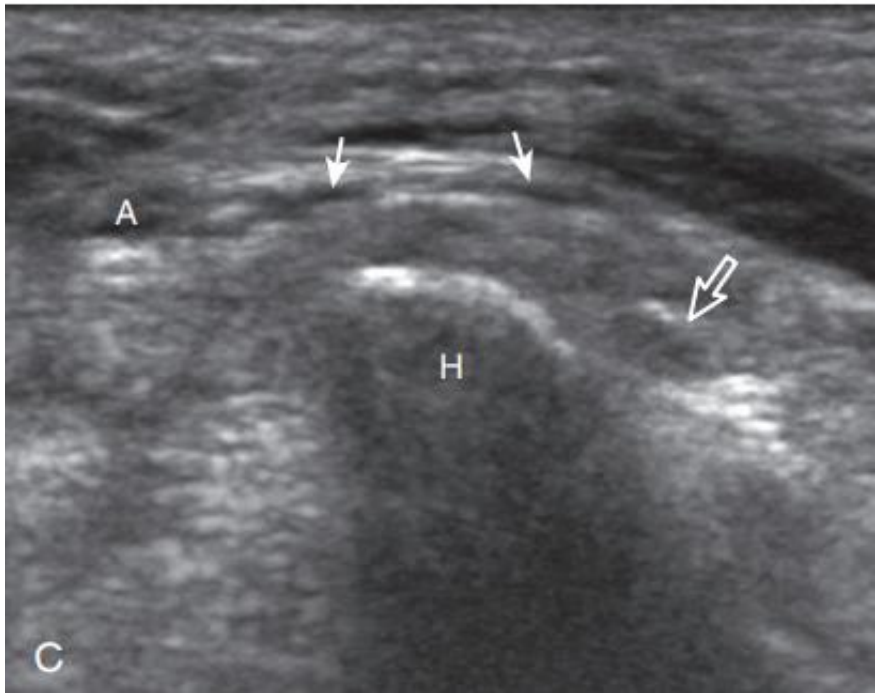
- With the flexor carpi radialis tendon and radial artery in view, the transducer is moved both proximally and distally from the radiocarpal joint to evaluate for ganglion cysts
- Placement of the transducer in the transverse plane between the scaphoid and lunate will show the normal hyperechoic and fibrillar volar component of the scapholunate ligament

Scapholunate ligament

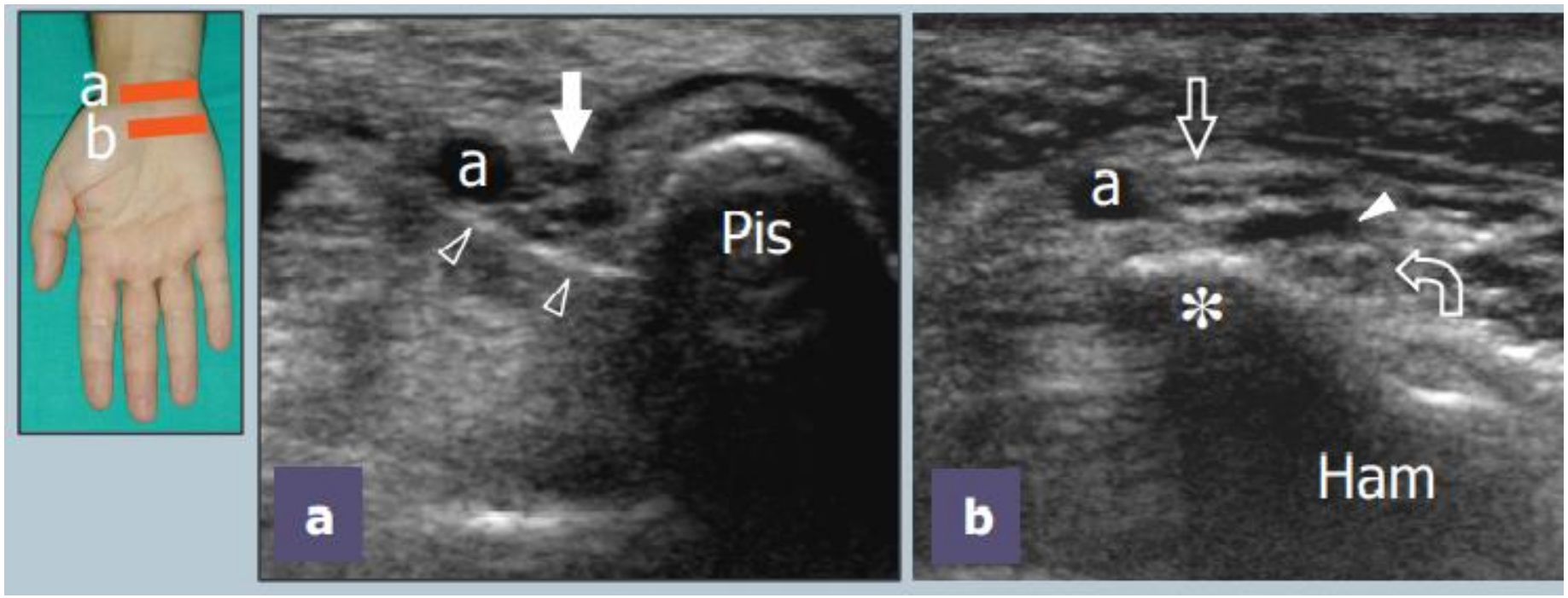
- The scapholunate ligament is “U” shaped in the sagittal plane, with the open end of the U distal, and it consists of a volar portion, a thin proximal or central portion, and a thick and mechanically important dorsal portion

Guyon Canal Evaluation (Transverse)

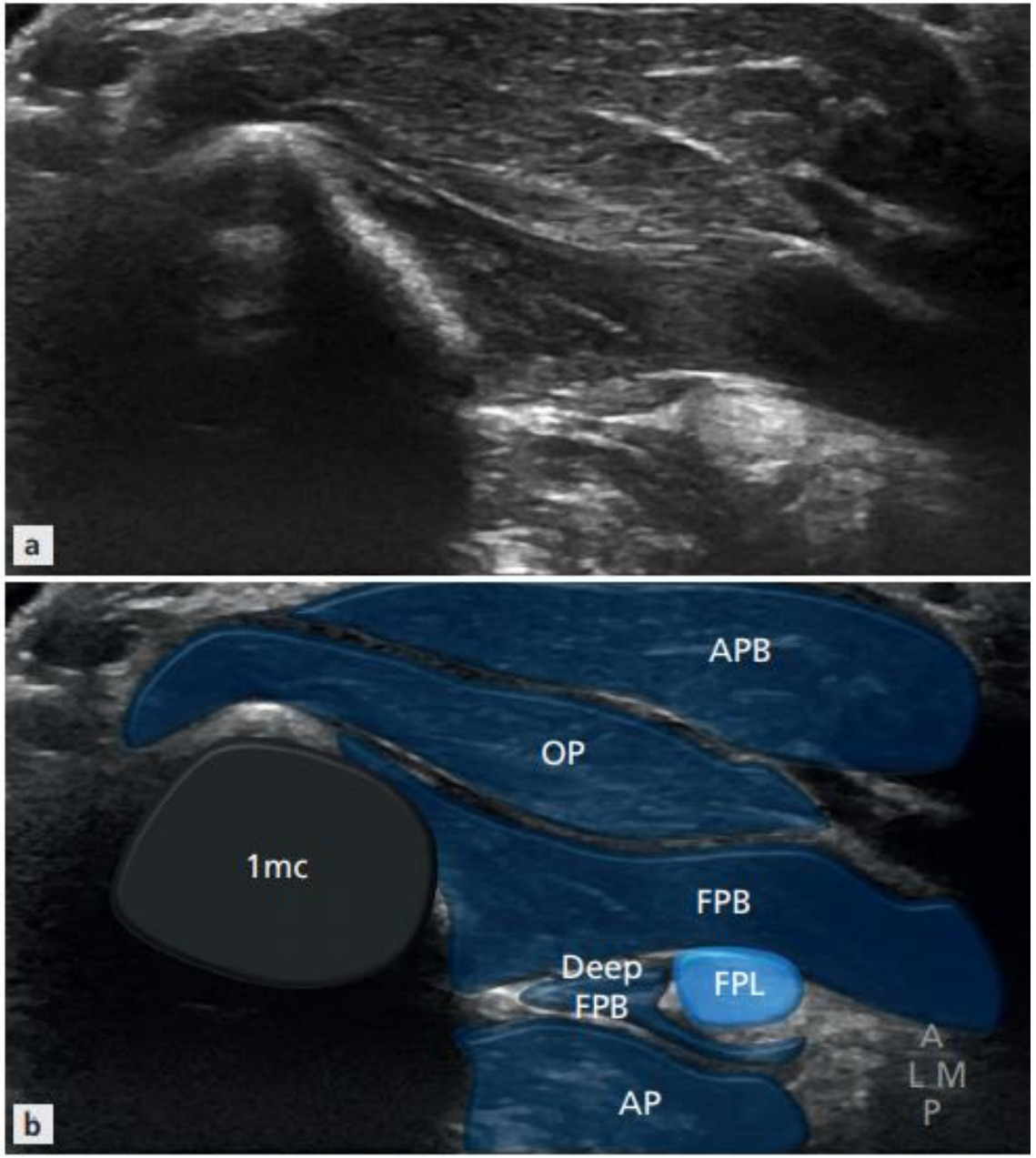




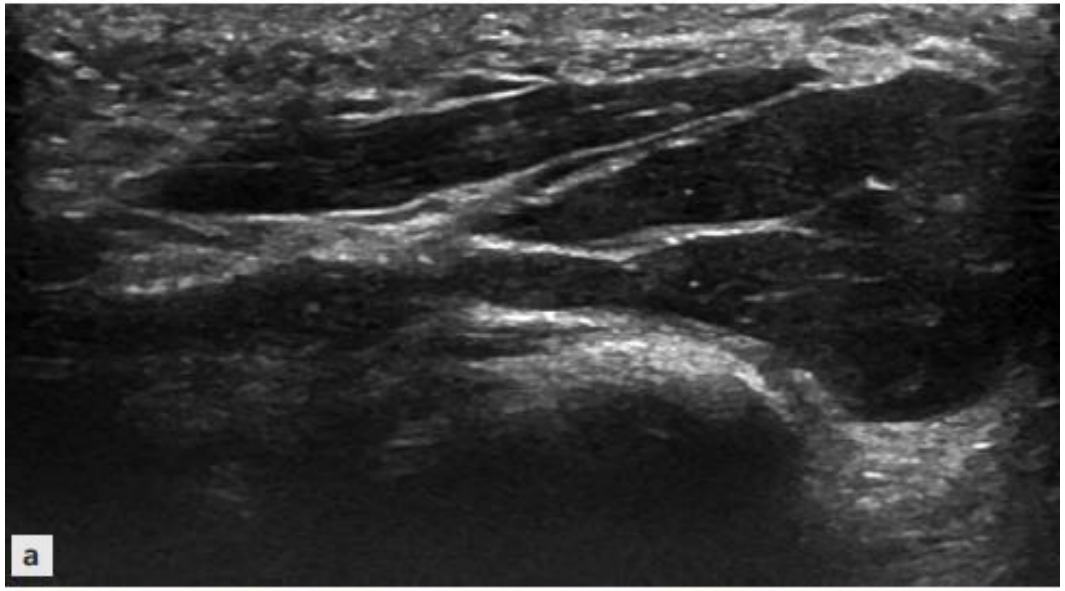
- As the transducer is moved distally, the hyperechoic and shadowing surface of the hook of the hamate is seen deep to the ulnar nerve and artery. The ulnar nerve branches, with a deep motor branch coursing along the ulnar side of the hamate hook and one to two predominantly sensory branches superficial to the hamate hook

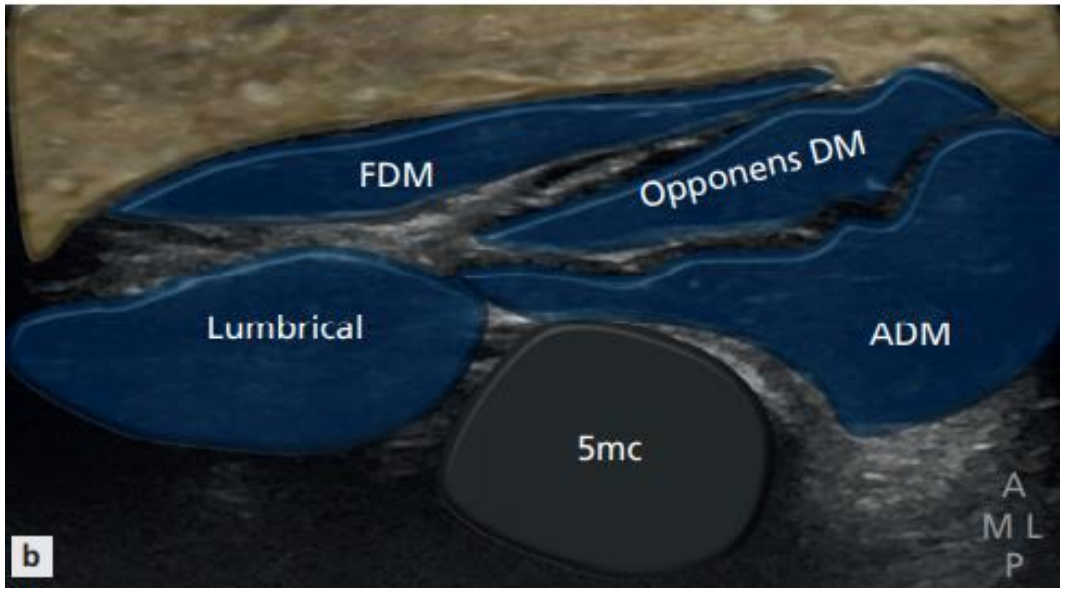

a
b
a
Pis
a
a
Ham
b

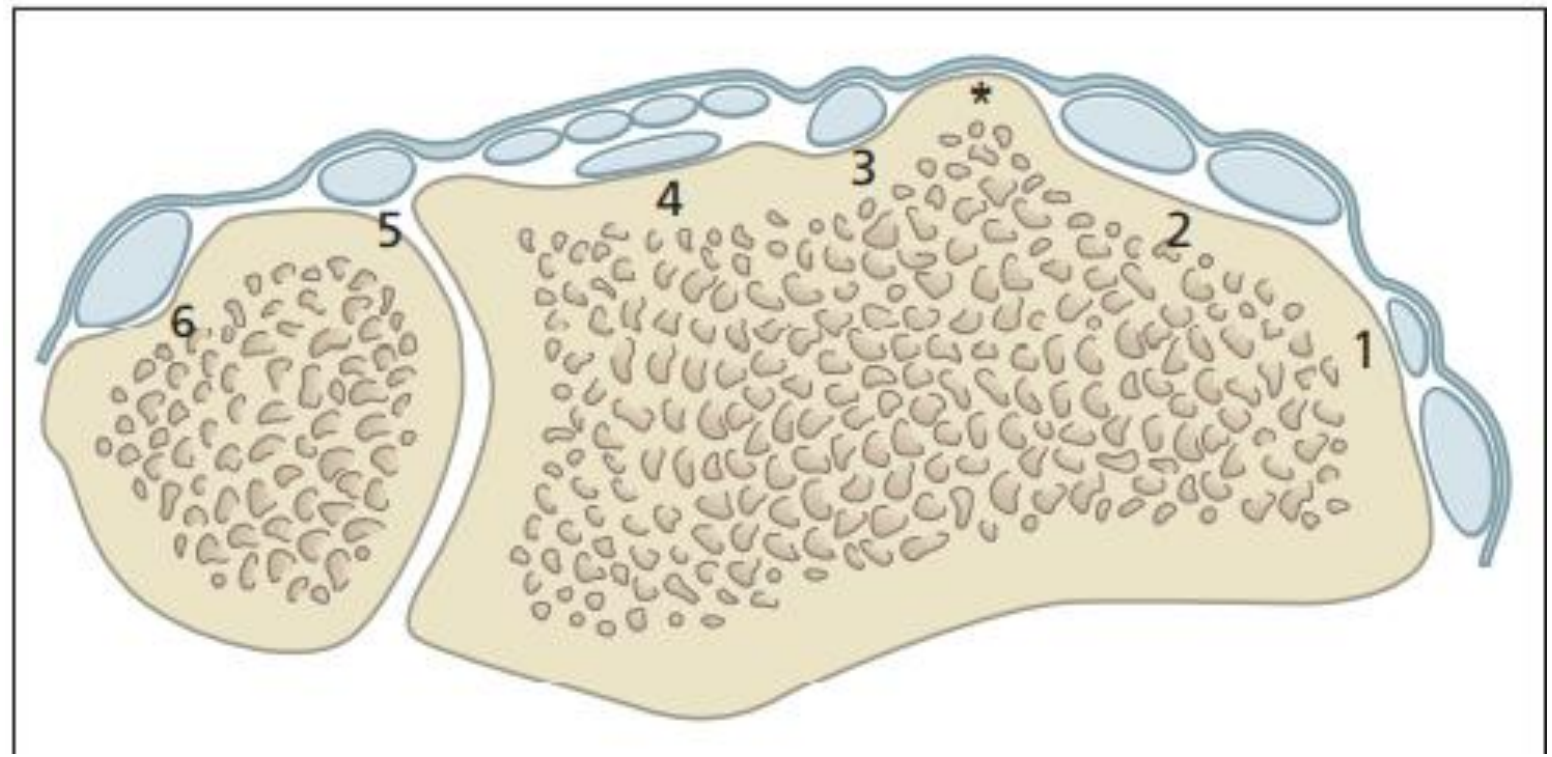
Axial? anatomy of the thenar eminence.



Axial? anatomy of the hypothenar eminence.



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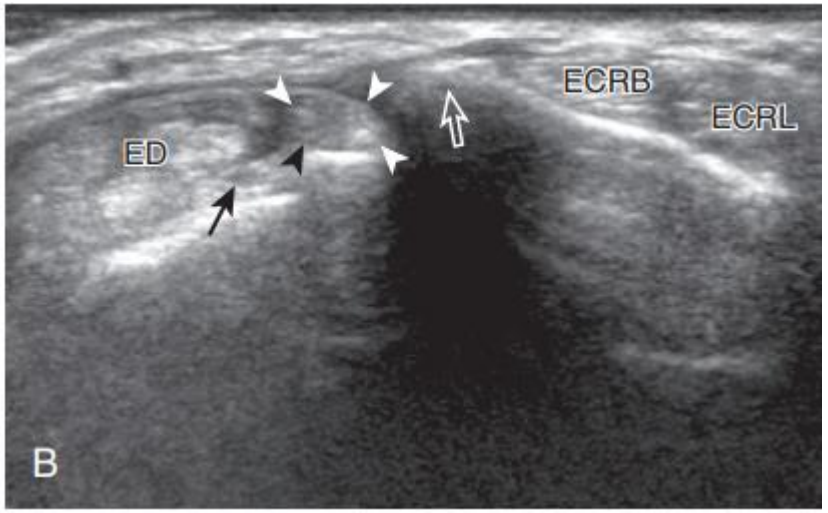
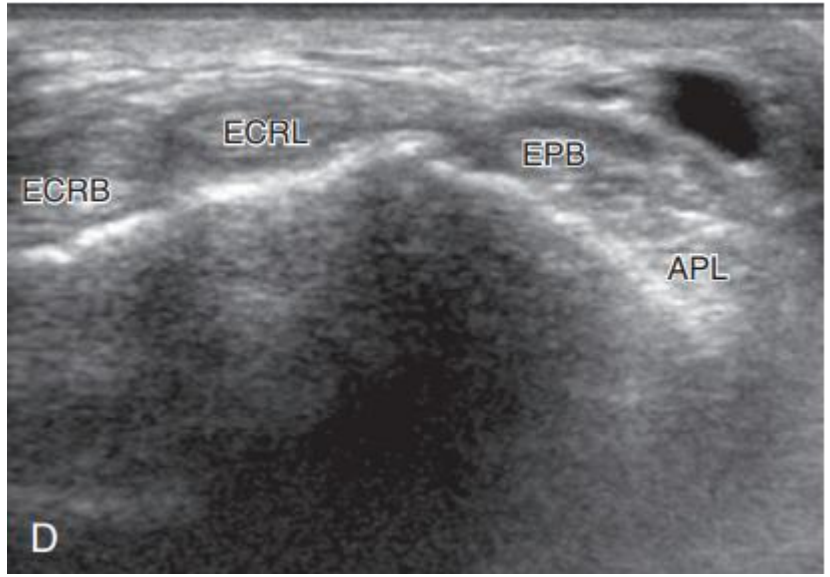
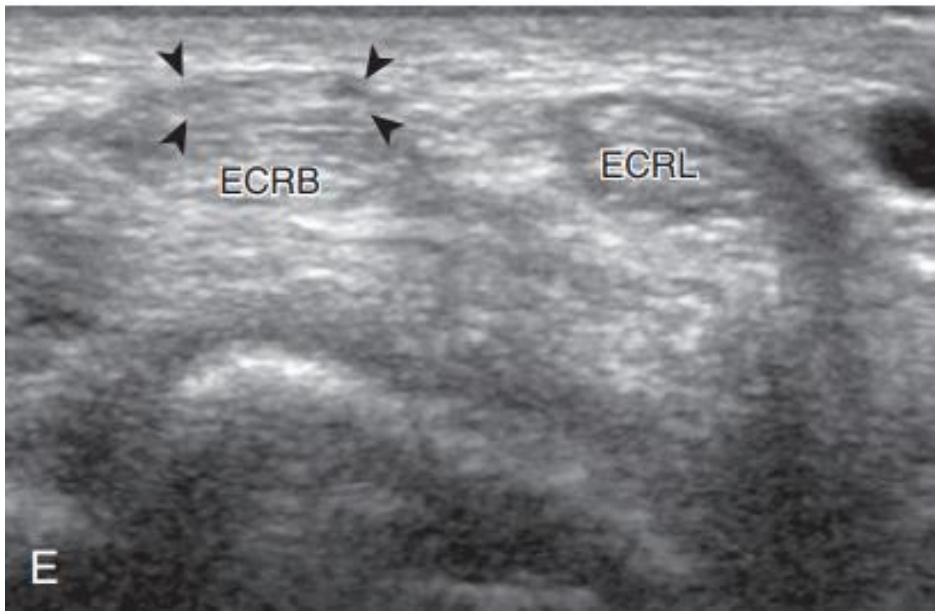
Dorsal Wrist Evaluation (Extensor Compartments 1 to 3) AXIAL






ECRB
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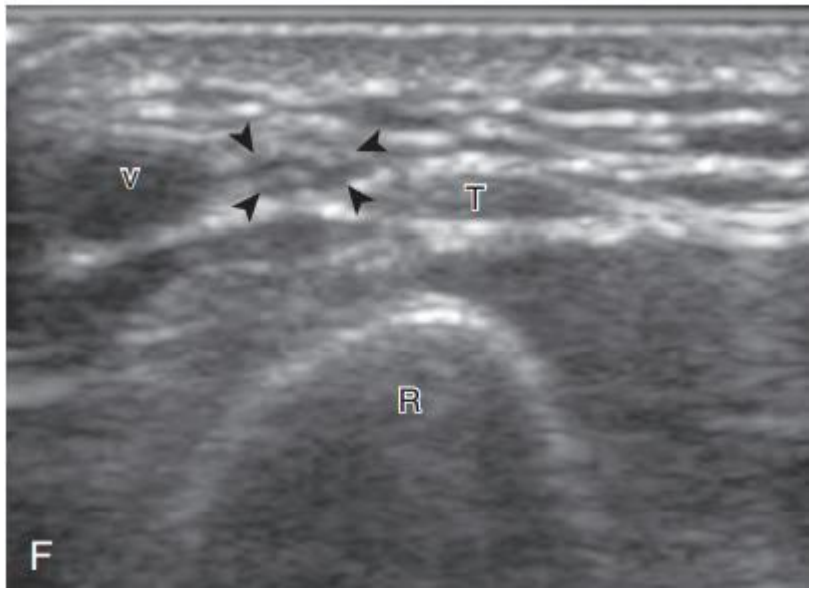
V
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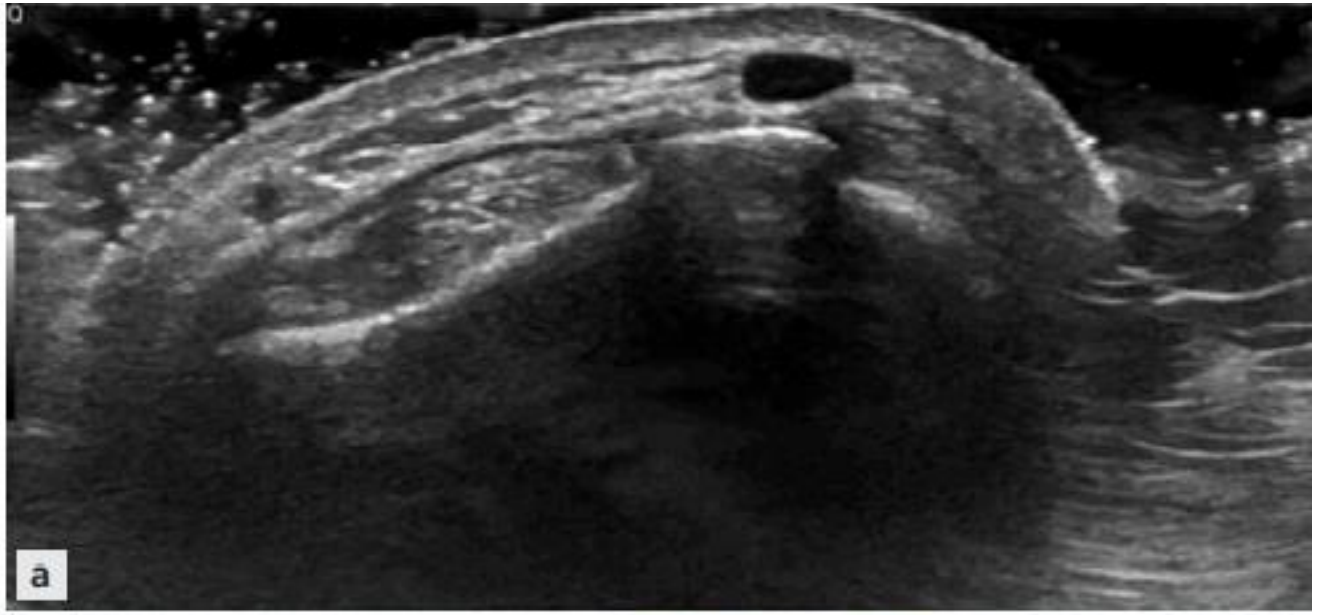
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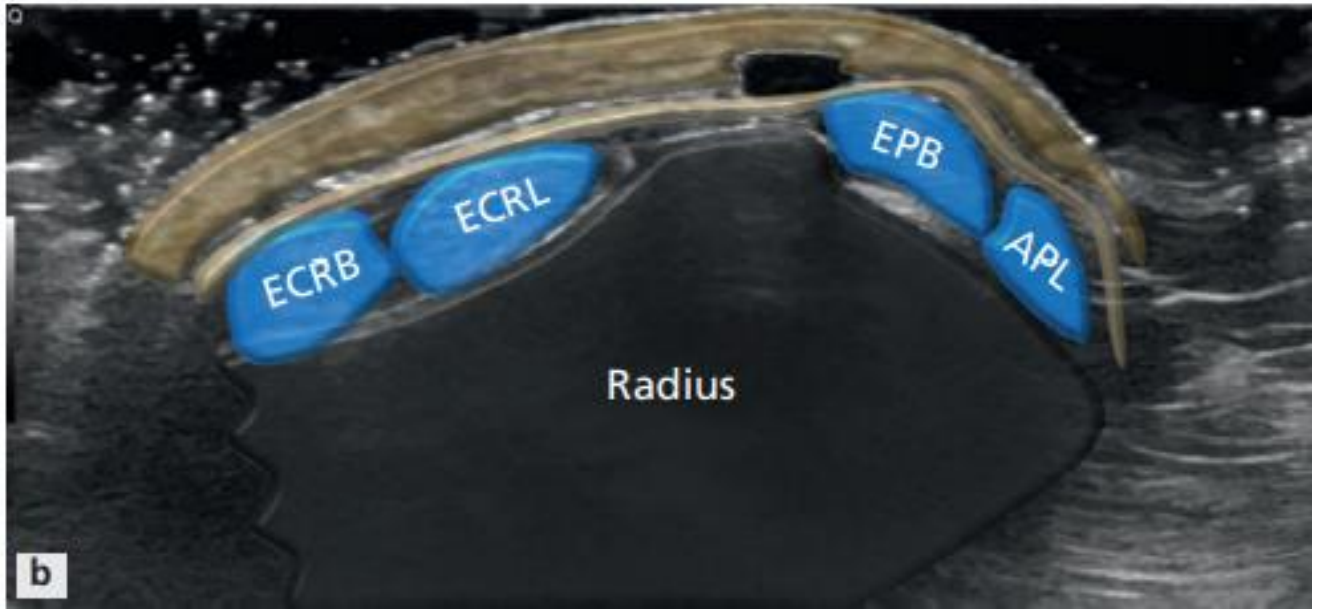
ECRB
ECRL
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Radius
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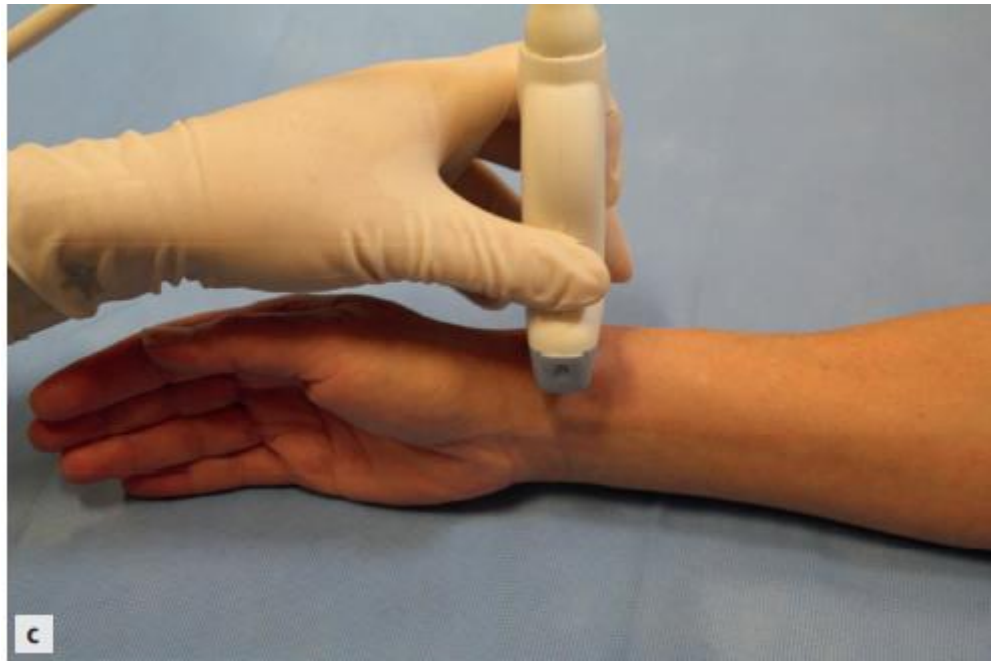
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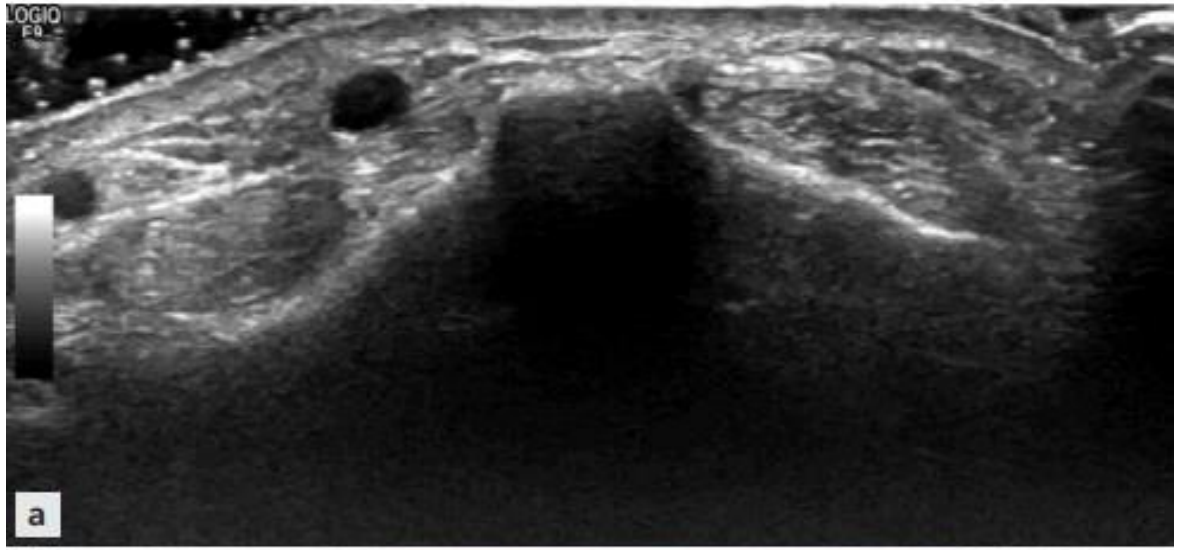
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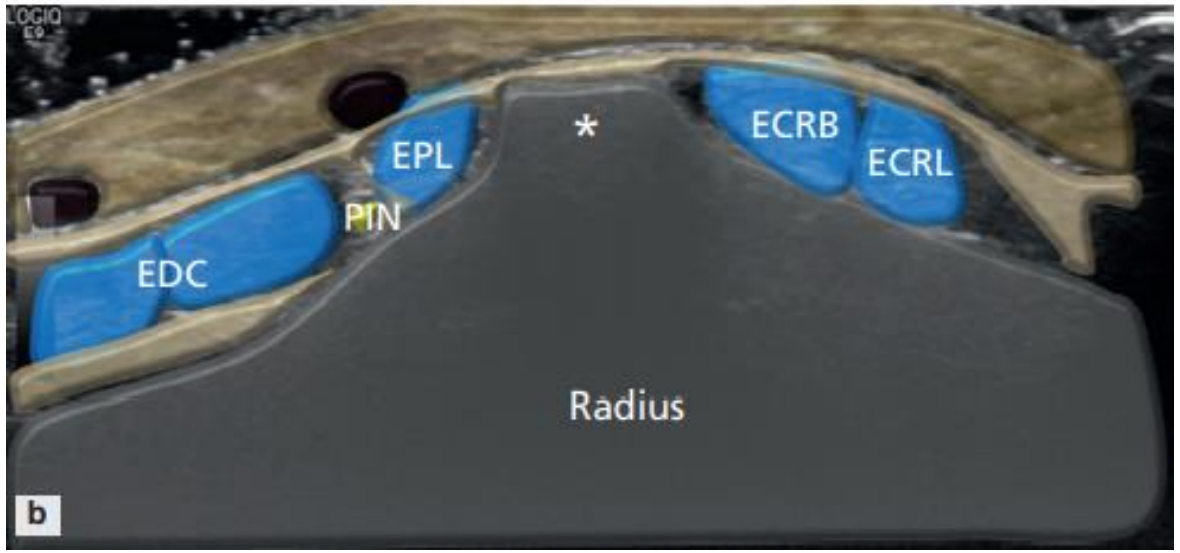
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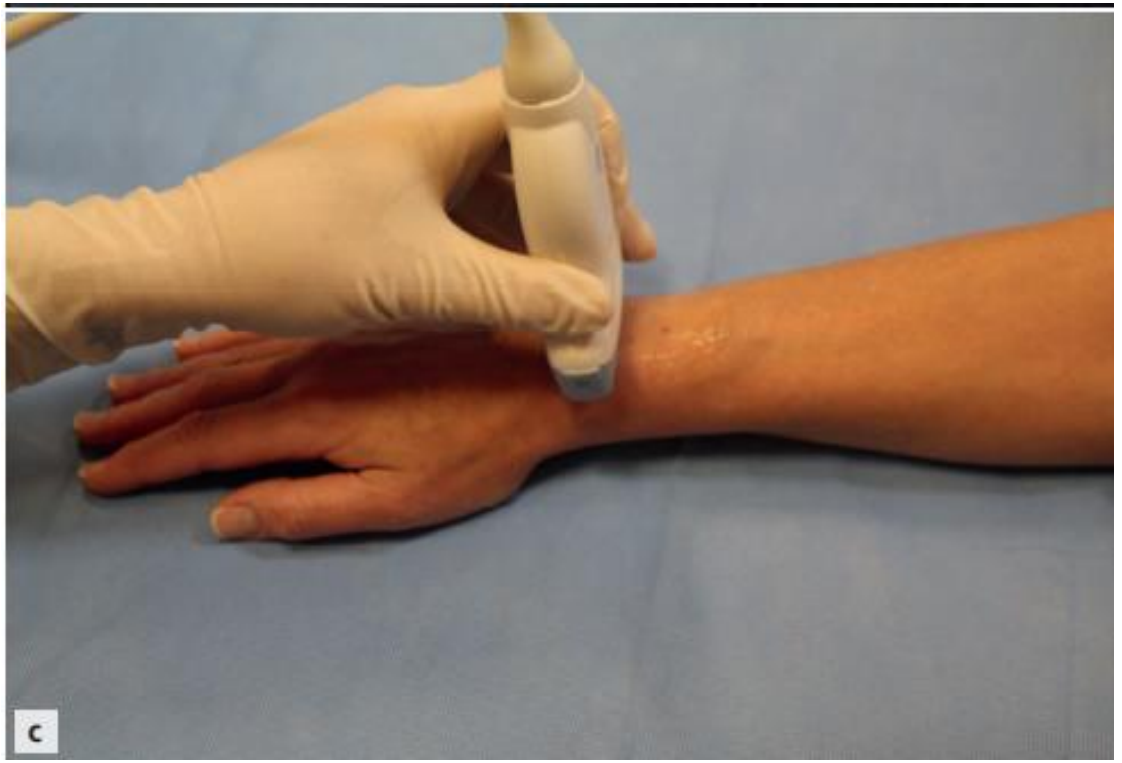
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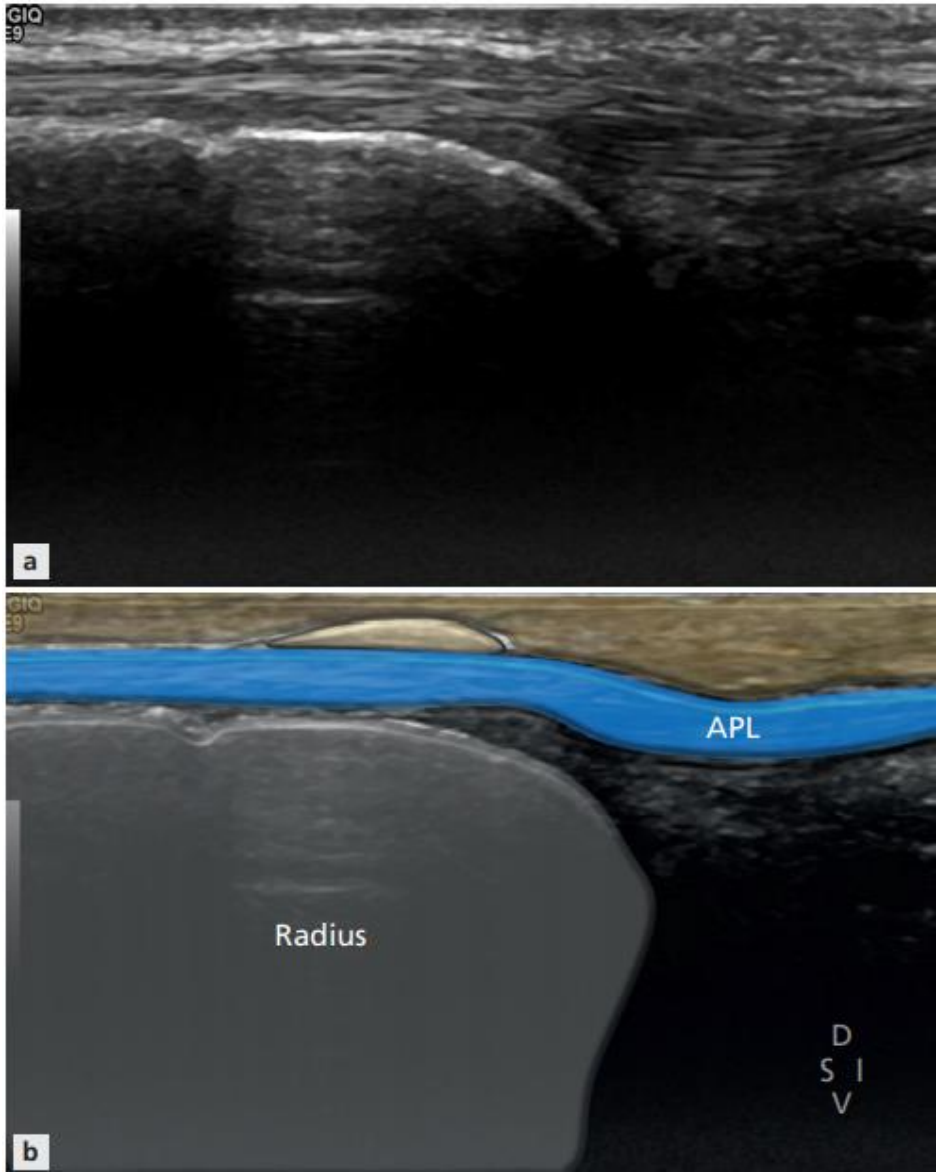
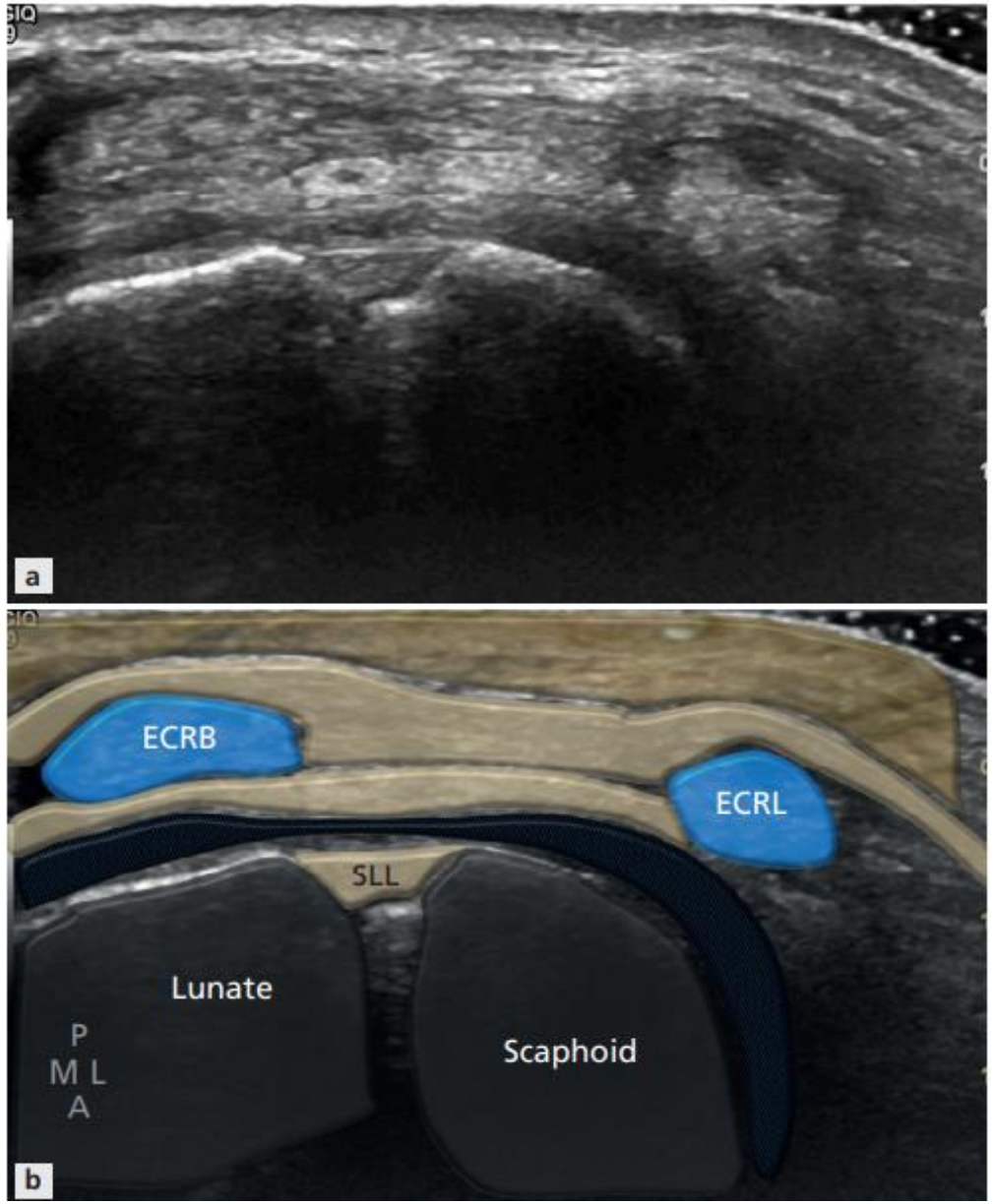
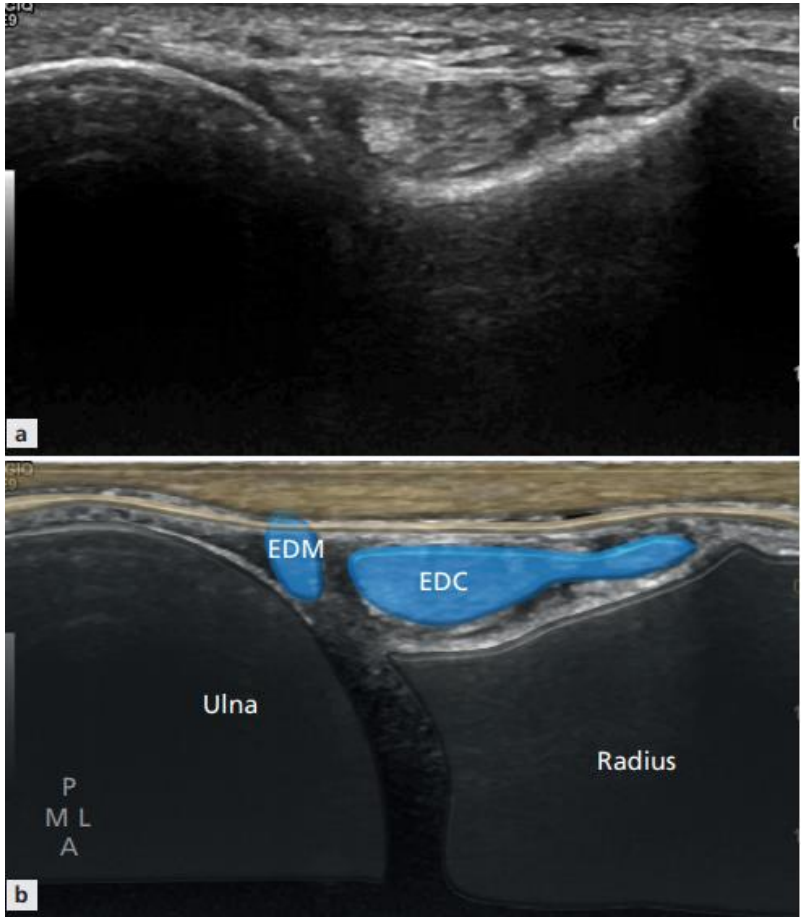
Long axis image of EC1 with the thin extensor retinaculum above it.



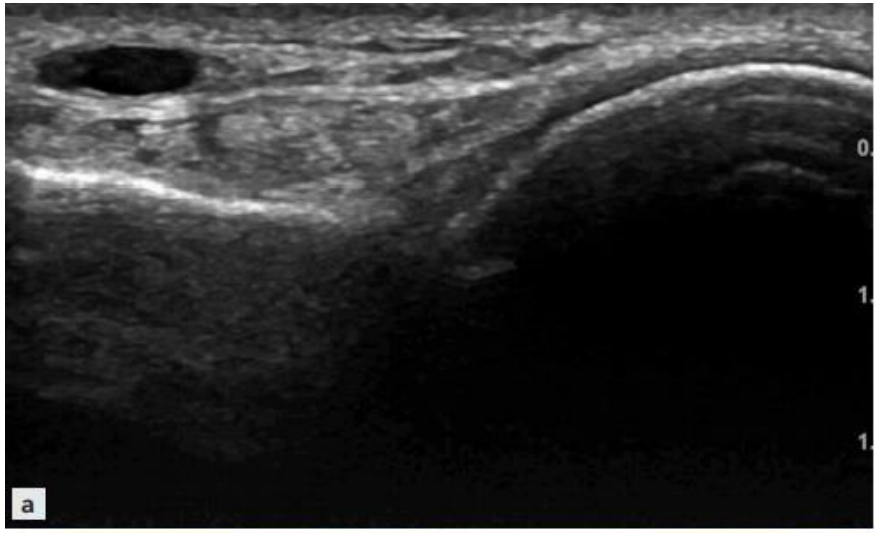


- Image over dorsal aspect of the scapholunate articulation demonstrating the short but strong scapholunate ligament.

Image of EC4 and EC5. EC5 is a single tendon, the EDM, and is a good marker for the distal radio-ulnar joint.



The EC5 is a good landmark for the joint.



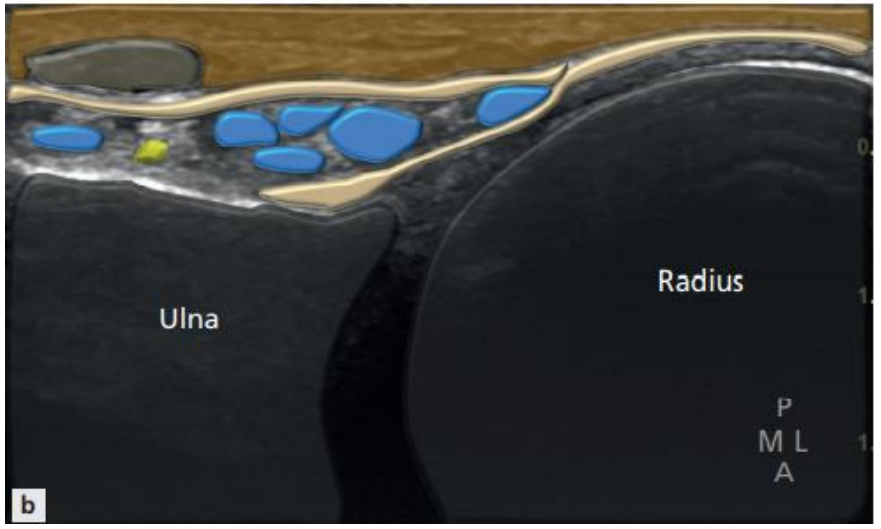
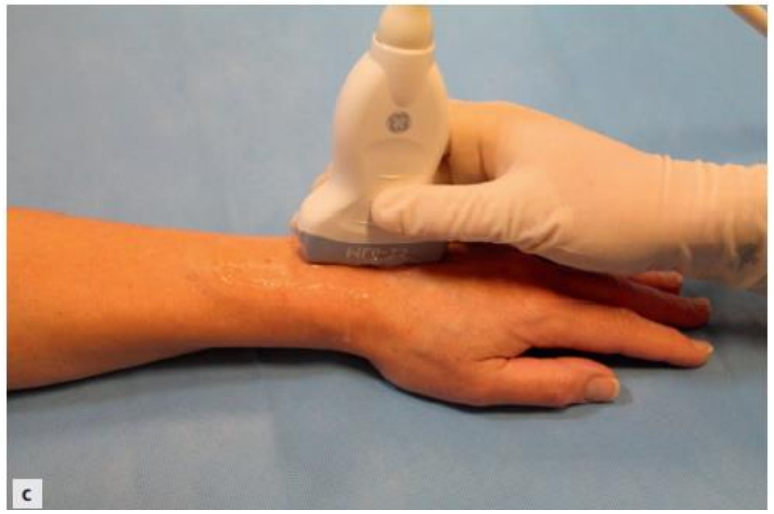
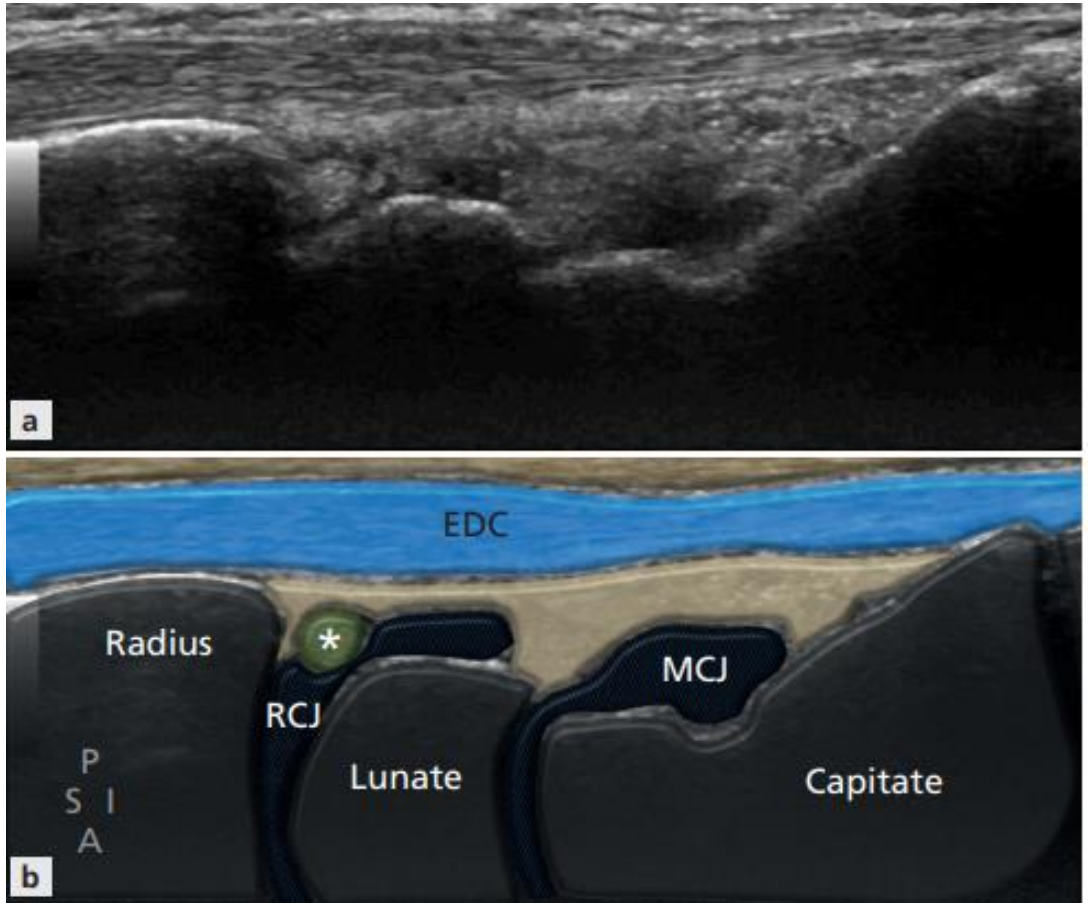
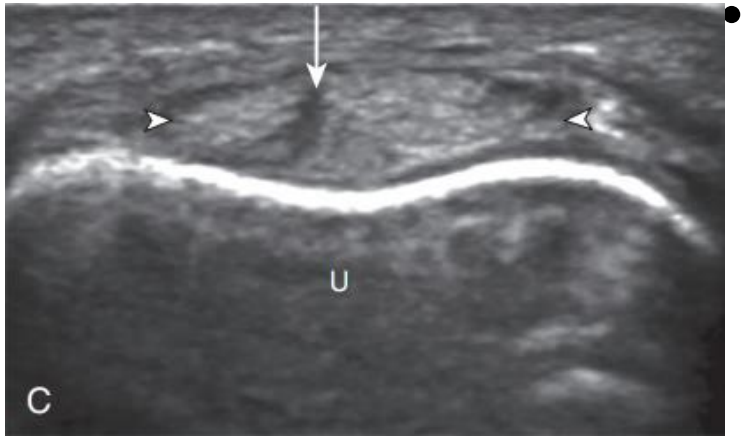
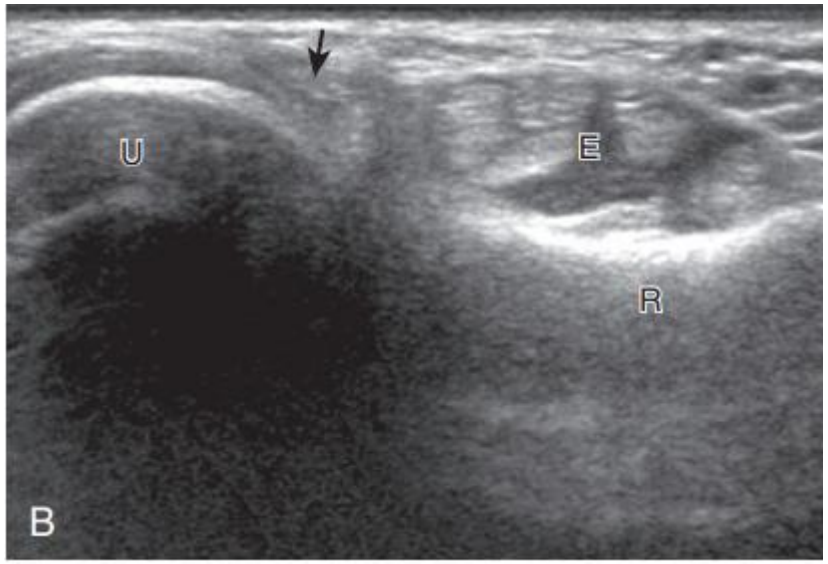


Image of the radiocarpal and midcarpal joints. The traversing radiolunotriquetral ligament (*) is seen crossing the joint.



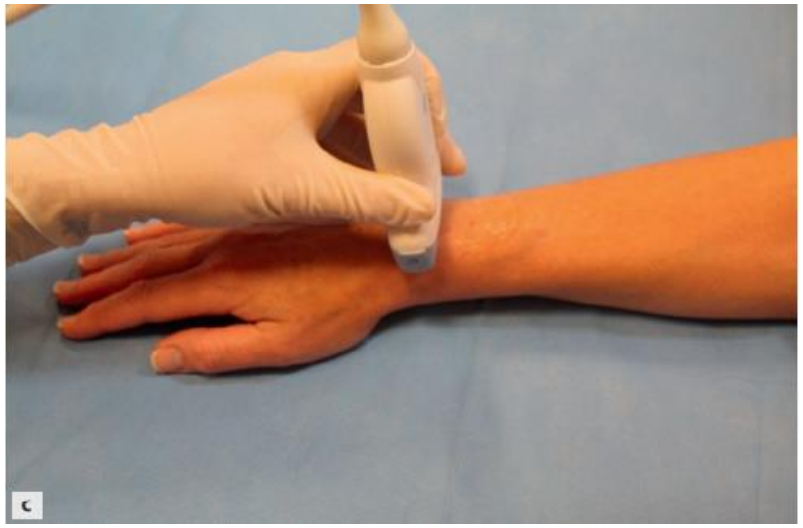


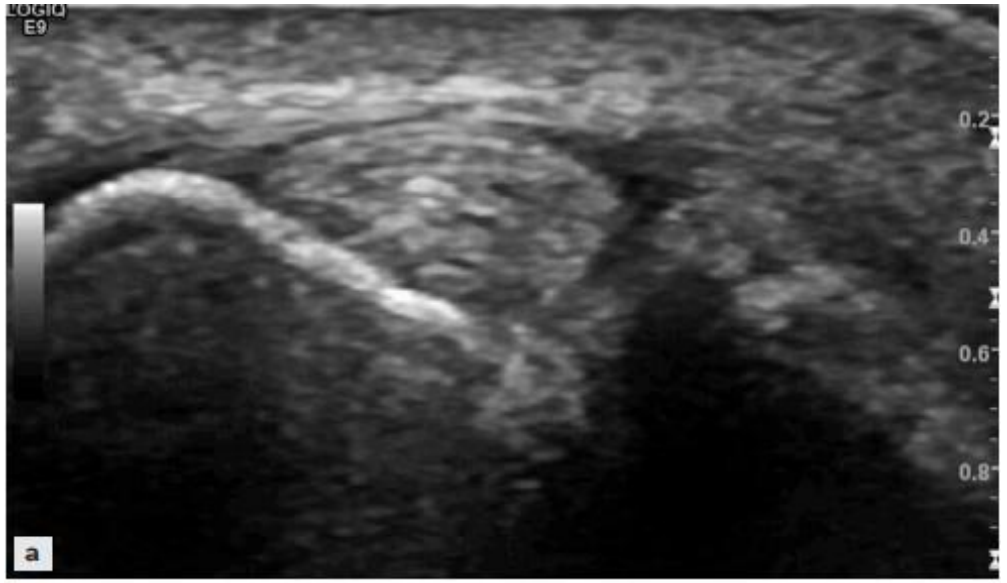




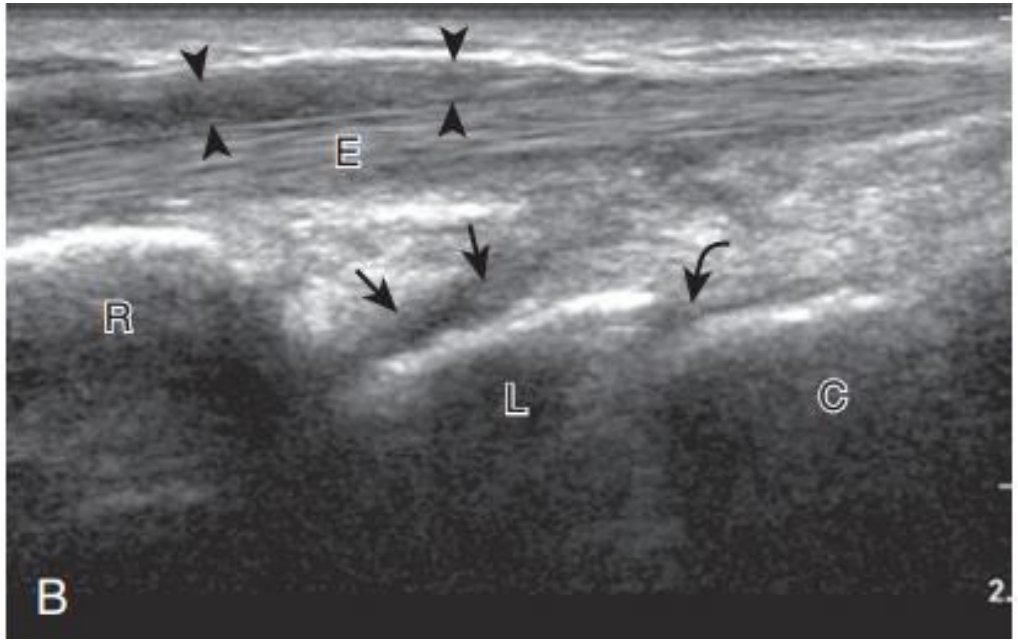
- Over the most ulnar aspect of the ulna, the extensor carpi ulnaris tendon is identified in a concave groove of the ulna in the sixth extensor compartment .The extensor carpi ulnaris tendon often has a normal thin hypoechoic longitudinal cleft that should not be interpreted as a tendon tear.
- The dorsal retinaculum and the deeper subsheath stabilize the extensor carpi ulnaris, with the latter attaching to the ulna. Up to 50% of the extensor carpi ulnar tendon can be located outside of the groove and still be considered normal.

Extensor carpi ulnaris is contained with the ulnar groove by a short retinaculum called the ECU subsheath.



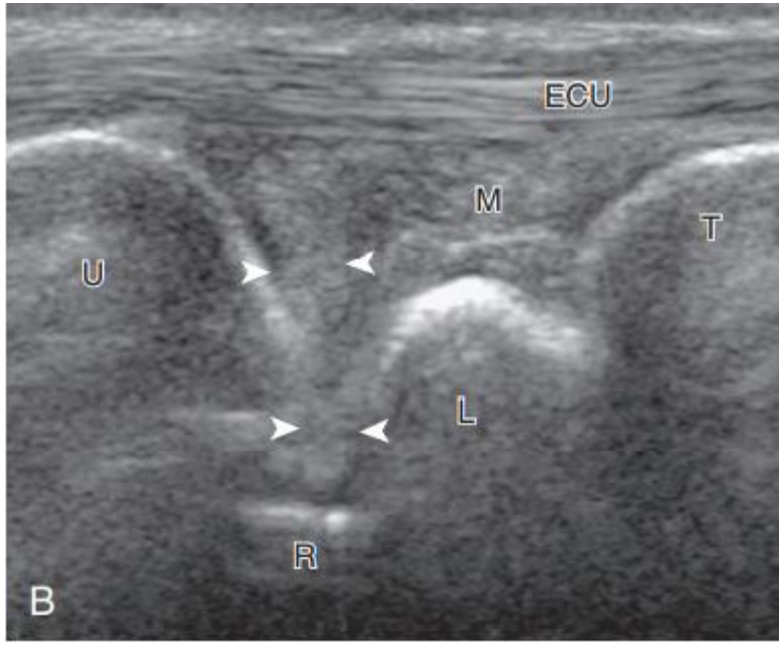


Dorsal Wrist Evaluation (Longitudinal)



- Sagittal imaging shows (B) the extensor retinaculum (arrowheads), extensor tendons (E), and dorsal recesses of radiocarpal (arrows) and midcarpal (curved arrow) joints. C, Capitate; L, lunate; R, radius.

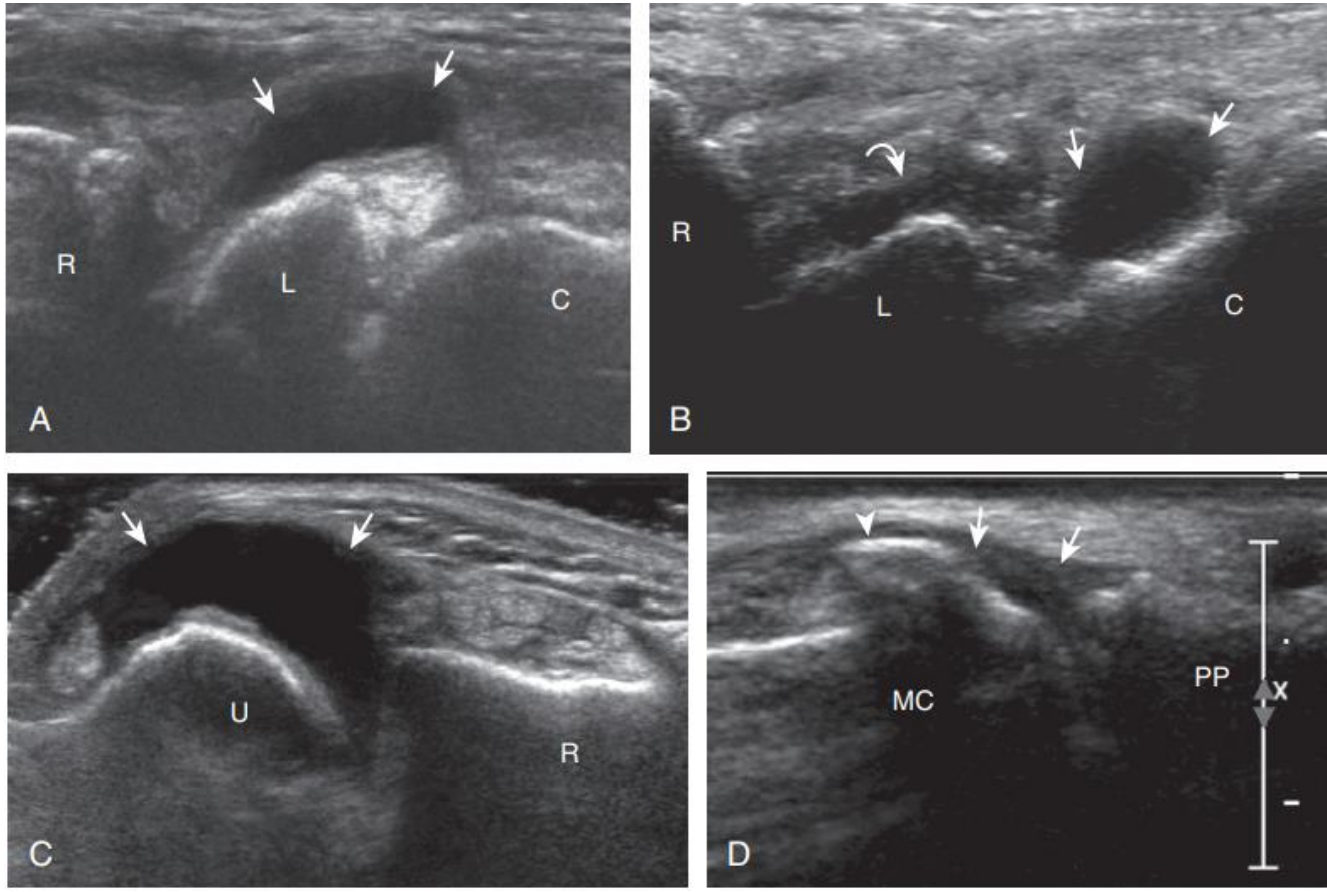
Triangular Fibrocartilage Evaluation



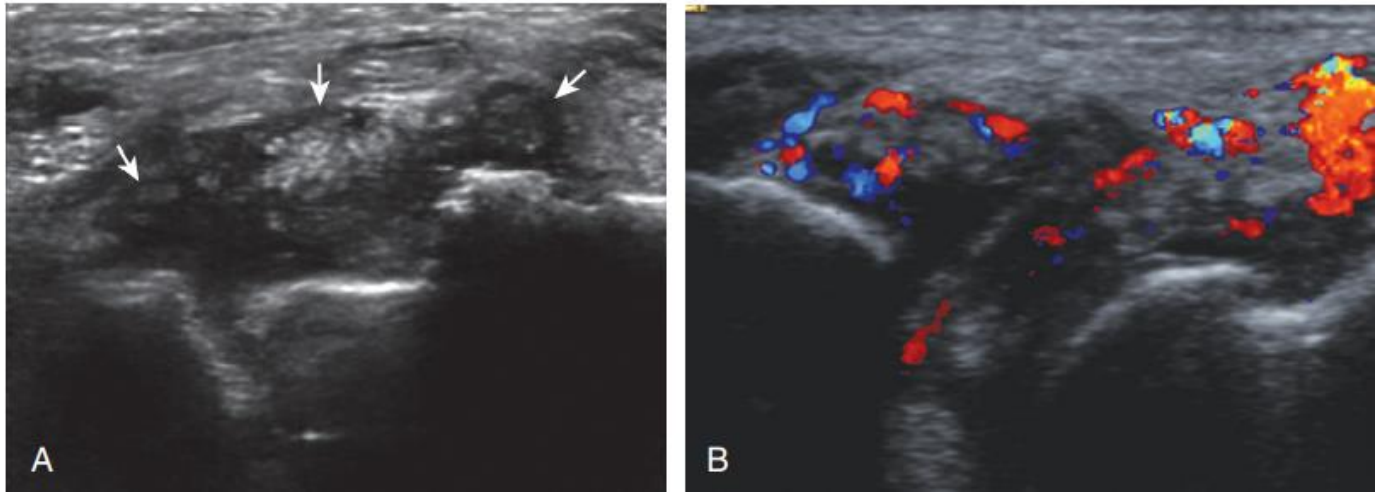
- Coronal-oblique imaging dorsal to the ulnar styloid shows (B) the triangular fibrocartilage (arrowheads) and the meniscus homologue (M). ECU, Extensor carpi ulnaris; L, lunate; R, radius; T, triquetrum; U, ulna

Joint abnormalities

- Anechoic distention of a joint recess typically represents simple fluid although possible etiologies include degenerative, reactive, traumatic, and inflammatory causes; if there is concern for infection, ultrasound-guided aspiration should be considered



- If a joint recess distention is not anechoic
  - 1-complex fluid
  - 2-synovial hypertrophy
- both may appear hypoechoic or isoechoic compared with the overlying subcutaneous tissues
- Complex fluid



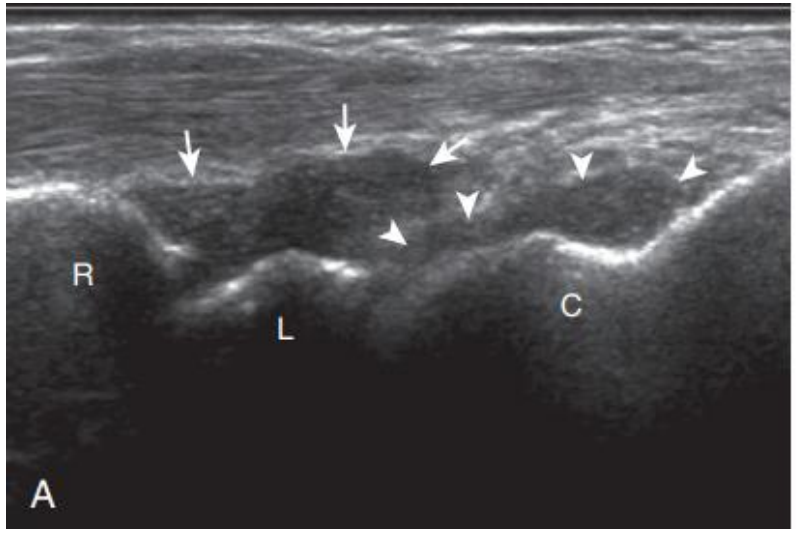
1. collapses with transducer pressure or joint movement
2. swirling of echoes within the recess
3. no internal flow on color Doppler imaging

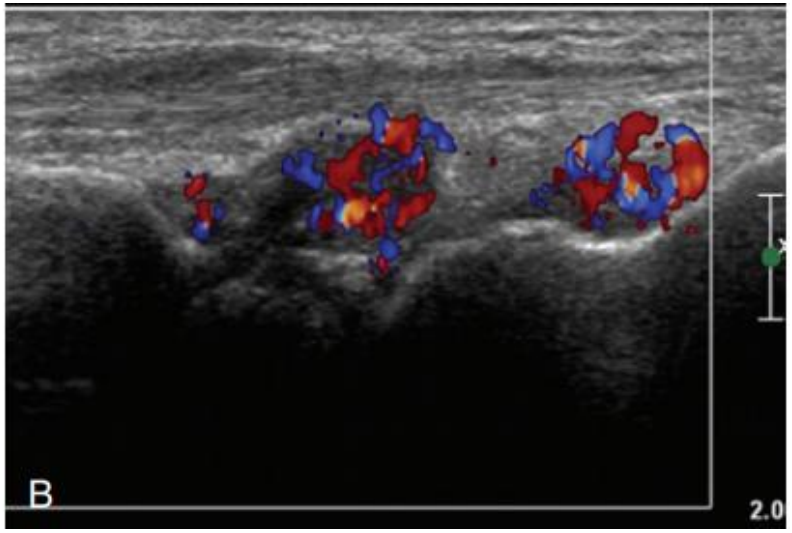
synovial hypertrophy

In contrast

- if there is

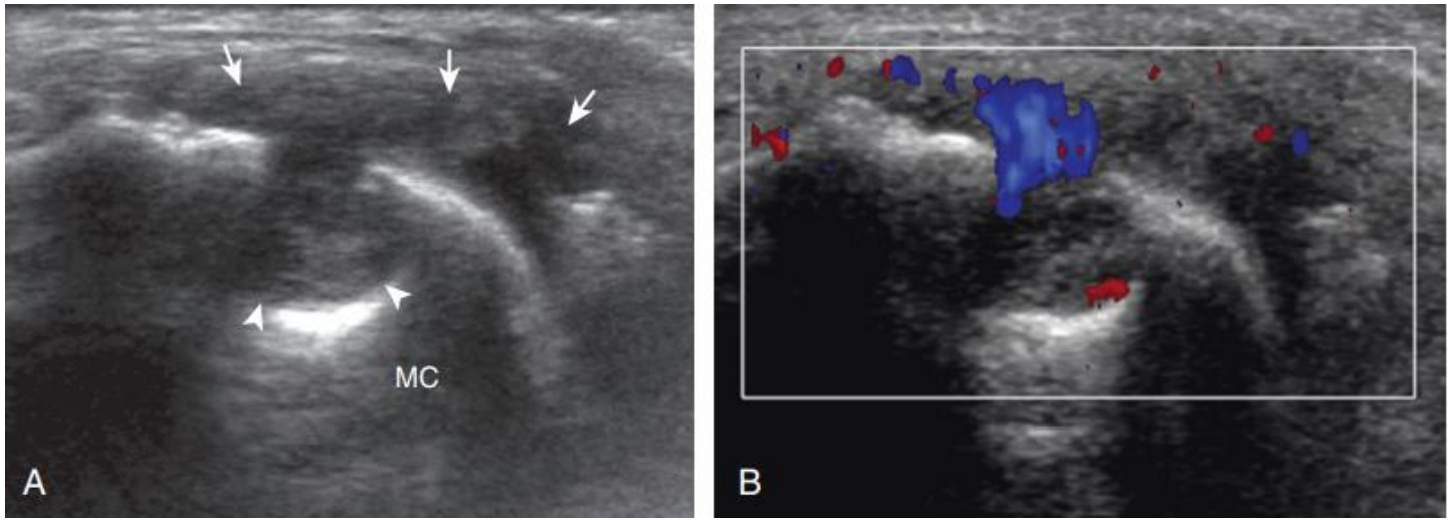
1. no displacement
2. little compressibility of the joint recess
3. internal flow on color Doppler imaging





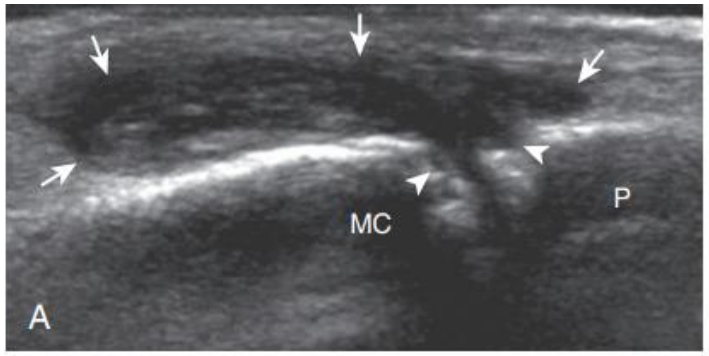
Active inflammatory synovitis

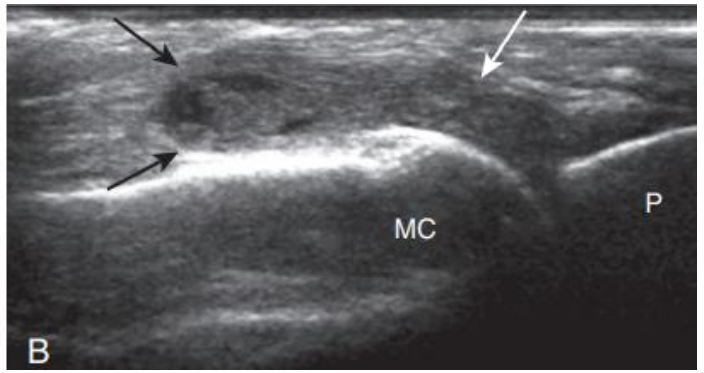
- is usually hypoechoic with hyperemia on color Doppler imaging
- When evaluating superficial structures, the transducer should be “floated” on a thick layer of gel with minimal transducer pressure so as to not compress the vascularity

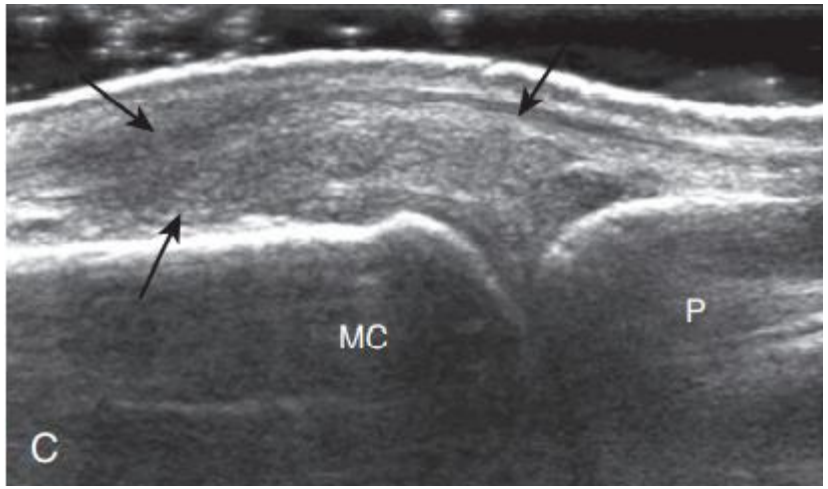


Synovial hypertrophy

- appears as nondisplaceable and poorly or noncompressible distention of a joint recess that is hypoechoic or less frequently isoechoic or hyperechoic compared with the adjacent subdermal fat





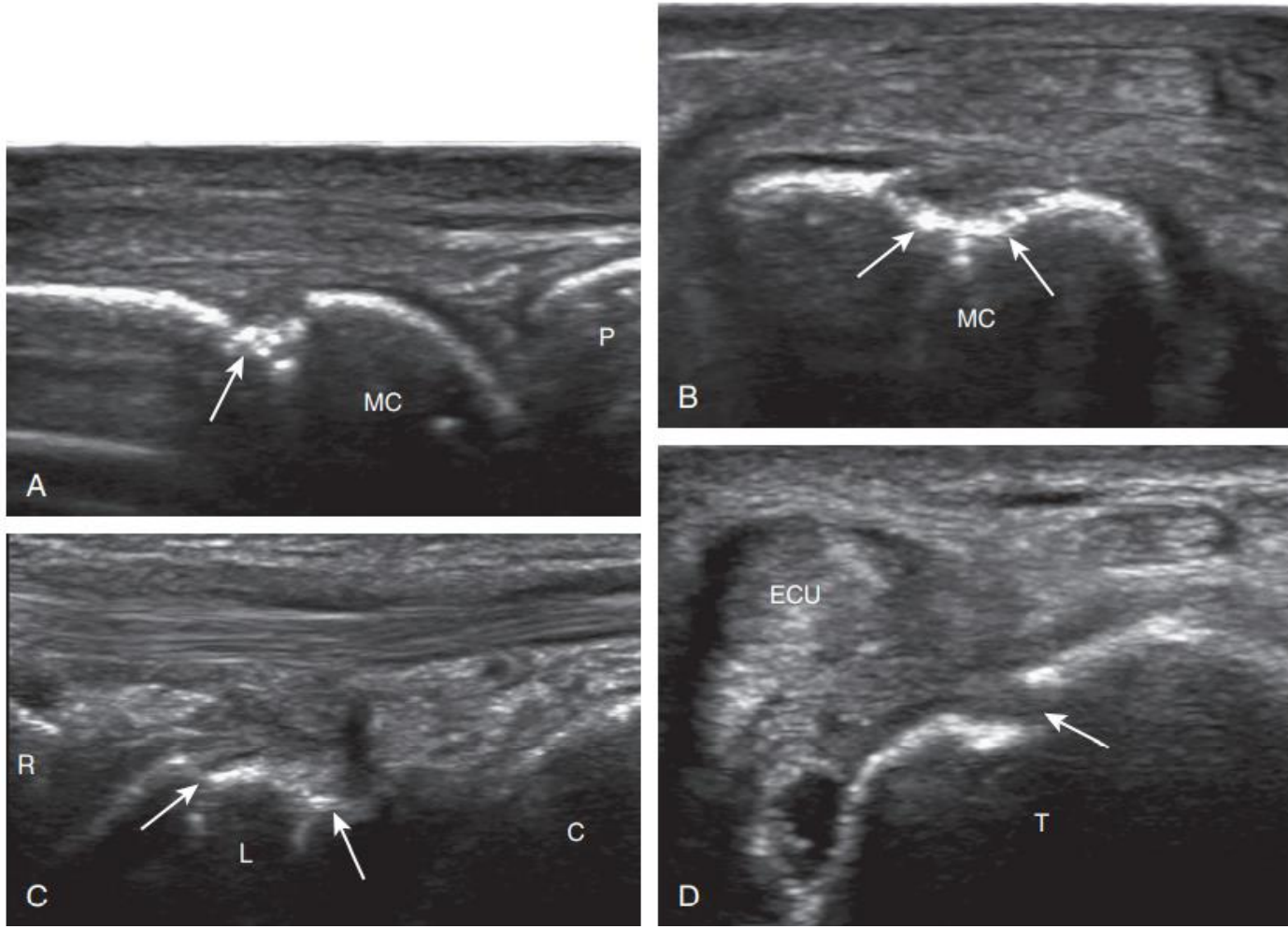


Erosion

If inflammatory synovitis is suspected, the hypoechoic hyaline articular cartilage and the adjacent bone cortex should be evaluated for erosions where thinning or defects of the hyaline cartilage may be identified

- While the cause for an erosion can be from many inflammatory conditions, a large erosion at the second or fifth metacarpal head, or distal ulna, suggests rheumatoid arthritis as the etiology

- A small depression in the dorsal metacarpal at the edge of the hyaline cartilage can be a normal variation, especially at the second metacarpal
- Unlike a true erosion, this cortical depression is usually smooth and shallow (less than 2 mm) without cortical disruption; however, the absence of synovial hypertrophy is a critical finding to suggest a normal variation
- cortical irregularity is normally seen at the lunate and triquetrum related to vascular channels and can simulate erosion



Protocol for inflammatory arthritis screening mainly RA

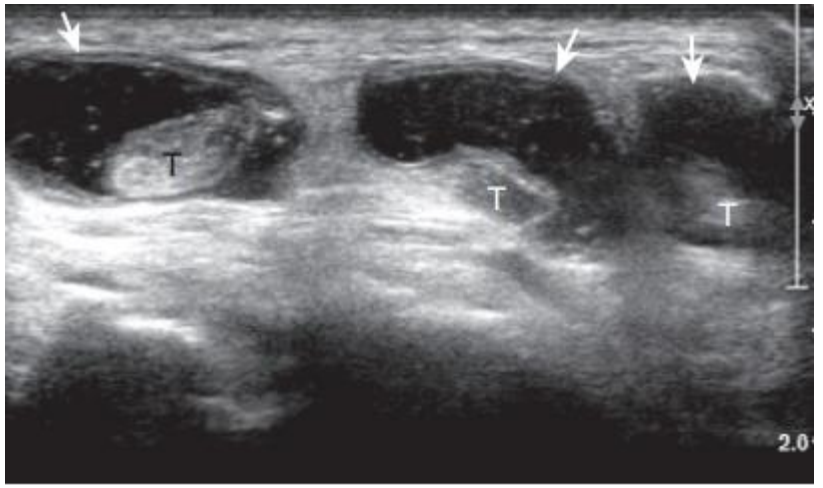
- the metacarpophalangeal joints of each index and long fingers,
- the three joints of each wrist,(RC, RU, mid carpal)
- the fifth metatarsophalangeal joint of the foot
- Focused assessment at any symptomatic site
- although other protocols additionally include the proximal interphalangeal joints of the index and long fingers

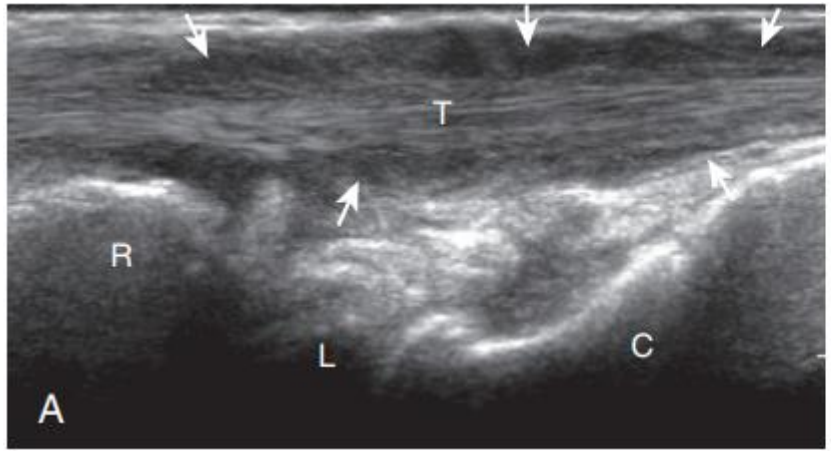
- Screening for synovial hypertrophy with hyperemia and erosions increases the likelihood of an inflammatory arthritis

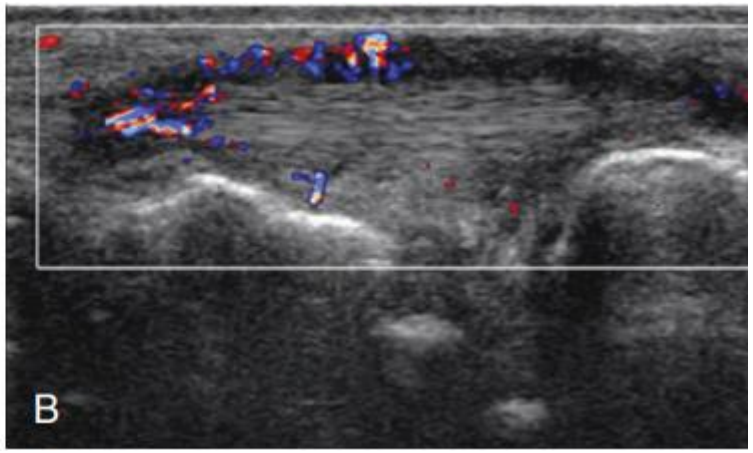
Tendon and muscle abnormalities

- Tenosynovitis is characterized by distention of the synovial sheath around the tendon
- Similar to a joint recess, distention of a tendon sheath may be predominantly anechoic
- NOT anechoic,

1. complex fluid
2. synovial hypertrophy







Complex fluid

1. Compressibility
2. movement of internal echoes with transducer pressure,
3. and lack of flow on color Doppler imaging suggest

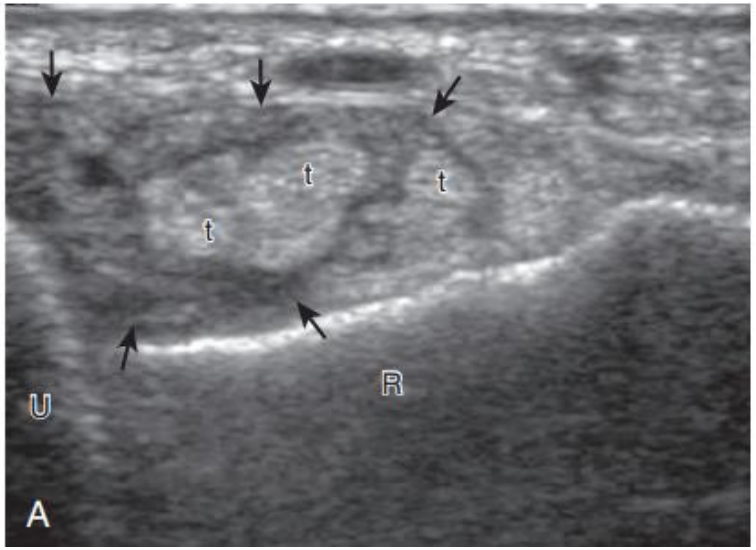
synovial hypertrophy

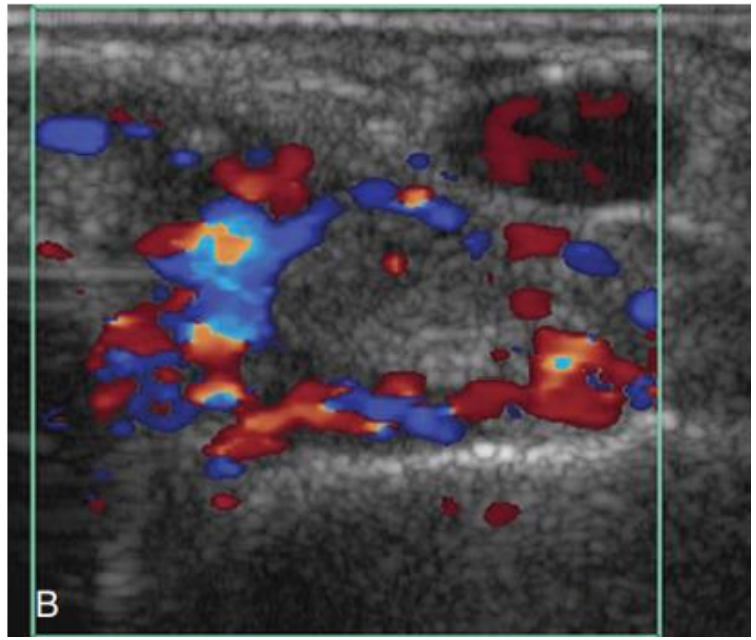
1. non-compressibility
2. No movement in internal echoes
3. flow on color Doppler imaging

Synovial hypertrophy

- is most commonly hypoechoic, or less commonly isoechoic or hyperechoic compared with subdermal fat

- Tenosynovitis may cause erosion of an adjacent bone, such as the ulnar styloid with rheumatoid arthritis



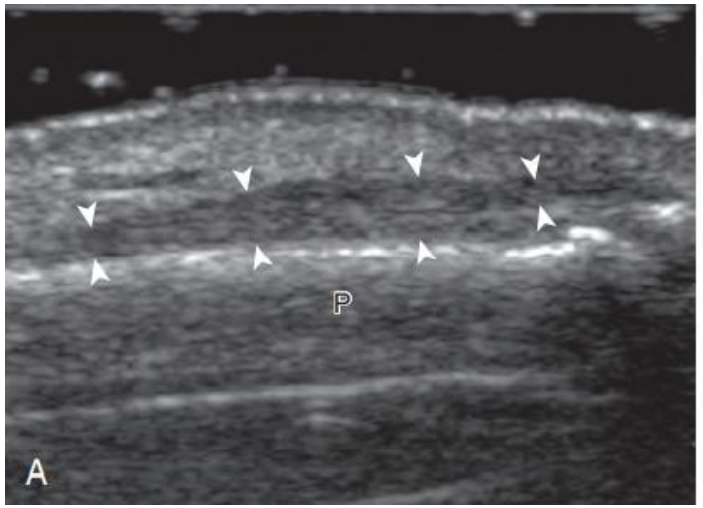


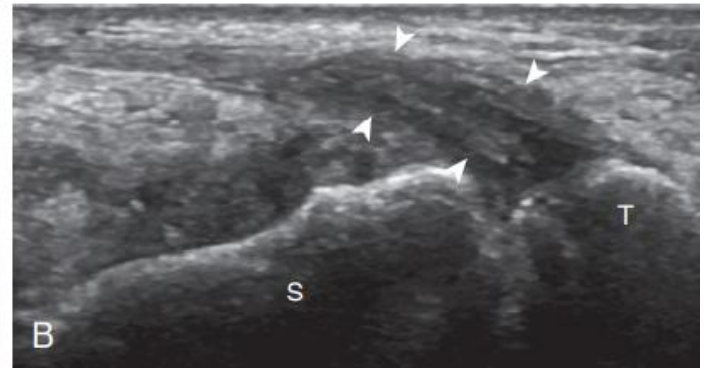
Screening in RA

- the extensor carpi ulnaris and second flexor tendon, can indicate early disease and further progression

Tendinosis

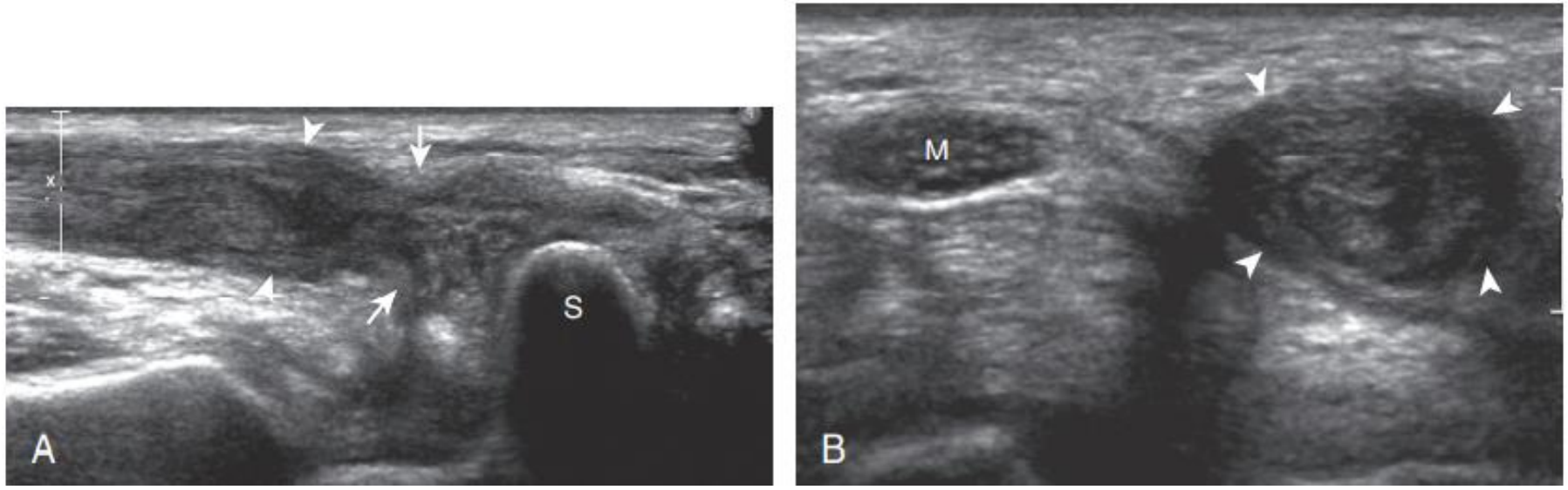
- Tendinosis represents tendon degeneration, typically from overuse, and is characterized by hypoechoic tendon enlargement without disruption of tendon fibers





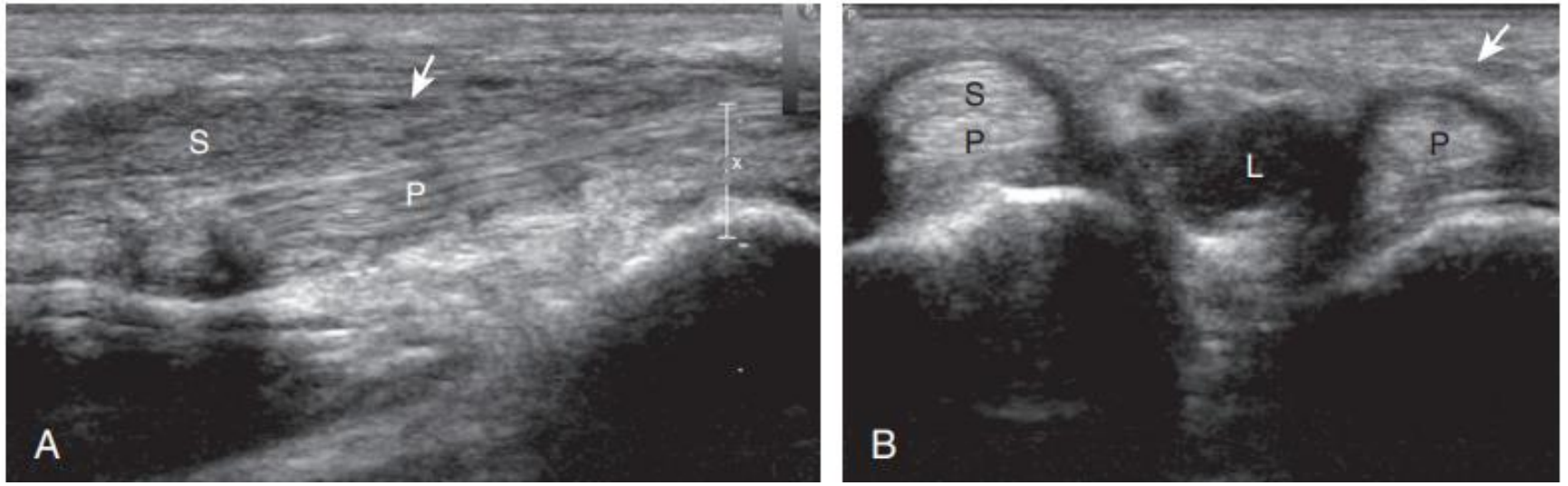
Partial tendon tear

- The finding of incomplete hypoechoic or anechoic tendon fiber disruption indicates partial-thickness tendon tear



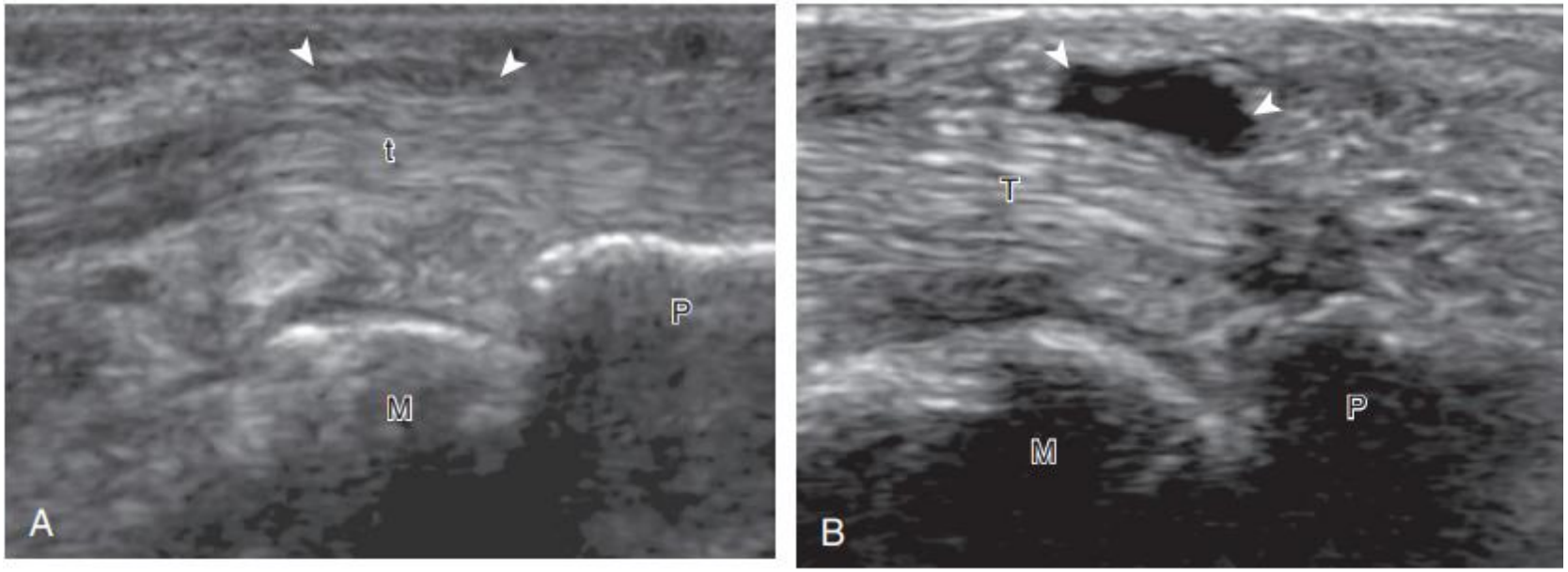
Full thickness Tendon Tear

- The finding of complete fiber disruption indicates a full-thickness tendon tear

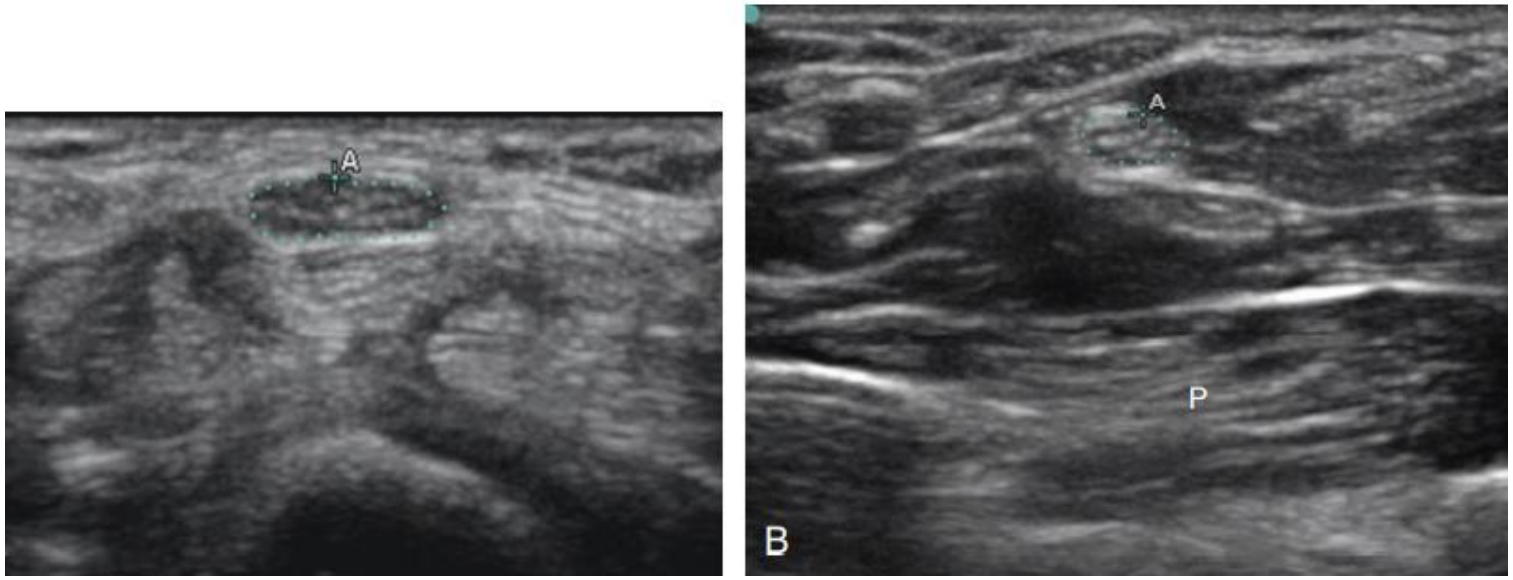


Trigger finger

- impaired flexor tendon gliding is caused by tendon constriction due to thickening of the A1 pulley with possible cyst formation, pulley hyperemia, tendinosis, and tenosynovitis

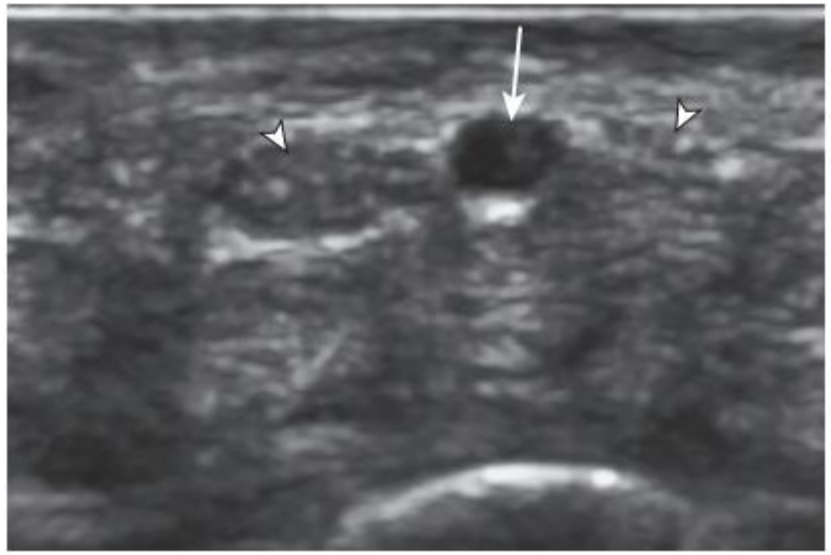


CTS(other technique)



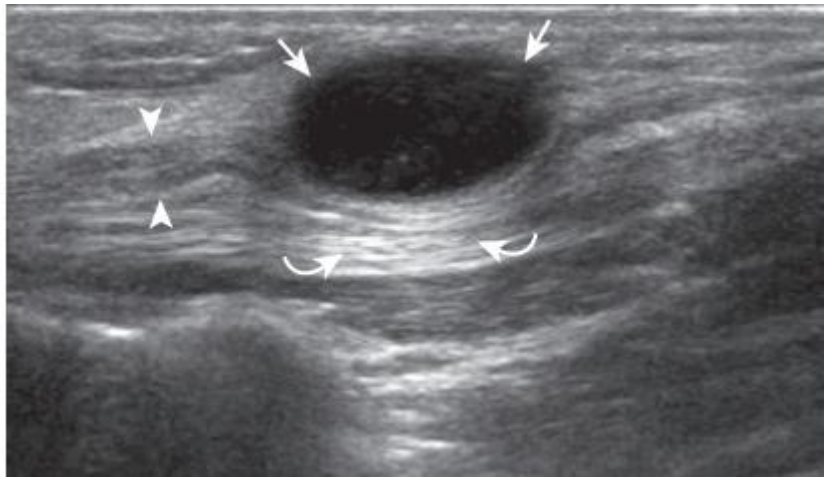
- Carpal Tunnel Syndrome: Measurement Technique. Ultrasound images in short axis to the median nerve at the level of (A) carpal tunnel and (B) pronator quadratus (P) show the circumferential trace method of calculating median nerve area which was greater than 2 mm2 difference comparing proximal to distal.

Bifid median



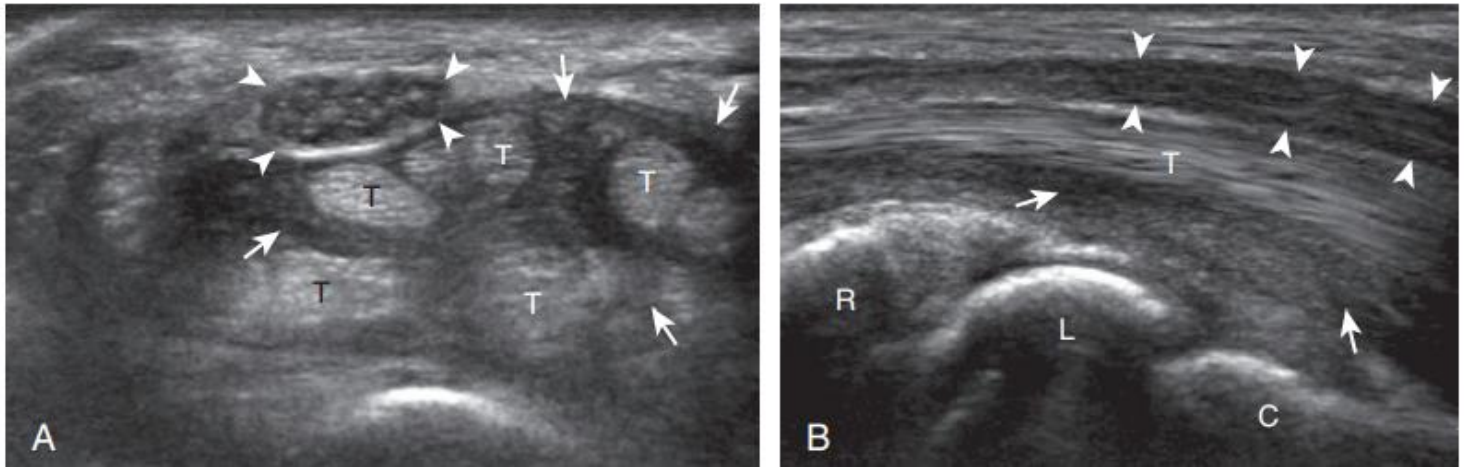
- Bifid Median Nerve and Persistent Median Artery. Ultrasound image in short axis shows bifid median nerve (arrowheads) and a large persistent median artery (arrow).

CTS and ganglion cyst



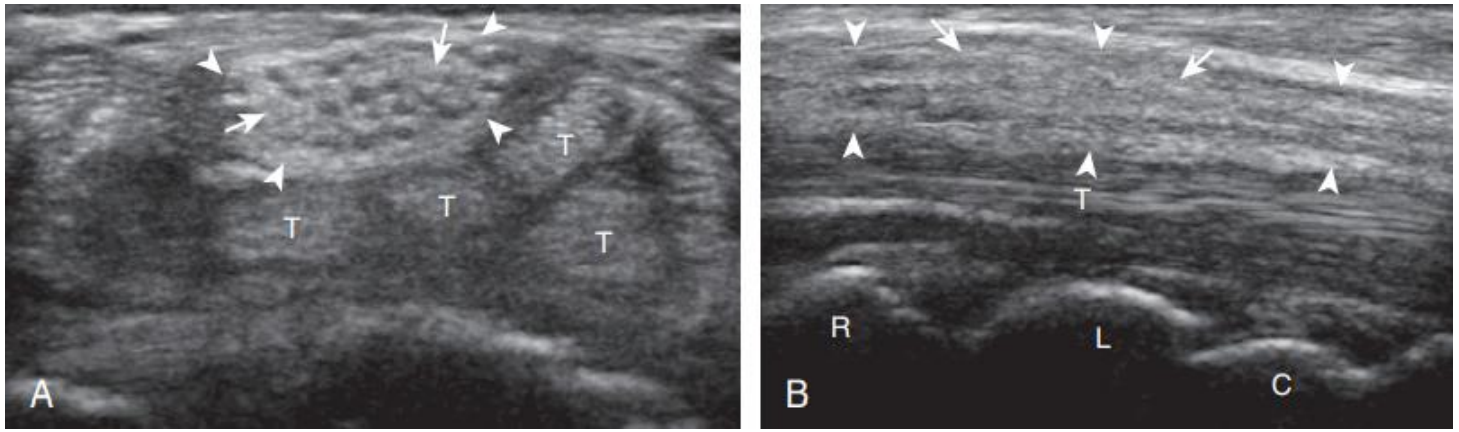
- Carpal Tunnel Syndrome: Ganglion Cyst. Ultrasound image in long axis to the median nerve (arrowheads) shows an anechoic ganglion cyst (arrows) with increased through-transmission (curved arrows

CTS with tenosynovitis



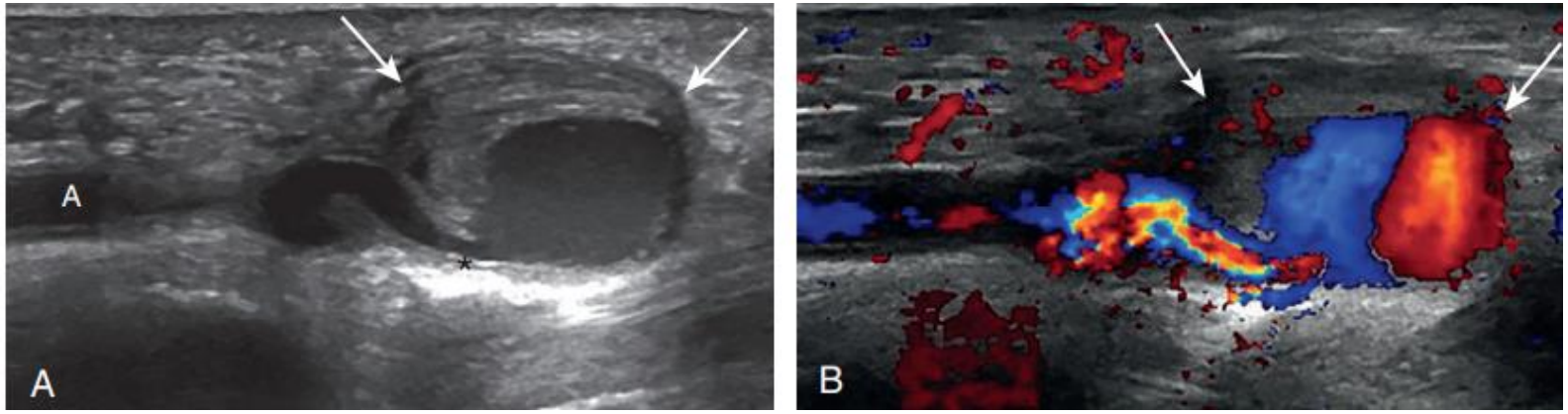
- Carpal Tunnel Syndrome: Tenosynovitis. Ultrasound images in (A) short axis and (B) long axis to the median nerve show hypoechoic nerve enlargement (arrowheads). Note hypoechoic synovial hypertrophy (arrows) surrounding the flexor tendons (T). C, Capitate; L, lunate; R, radius.

Fibrolipomatous Hamartoma



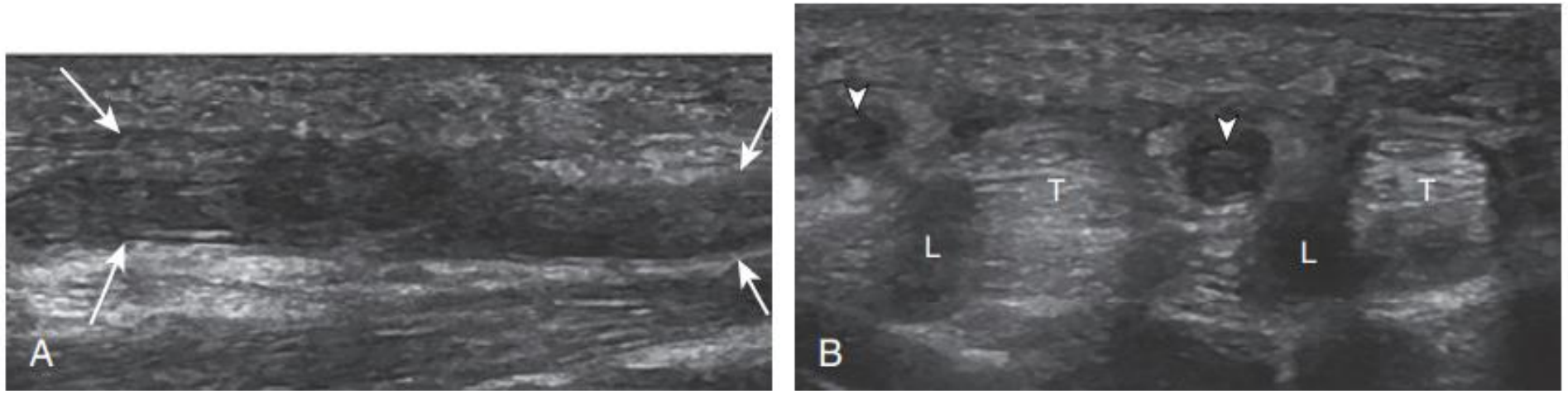
- Fibrolipomatous Hamartoma of the Median Nerve. Ultrasound images in (A) short axis and (B) long axis to the median nerve (arrowheads) show hyperechoic fibrofatty tissue (arrows) interspersed between the hypoechoic nerve fascicles. C, Capitate; L, lunate; R, radius; T, flexor tendons

Ulnar nerve entrapment



- Aneurysm: Ulnar Artery. Ultrasound image (A) in long axis to the ulnar artery shows heterogeneous aneurysmal enlargement (arrows) continuous with the ulnar artery (A). Note to-and-fro flow pattern on (B) color Doppler image

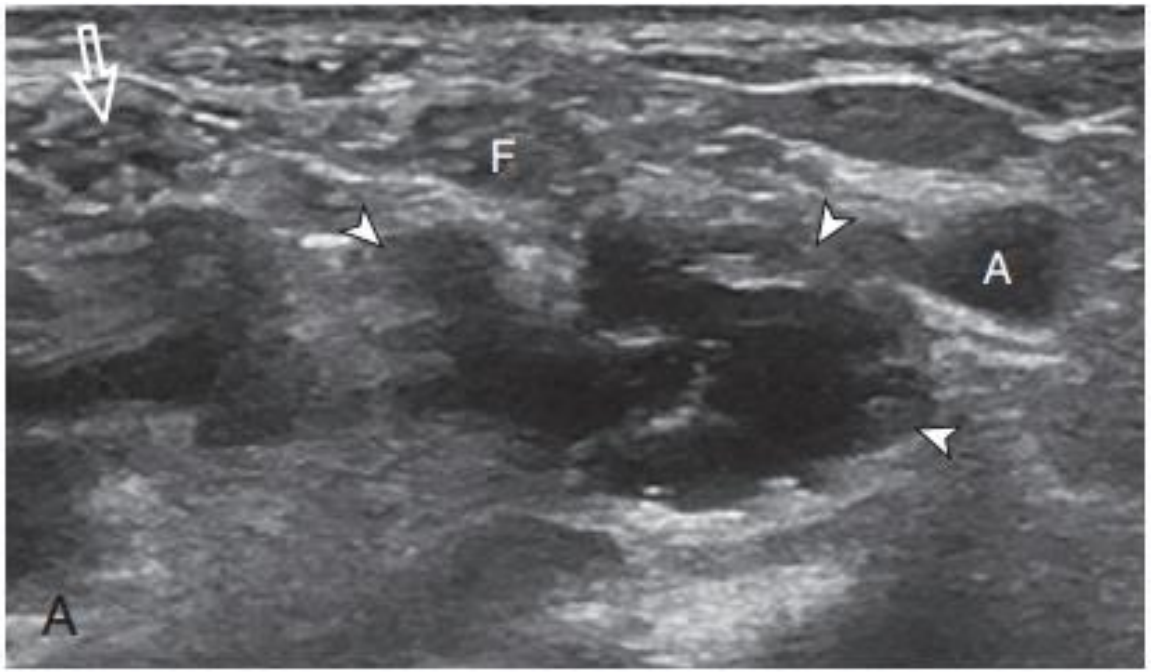
Hypothenar Hammer Syndrome



- Hypothenar Hammer Syndrome. Ultrasound images in long axis (A) to ulnar artery shows noncompressible hypoechoic thrombus. Note distal thrombosis of common digital arteries (arrowheads) in (B). T, Flexor digitorum tendons; L, lumbricals.

Ganglion cyst

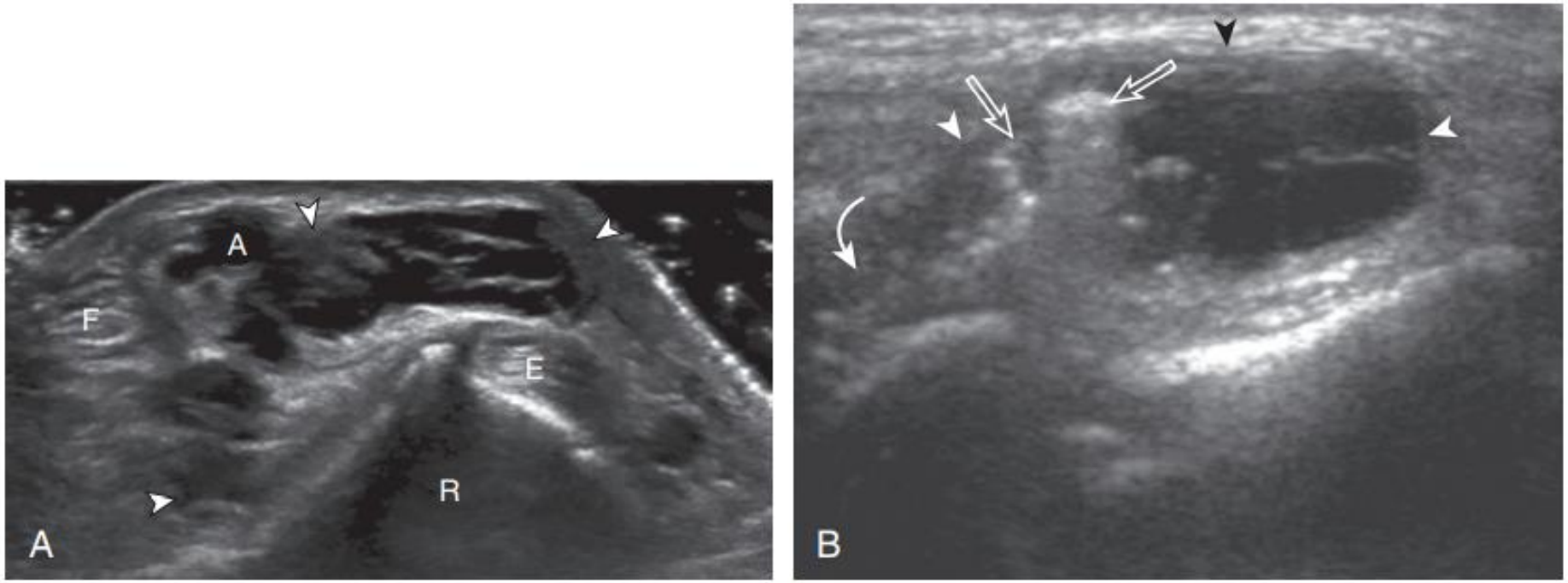
1. multilocular
2. hypoechoic or anechoic
3. non-compressible



Ganglion cyst cont..

- Many ganglion cysts are located dorsal, adjacent to the scapholunate ligament
- A dorsal ganglion cyst should be differentiated from a distended dorsal wrist joint recess as both have similar anatomic locations; with wrist movement or transducer pressure, a joint recess typically collapses, whereas a ganglion cyst is non-compressible
- Another very common and often underreported site for ganglion cysts is volar, between the radial artery and the flexor carpi radialis tendon, originating from the radiocarpal joint between the radius and scaphoid and extending proximally

Volar ganglion cyst



Thank you