The Wrist & Hand
The Wrist & Hand
Median Nerve Anatomy

Median nerve is NOT midline/center of the wrist, but found toward the Radial margin of the volar wrist.

The Wrist & Hand
Palmar Transverse: Median Nerve Localization

Ask the patient to slowly flex and extend the thumb to activate the FPL (Flexor Pollicis Longus).

The hyper-echoic FPL tendon is seen pushing the hypo-echoic, ovoid nerve superficially and right.
Identify the hypoechoic nerve at the Carpal Tunnel entry. Scaphoid and Pisiform are bony landmarks.

Elliptical measurement yields x-sectional value.

Do not compress nerve!
Reduce probe pressure.
Irregular contours can be traced manually.
The Wrist & Hand
Median Nerve Cross-Sectional Area
Wrist to Forearm Ratio: Step Two

From distal image
Trace MN proximally

12cm … 4.7 inches

The MN is seen between the FDS and the FDP
Flexor Digitorum Superficialis & Profundus
The Wrist & Hand
Median Nerve Cross-Sectional Area

Wrist to Forearm Ratio Calculation

\[
\text{Ratio} = \frac{7\text{mm}}{17\text{mm}} = 0.417
\]

> 1.4 positive for Carpal Tunnel

Source: Clinical Neurophysiology 2008; 119:1353-1357

The Wrist & Hand
Palmar Longitudinal
Slightly off midline toward Radial margin

Palmaris Longus (PL) passes superficial to the Flexor Retinaculum (FR).
The most superficial structure of the volar wrist.
Absent in 20% of population
The Wrist & Hand
Palmar Longitudinal
Slightly off midline toward radial margin

Median nerve is deep to the Palmaris Longus.

Note!
The PL is NOT a sliding tendon.

Do not confuse the more superficial PL tendon with the slightly deeper, less echogenic Median nerve.

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The Wrist & Hand
Palmar Longitudinal
Slightly off midline toward radial margin

Long axis probe position just on Radial aspect of Palmaris Longus. (black arrow)

Read from the top down
PL = Palmaris Longus (purple hilite)
MN = Median Nerve (green hilite)

Median nerve will not have sliding/excursion as that of flexor tendons.
The Wrist & Hand
Median Nerve Has little or NO EXCURSION!

The Wrist & Hand
Ulnar Nerve Transverse In Guyon’s Canal

Ulnar Nerve is adjacent to the Ulnar Artery and superficial to Flexor Retinaculum. Probe is moved in short axis plane to medial/ulnar side of palmar wrist.
The Wrist & Hand
Ulnar Nerve Transverse In Guyon’s Canal

Ulnar Nerve can be identified using color flow or doppler

Pis : Pisiform
Red Hilite : Ulnar Artery (pulsatile, non-compressible)
Yellow Hilite : Ulnar Nerve
FDMB = Flexor Digiti Minimi Brevis

The Wrist & Hand
Ulnar Nerve Transverse In Guyon’s Canal

Ulnar Nerve is adjacent the artery and superficial to Flexor Retinaculum
Bony landmark is the Pisiform
Dupuytren’s Contracture

Dupuytren’s contracture is an idiopathic, benign proliferative disorder that results in fibrous tissue deposition in the Palmar Aponeurosis of the hand. It occurs in the fibro-fatty layer between the skin and deep palmar structures, resulting in 1st... the formation of nodules, that over time, 2ndly... develop into longitudinal cords.

The Wrist & Hand
Dupuytren’s Contracture

Hypoechoic... or possibly hyperechoic subcutaneous nodules...
In a “string of pearls” configuration

Can be treated with injectable collagenase clostridium histolyticum (Hurst L, NEJM 2009) with resolution of contracture

Product known as Xiaflex
The Wrist & Hand
Dorsal Transverse

1. Non Osseous = Extensor Retinaculum
   A Horizontal, Linear, Hyperechoic band
   The ER defines the dorsal anatomy.
   Forming 6 synovial compartments by means of radial and ulnar attachments.

2. Osseous: Lister’s Tubercle (at distal Radius)
   Serves as landmark dividing Compartment 2 from Compartment 3
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First 3 Dorsal Compartments

I = Extensor Pollicis Brevis & Abductor Pollicis Longus

II = Extensor Carpi Radialis Longus & Brevis

III = Extensor Pollicis Longus

Mid-Supination/Pronation to expose Radial margin
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First 3 Dorsal Compartments

II = Extensor Carpi Radialis Longus & Brevis

SAX at Radial aspect. Not true “midline’ to view ‘scalloping’ of cortical margin.

ECRB + ECRL

Radius

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DeQuervain’s Tenosynovitis

Red Hilite = APL (abductor pollicis longus)
Yellow Hilite = EPB (extensor pollicis brevis)

The EPB and APL occupy the same tendon “sheath”. Thickening of the “sheath” entraps the tendons.

The two tendons may not be seen separately, when normal, but a fibrous band may develop between them as a sequelae to stenosing
The Wrist & Hand
DeQuervain’s Tenosynovitis
Transverse/Short Axis View

Mid-Supination/Pronation

Purple Hilite = Ext. Retinaculum
Red Hilite = EPB
Yellow Hilite = APL
£ = Cephalic vein
* = Radial Artery

De Quervain’s Injection
Out of Plane Approach
Dissecting the two tendons

A perpendicular view may reveal or confirm thickening of the sheath or fluid within it.

Note: Some normal physiologic fluid is expected. Significant amounts of fluid would produce a “halo”
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Dorsal Longitudinal

Extensor retinaculum is superficial to tendons.

With Stand off Extensor tendon fibrillar pattern is seen more clearly.

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Dorsal Metacarpal-Phalangeal Longitudinal

Longitudinal probe position across the MCP joint.

Supporting the joint on palmar side helps with flexion and distraction for dynamic imaging.

Purple = anatomic neck of MC
Yellow = synovial membrane
Lite Blue = synovial fluid
Red = capsule
Green = tendon
The Wrist & Hand
Dorsal Metacarpal-Phalangeal Longitudinal

Acoustic standoff helps with probe contact

Purple = anatomic neck of MC
Yellow = synovial membrane
Lite Blue = synovial fluid
Red = capsule
Green = tendon

The Wrist & Hand
Dorsal MCP Longitudinal

Normal smooth, intact cortical outline

1. Cortical erosion. No distinct anechoic cartilage margin
2. Distended joint capsule and synovial thickening
3. Poorly visualized extensor tendon
The Wrist & Hand
Synovial Thickening Assessment

Grade 1: Synovium in “triangle” between the bones
Grade 2: Synovium extending proximally over the Metacarpal Head
Grade 3: Synovium extending to metaphysis of Metacarpal

The Wrist & Hand
Palmar MCP Longitudinal View

* = Volar plate (thickened portion of capsule)
1 = Flexor tendons/ A1 Pulley
The A1 pulley is a very thin, anechoic line above the tendon

*Not the optimal view to see the pulley*
The Hand & Wrist
Palmar Transverse MCP

The A1-2 Pulley

The Annular Ligaments/Pulley system forms a fibro-osseous tunnel through which pass the deep and superficial flexor tendons of the fingers (FT). They provide strategic constraints to the flexor tendons and prevent “bowstringing” during flexion/extension of the digits.

The Wrist & Hand
Palmar Transverse MCP

The A1-2 Pulley “trigger finger”

PP= Proximal Phalanx
VP/purple hilite = Volar Plate
FT/red hilite = Flexor tendons (FDS and FDP)
Green Hilite = Annular Ligament/Pulley

The Pulley ligament is a slim, uniform “anechoic arch” surrounding the VP and FT.
The Pulley ligament is a slim, uniform “anechoic arch” surrounding the VP and FT.

The Wrist & Hand
Palmar Transverse MCP
The A1-2 Pulley “trigger finger”

PP= Proximal Phalanx
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The Wrist & Hand
1st CMC Joint Longitudinal Navigation
3rd Joint Space From Radius

Radius
Scaphoid
Trapezium
The Wrist & Hand

1st CMC Joint Longitudinal

Reciprocal reception between 1st Metacarpal and Trapezium

The 3rd Joint Space From Radius

**The 1st CMC Joint**

- **Fig. 1**: Long axis probe position, kept at radial aspect of the joint.
- **Fig. 2**: First identify the distal radius. Count 3 joint spaces to correctly identify the 1st CMC.
- **Fig. 3**: 1. Radio-Scaphoid
   2. Scaphoid-Trapezium
   3. Trapezium-Metacarpal

The Wrist & Hand

Thenar Longitudinal Views

Ulnar Side

- **Fig. 1**: Long axis probe on ulnar/medial side of the thumb.
- **Fig. 2**: The collateral ligament is deep to the Adductor Pollicis tendon/aponeurosis (purple hilite).
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Thenar Longitudinal Views
Ulnar Collateral Ligament

The collateral ligament is deep to the Adductor Pollicis tendon/aponeurosis. The collateral ligament (1) and its accessory portion cross over the joint space. The aponeurosis is more hyperechoic than the UCL. Long axis probe on ulnar/medial side of the thumb.

The Wrist & Hand
Gamekeeper’s or Skier’s Thumb, Stener Lesion
Severe hyper-abduction injury

The ligament is often torn from the bone, and avulsion fractures can be seen on ultrasound. Check continuity of met head cortex. Stener lesion includes UCL tear PLUS Aponeurosis detachment from 1st MP Jt.

Mechanism of Injury
Falling forward and catching the thumb will hyper-abduct the 1st Metacarpal joint.
The Triangular Fibrocartilage Complex is a term used to describe the various structures suspending the distal Radius and the Ulnar Carpus...

Aka...
the anatomic collection connecting the lower arm to the hand.

On the Ulnar side of the wrist, the intra-articular disc thickens, making it somewhat visible to insonation, ...and prone to impaction type injury.

The fibrocartilage/meniscus is supported by a meniscal "homologue".

Homologue means a “double or duplicate”.

Deep Intra-articular TFC Disc
Green Hilite

Meniscal Homologue
Purple Hilite and *
the “duplicate” attaching the disc to Triquetrum.

Homologue, referred to as
A “sling or leash”
The Wrist & Hand
TFCC: Triangular Fibrocartilage Complex

Long Axis probe at the distal Ulna active Radial deviation

TFC images most reliably visualize the TFC Homologue

Identifying the Homologue as separate from the fibrocartilage is helpful, and may display tears not involving the fibrocartilage. Also, ultrasound has known limitations in completely evaluating fibrocartilage in general.
Thank You!