

## Approach to Ultrasound of the Wrist



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## Disclosure

- I have no commercial or financial interests related to the subject matter of this presentation

## Objectives

At the end of this presentation, the participant will be able to:

1. Understand anatomy of the wrist flexor/extensor compartments
2. Have an approach to ultrasound examination of the wrist
3. Understand common uses and pathologies seen on wrist ultrasound

## Outline

- Imaging technique
- Normal Anatomy
- Common Pathologies:
  - **Tendons:** Tendinosis, Dequervain's Disease, tear
  - **Joints:** Arthritis (Inflammatory, Depositional, OA)
  - **Nerves:** Neuropathy (Ulnar n, Median n, Radial n)
  - **Other:** ganglion cyst, intersection syndrome, implantation dermoid, foreign body

## Technique

## Technique

- Position opposite patient with table



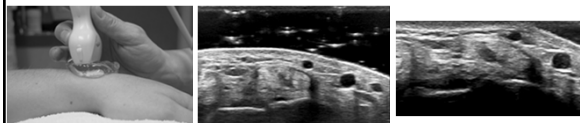
### Technique

- Elevate on small towel
- Control probe with finger on patient



### Technique

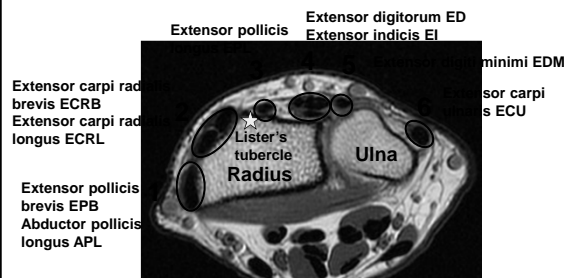
- 10 -17 MHz linear array transducer
- Small foot print transducer (hockey stick)
- Stand off pad or gel



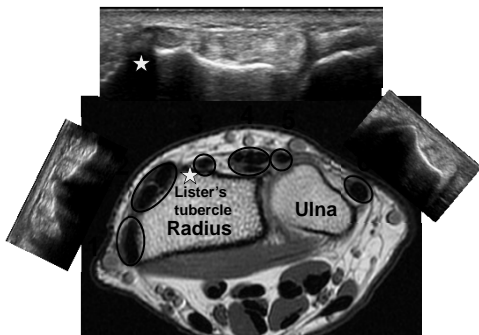
## Anatomy

### Anatomy – Extensor Compartment

- 6 Extensor compartments

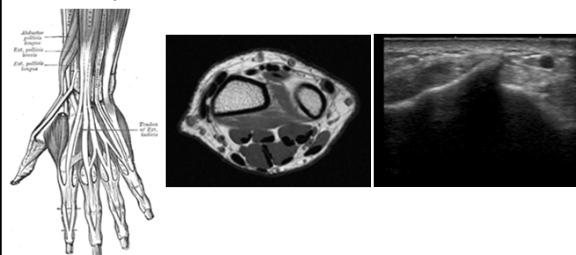


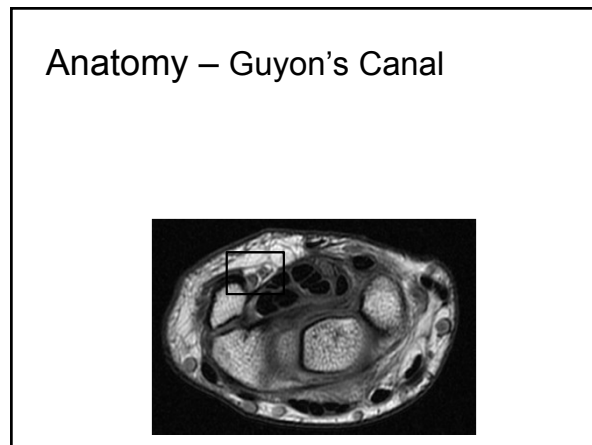
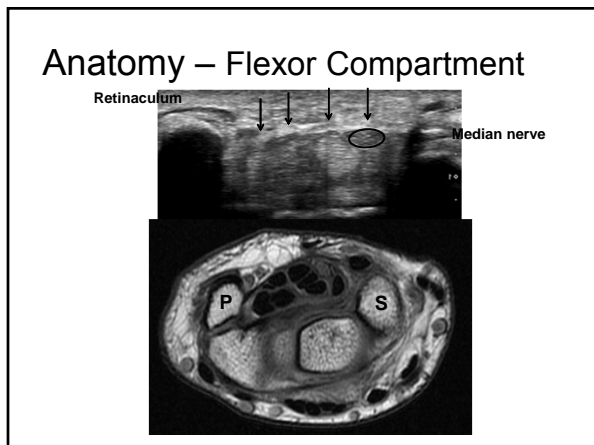
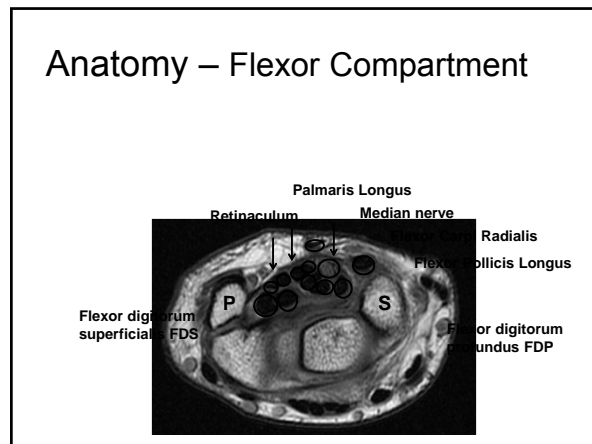
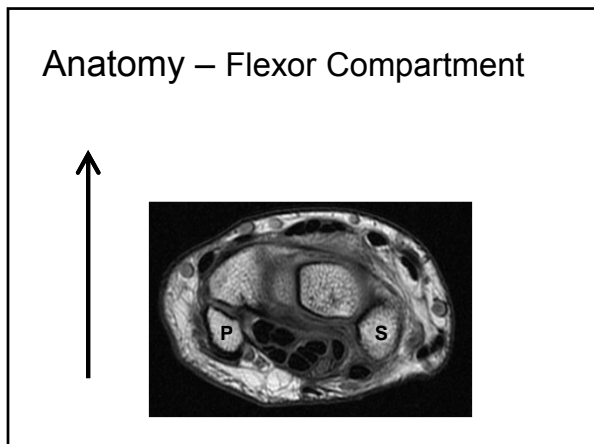
### Anatomy – Extensor Compartment



### Anatomy – Extensor Compartment

- Compartment 3 – crosses over 2





### Anatomy – Guyon's Canal

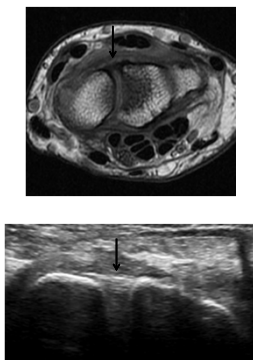
- Semi-rigid canal
- Medial – pisiform, FCU
- Superficial – palmar carpal ligament
- Deep – flexor retinaculum
- Passage of ulnar artery and nerve

### Structure

- Tendons
  - Echogenic and fibrillar
  - Uniform thickness
  - Synovial sheath – thin echogenic line around tendon
  - Small amount of fluid normal

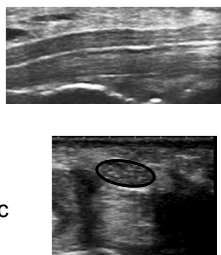
### Structure

- Ligaments
  - Echogenic and fibrillar




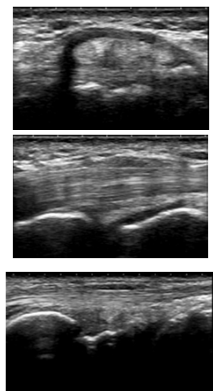
### Structure

- Nerves
  - Multiple axons bundled together in fascicles
  - Grouped together by loose connective tissue epineurium
  - Multiple parallel hypoechoic fascicles
  - Surrounded by echogenic perineurium



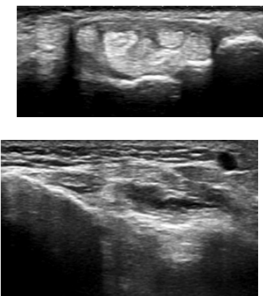
### Pitfalls

- Retinaculum
  - Normal structures
  - Extensor retinaculum

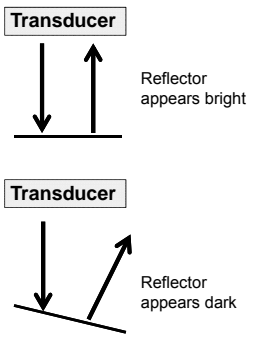
### Pitfalls

- Muscle
  - Appears hypoechoic
  - Not fluid



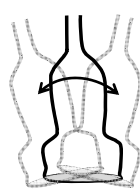
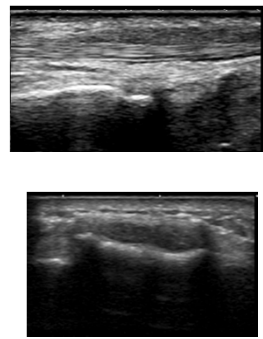
### Pitfalls

- Anisotropy
  - Beam reflected away from transducer if probe not perpendicular to the structure
  - Appears hypoechoic



### Pitfalls

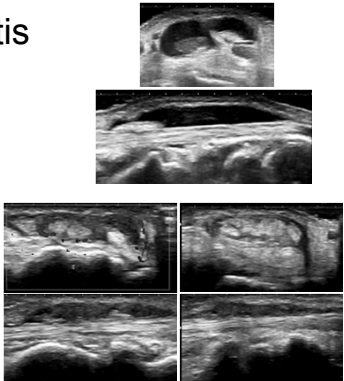
- Solution:
  - Heel toe transducer in longitudinal
  - Rock transducer in transverse

# Common Pathologies

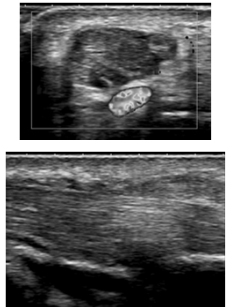
## Tenosynovitis

- Distention of tendon sheath with fluid or synovial hypertrophy
- Possible hyperemia



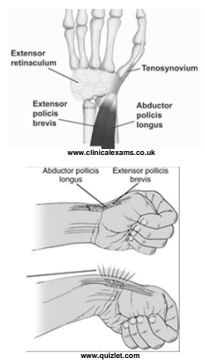
## Tendinosis

- Hypoechoic tendon enlargement
- Variable hyperemia



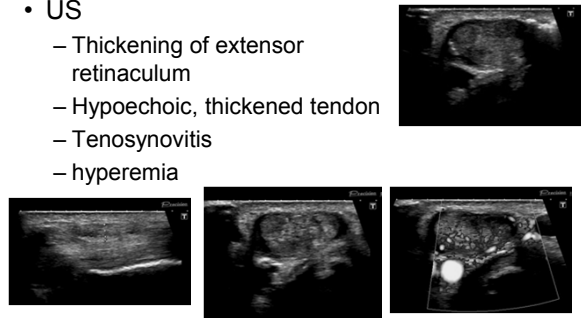
## De Quervain's Disease

- Repetitive thumb movements
- Pain over radial styloid
- Positive Finkelstein test
- Cmpt 1 tendons
  - APL
  - EPB
  - Extensor retinaculum




## De Quervain's Disease

- US
  - Thickening of extensor retinaculum
  - Hypoechoic, thickened tendon
  - Tenosynovitis
  - hyperemia



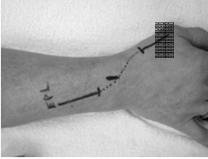
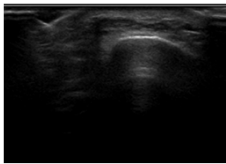
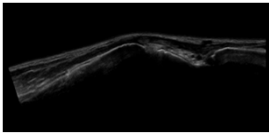
## Tendon Tear

- Partial thickness tear
  - Incomplete anechoic cleft
- Full thickness tear
  - Complete discontinuity with retraction of tendon ends
- Dynamic assessment improves accuracy
- Pitfall:
  - Some tendons can have multiple tendon slips (APL)



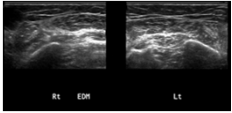
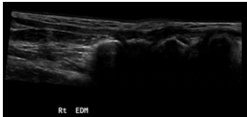
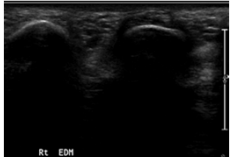
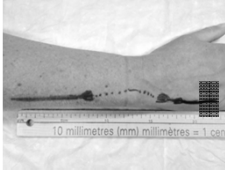
### Tendon Tear

- EPL Tear
- Common to occur at Lister's tubercle


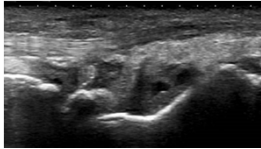
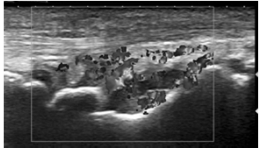
### Tendon Tear

- EDM Tear



### Arthritis - Inflammatory

- Hallmark is synovial hypertrophy
- Usually hypoechoic
- "Synovitis" when hyperemia on power or color Doppler


### Arthritis - Inflammatory

- Erosions
- Can see at various joints
- Look for early changes at ulnar styloid


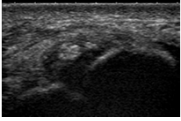
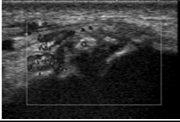
### Arthritis - Depositional

- Crystals deposit around joints, ligaments, tendons
- Gout, CPPD, HADD
- HADD – calcific periarthritis
  - Monoarticular
  - May have antecedent trauma
  - Painful – simulate infection
  - PF – periarticular calcifications



### Arthritis - Depositional

- HADD – calcific periarthritis
- US
  - Echogenic calcium deposits at joint margin
  - Hypoechoic synovial thickening
  - Hyperemia

### Arthritis - Depositional

- CPPD
- US
  - Echogenic calcium deposits at joint margin
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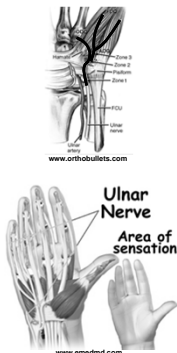
### Arthritis - OA

- Common location at wrist
- 1<sup>st</sup> CMC and STT
- Osteophytes
- +/- effusion/synovitis
- PF correlation



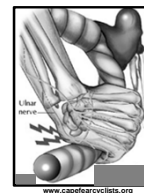
### Neuropathy – Ulnar Nerve

- Ulnar Tunnel Syndrome  
Guyon's Canal
  - Symptoms depend on location of compression/injury
  - 3 zones
  - Numbness & pain 5<sup>th</sup> finger and ulnar 1/2 of 4<sup>th</sup> finger
  - Weakness intrinsic muscles



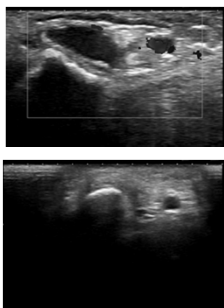
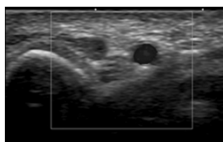
### Neuropathy – Ulnar Nerve

- Ulnar Tunnel Syndrome  
Guyon's Canal
- Causes:
  - Compression of ulnar n.
  - Cyclists (handlebar palsy)
  - Trauma - hook of hamate #
  - Inflammatory arthritis
  - Ganglion cyst



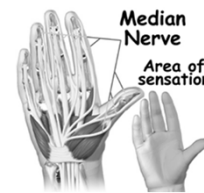
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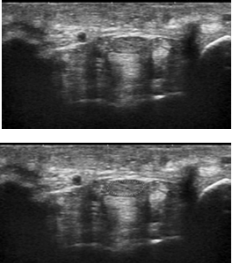
### Neuropathy – Median Nerve

- Carpal Tunnel Syndrome
  - Numbness & Pain median n. distribution
  - First 3 1/2 digits
  - Trauma, repetitive use, arthritis, pregnancy, SOL



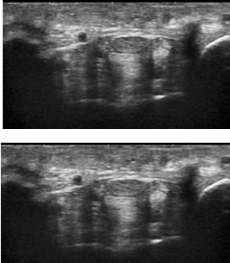
### Neuropathy – Median Nerve

- Carpal Tunnel Syndrome
- US
  - Hypoechoic enlarged nerve at and prox to retinaculum
  - Measure at level of pisiform & Flexor retinaculum



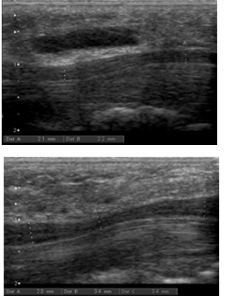
### Neuropathy – Median Nerve

- Measurements variable:
  - <math>< 8 \text{ mm}^2</math> – normal
  - 8 – 12  $\text{mm}^2</math> – borderline$
  - >12  $\text{mm}^2</math> – abnormal$
- Compare area proximal and distally where enlarged:
  - Enlargement  $\geq 2\text{mm}^2$  (90% sensitivity and 100% specificity)



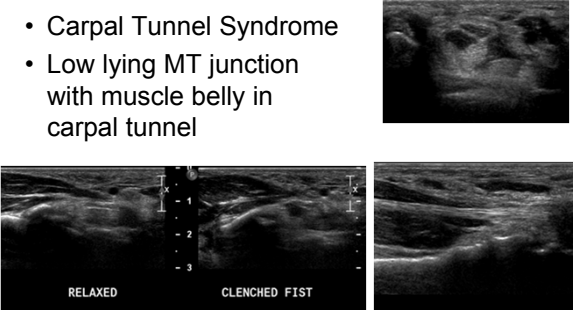
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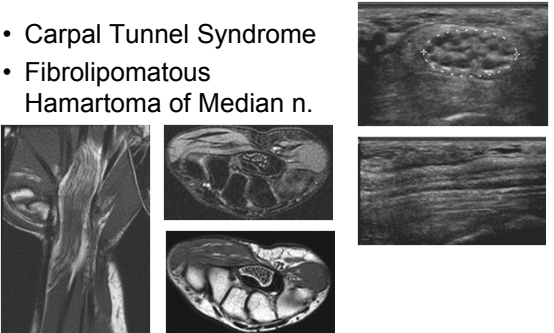
### Neuropathy – Median Nerve

- Carpal Tunnel Syndrome
- Low lying MT junction with muscle belly in carpal tunnel



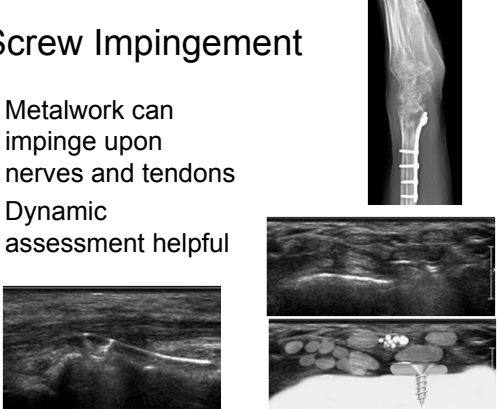
### Neuropathy – Median Nerve

- Carpal Tunnel Syndrome
- Fibrolipomatous Hamartoma of Median n.



### Screw Impingement

- Metalwork can impinge upon nerves and tendons
- Dynamic assessment helpful





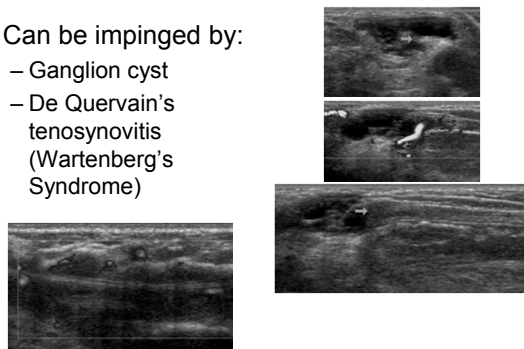
### Neuropathy – Radial Nerve

- Superficial branch innervates dorsum of hand



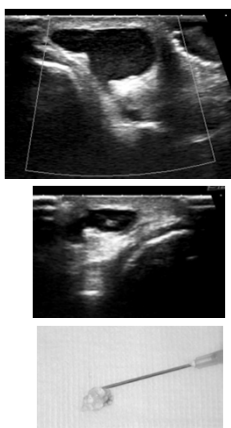
### Neuropathy – Radial Nerve

- Can be impinged by:
  - Ganglion cyst
  - De Quervain's tenosynovitis (Wartenberg's Syndrome)



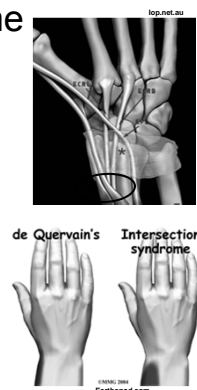
### Ganglion Cysts

- Arise from joints or tendons
- Thin connective tissue capsule, no synovial lining
- Gelatinous fluid
- Rx: aspiration and/or steroid injection
- Can recur

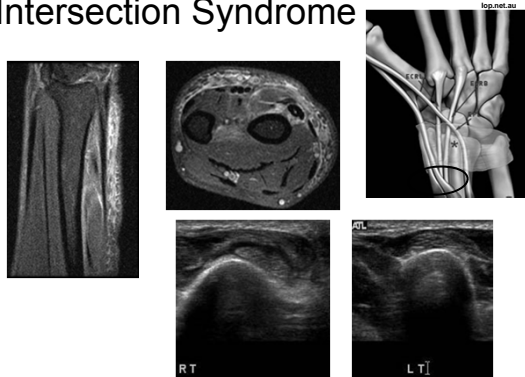


### Intersection Syndrome

- Overuse tenosynovitis
- Occurs around the intersection of the 1<sup>st</sup> (APL, EPB) and 2<sup>nd</sup> (ECRL, ECRB) cmpts within forearm
- Weightlifters, rowers, racket sport players



### Intersection Syndrome

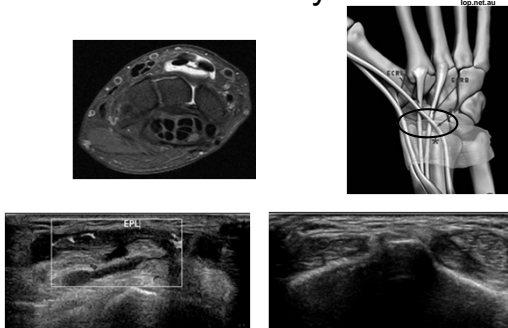


### Distal Intersection Syndrome

- Tenosynovitis of the 3<sup>rd</sup> (EPL) and 2<sup>nd</sup> compartments
- Distal to Lister's tubercle
- Tendon sheaths connected by foramen
- Inflammation of one compartment spreads to other

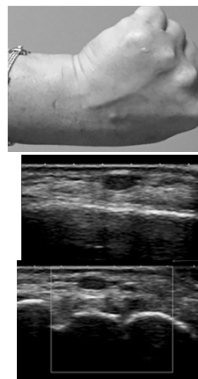


### Distal Intersection Syndrome



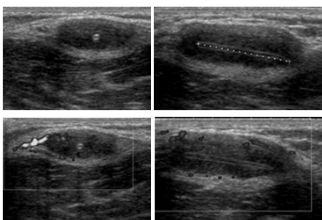
### Implantation Dermoid

- Hx previous puncture
- Implantation of epidermal fragments into dermis
- Grows and forms cyst lined with squamous epithelium
- Small, painless nodule
- US
  - Hypoechoic
  - No hyperemia



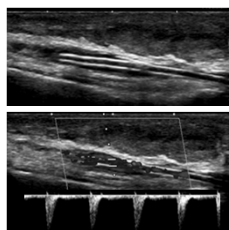
### Foreign Bodies

- History may or may not be provided
- Can cause swelling, redness, hematoma, hyperemia



### Foreign Bodies

- PF for radiopaque FB



### Summary

- Reviewed anatomy of the wrist including flexor/extensor compartments
- Described an approach to ultrasound examination of the wrist
- Reviewed common uses and pathologies for wrist ultrasound

The End

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## References

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