US of the Hand and Wrist
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Sonographic technique
- Benign soft tissue lesions
- Tenosynovitis
- Inflammatory arthritis
- Tendon injuries
- Foreign bodies

Sonographic Technique
- High frequency transducer
- Tissue harmonic imaging
  - ↑ tissue contrast and spatial resolution
  - ↓ side lobe and noise artifact
- Color/power Doppler
  - Hyperemia
  - Tumor vascularity

Positioning
- Patient seated facing physician
- Wrist placed on an adjustable stand in neutral position

Scan technique
- Directed, dynamic study
- Longitudinal, transverse views
- Gel

Benign Soft Tissue Lesions
- Ganglion
- Giant cell tumor
- Fibroma
- Hemangioma
- Nodular fasciitis
- Epidermal cyst
- Lipoma
- Nerve tumor
- Glomus tumor

Ganglions
- Most common hand lesion
- Mucin-filled, fibrous-lined cyst
- Etiology unclear
  - Stress on joint capsule, ligaments stimulates mucous production → ganglion
  - Arise from tendon sheaths, ligaments, joints, bone

Dorsal ganglion (60-70%)
- Arises from the joint capsule where it attaches to SL ligament
- Tiny duct pierces SL ligament and connects SL joint with the main cyst

Athanasian, Bone and Soft Tissue Tumors in Green's Operative Hand Surgery, 5th ed., pp 2221-2237

- Sonographic findings
  - Simple (38%)
    - Anechoic, unilocular, thin wall, no color Doppler flow
  - Complex (57%)
    - Multiloculated, thick wall, debris, color Doppler flow (rare)
  - Solid appearing (5%)

Teeffy, AJR 2008; 191:716-720

Volar wrist ganglion (18-20%)
- Origin
  - Capsule of radio-scaphoid joint
  - Capsule of scapho-trapezial joint
  - FCR tendon sheath


Flexor tendon sheath (volar retinacular) ganglion (10-12%)
- Usually arise from A1 pulley (MCP) or A2 pulley (PP)
- Attached to the tendon sheath
  - No cyst movement with flexor tendon motion

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FTS ganglion
volar, proximal phalanx (A2)

Mucous cyst
- Ganglion that arises from the DIP joint
- Associated OA
- Dorsal, distal to DIP joint
- Nail deformity from pressure on the nail matrix

Mucous cyst
dorsal, 1st digit

GCT of the tendon sheath
- 2nd most common hand lesion
- Benign soft tissue tumor
- Cells resemble synoviocytes
- Arise from tendon sheath
  - No tumor motion with flexion
- Signs/symptoms
  - Slowly enlarge, nontender

GCT of tendon sheath
- Location
  - Volar surface
  - Dorsal locale not uncommon
- Sonographic findings
  - Hypoechoic, homogeneous
  - Posterior acoustic enhancement
  - Well-defined margins
  - Internal vascularity
  - Adjacent bony erosion

Middleton, AJR 2004; 183: 337-339
Hemangioma
- 10% of benign hand tumors
- Capillary (most common in infancy), cavernous
- Subcutaneous
- Signs/symptoms
  - Slowly growing, painless
  - Bluish discoloration of skin

Olsen, Radiographics 2004; 24:849-854
Paltiel, Radiology 2000; 214:747-754

- Sonographic findings
  - Hypoechoic, solid
  - Phleboliths (rare)
  - Rubbery, compressible
  - Well-defined margins
  - Hypervascular
  - Low resistance arterial flow

Glomus tumor
- <5% of hand tumors
- Arises in dermis from glomus body
  - Regulates temperature/blood flow in digits
  - Subungual, finger tip
- Signs/symptoms
  - Light touch, cold exposure → paroxysmal pain
  - Bluish discoloration beneath nail

Koman, Vascular Disorders in Green’s Operative Hand Surgery. 5th ed., pp 2312

- Sonographic findings
  - Hypoechoic, solid
  - Slight posterior acoustic enhancement
  - Well-defined margins
  - Hypervascular
  - Subjacent cortical erosion

Baek, Radiographics 2010; 30:1621-1636
**Peripheral nerve sheath tumor**
- Schwannoma, neurofibroma, malignant PNST
  - Benign or malignant
  - Schwann cell origin
  - Slow-growing, painless
  - Schwannoma: flexor surface of forearm/hand (ulnar n.)

**Sonographic findings**
- Hypoechoic (most common), heterogeneous, target sign
- Posterior acoustic enhancement
- Peripheral nerve continuity
  - Difficult to distinguish schwannoma, NF, PNST
  - Eccentric versus central
  - Internal vascularity

**Ganglioneuroma - ulnar n.**

**Lipoma**
- Most common soft tissue tumor
  - Subcutaneous, intramuscular in the hand
  - Signs/symptoms
    - Slow growth, rubbery, mobile, nontender?
    - Nerve compression symptoms if in deep palmar space

**Sonographic findings**
- Elongate
- Thin capsule or ill-defined
- Hyperechoic, isoechoic, hypoechoic to muscle
- Septations
- If significant ↑ in size → MRI

**Lipoma**
- 1st digit, thenar eminence
Epidermal cyst
- Dermal or subcutaneous epithelial cyst containing keratin
- Etiology
  - Displaced embryonic epi. rests in hair-bearing areas
  - Traumatic implantation of epithelial cells into fingertip
  - Occlusion of pilosebaceous unit
- Firm, slow-growing, ± pain

Huang, J Ultrasound Med 2011; 30:11-17

Epidermal inclusion cyst

volar, 3rd digit

Khuu, J Ultrasound Medicine 2014; 33:565-573

- Sonographic findings
  - Pseudotestis appearance
    - Homogeneous, hypoechoic, linear anechoic areas, echogenic foci
  - Heterogeneous, cystic spaces, concentric rings
  - Posterior acoustic enhancement
  - Focal protrusion into the dermis

Huang, J Ultrasound Med 2011; 30:11-17

Nodular fasciitis
- Benign soft tissue tumor
  - Fibroblastic/myofibroblastic cells, fibromyxoid matrix
- Location
  - Volar forearm, LE, hand (rare)
  - Subcu, intra/intermusc, fascia
- Signs/symptoms
  - Rapidly-growing, tender/pain

Khuu, J Ultrasound Medicine 2014; 33:565-573

- Sonographic findings
  - Well-defined, lobular
  - Hypoechoic, heterogeneous
  - Posterior acoustic enhancement
  - Increased color Doppler flow
  - Attached to deeper fascia
  - Differential
    - Sarcoma

Nikolaidis, JUM 2006; 25: 281-285
Khuu, J Ultrasound Medicine 2014; 33:565-573
**Tenosynovitis**

- Inflammation of the synovial lining
  - Idiopathic
  - Inflammatory arthritis
  - Crystalline tendinopathy (gout, calcific tenosynovitis)
  - Deposition diseases (amyloidosis)
  - Infectious

**Sonographic findings**
- Sheath fluid/debris
- Sheath thickening, nodularity
- Hypervascularity
- Cellulitis (infectious tenosynovitis)

**Complications**
- Tendonitis
- Tendon rupture

**Idiopathic tenosynovitis**

**Rheumatoid arthritis**

**Flexor tendon avulsion**
- Forced extension of digit during maximum contraction of profundus muscle → avulse FDP
- Inability to flex DIP joint
- Young male athletes
**Foreign Bodies**

*Penetrating injuries*
- Radiopaque (radiograph)
  - Glass, metal, stone
- Radiolucent (US)
  - Wood

*Sonography*
- High sensitivity - 90-94%
- High specificity - 97-99%

*Sonographic technique*
- Transducer perpendicular to long axis of the foreign body

Jacobson, Radiology 1990; 206: 45-48
Bray, J Hand Surg 1995; 20A: 661-666

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**Sonographic findings**
- Absence of flexor tendon
- FDP tendon avulsion classification
  - Retraction into palm
  - Retraction to PIP joint (A3 pulley)
  - Retraction to distal MP (A4 pulley)
  - Bony fragment

Boyer, Flexor Tendon Injury in Green's Operative Hand Surgery, pp 226

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**Sonographic findings**
- Glass, metal
  - Comet-tail artifact
    - Smooth surface: sound wave returns along same path
- Wood
  - Echogenic with posterior shadowing
    - Rough surface: sound wave reflected in dif. directions

Rubin, Radiology 1991; 181: 231-236

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**Glass foreign bodies**

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**Sonographic findings**
- 5th digit retracted tendon - PP

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**FDP rupture**
**Summary**

US is an excellent test to evaluate the hand and wrist. Patient history, lesion shape, location, signs/symptoms, sonographic findings can help to provide an accurate diagnosis.