Ultrasound of the Foot and Ankle

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Outline:
- Tendon Pathology
- Ligament Pathology
- Inflammation
- Masses

Tibialis Posterior Tendon:
- Medial malleolus
  - Longitudinal split
  - Complete tear: rheumatoid arthritis
  - Subluxation: retinaculum injury
- Navicular
  - Avulsions: diabetic

Tenosynovitis: US
- Fluid distending tendon sheath
  - Anechoic or hypoechoic
  - May be heterogeneous, complex
- Synovial proliferation:
  - Hypoechoic
  - May be isoechoic to tendon
  - Variable flow on color Doppler imaging

Tenosynovitis: ankylosing spondylitis

Short Axis
Tendinosis
- Tendon degeneration
- Not tendinitis: no acute inflammation
- Swollen, hypoechoic tendon
- Unlike tear:
  - Tendon fibers still continuous
  - No defined clefts

Partial-thickness Tear: tibialis posterior

Full-thickness Tear: tibialis posterior

Peroneal Tendon Pathology:
Retrospective: 40 patients with surgery:
- 88% peroneus brevis tear
- 37% peroneus brevis + longus tears
- 33% low lying peroneus brevis muscle
- 20% tendon subluxation
- 13% peroneus longus tear

J Foot Ankle Surg 2003; 42:250
Longitudinal split: peroneus brevis

Fibula
PL

Calcaneus
CFL

Transverse: proximal
Transverse: distal

Peroneal Tendon Tears: US

- 54 tendons (5 peroneal): surgery
  - US: 100% sensitivity, 93% accuracy
- 60 peroneal tendons: surgery
  - US: 100% sensitivity, 90% accuracy

1 Waitches et al. JUM 1998; 17:249
2 Grant et al. 2005; 87:1788

Peroneal Retinaculum

Rosenberg et al. AJR 2003; 181:1551

Peroneal Tendon:

- Subluxation: partially displaced from retromalleolar groove
- Dislocation: completely displaced
- Anterior and lateral to fibula
- Implies retinaculum injury

Peroneal Tendon Subluxation:

- Abnormal movement may only occur dynamically
- Predisposes to peroneal tendon tears
  - Longitudinal split of peroneus brevis
- US: examine with dorsiflexion / eversion
  - 100% accurate diagnosis with US

Neustadter et al. AJR 2004; 183:985
Peroneal Subluxation: *dynamic imaging*

**Posterior**

**Anterior**

**Transverse**

Dislocation: peroneus brevis & longus

**Anterior**

**Posterior**

**Short axis**

Intrasheath Subluxation

- Abnormal snapping of peroneal tendons
- No lateral displacement, intact retinaculum
- Associations:
  - Convex posterior fibula in 92%
  - Tendon tear in 86%
  - Low lying peroneus brevis muscle in 71%


*J Foot Ankle Surg* 2009; 48:323

Intrasheath Subluxation

**Transverse**

Achilles Tendon:

- 2 – 6 cm proximal to insertion
  - Tendinosis
  - Full-thickness tear
- Calcaneal attachment
  - Tendinosis, tear
  - Haglund Syndrome

Tendinosis: Achilles

**Longitudinal** power Doppler
Achilles Tendon: partial-thickness tear

Achilles Tendon: full-thickness tear

Achilles Tendon: complete tear

- Pitfall: intact plantaris tendon
  - Medial aspect of Achilles tendon
  - Misinterpreted as intact Achilles fibers

Radiology 2001; 220:406

Achilles FTT + Intact Plantaris

Achilles Tendon: complete tear

- Dynamic imaging: look for
  - Widening of gap with passive dorsiflexion
  - Lack of tendon movement across tear
Achilles Tendon: *healing tear*

**Plantar Fascia:**
- Fasciopathy
  - Central cord, proximal
  - Degenerative, tendinosis-like, tear
- US:
  - Hypoechoic, thickened > 4 mm
  - Painful with transducer pressure


**Plantar Fasciitis**

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**Ligament Tear:**
- Hypoechoic & thickened
- Acute: anechoic fluid tracking through defect indicates full-thickness tear
- Cortical avulsion: hyperechoic

**Trauma: ligament**
- Lateral:
  - Anterior talofibular: isolated tear in 66%
  - Calcaneofibular
    - 20% calcaneofibular + anterior talofibular
  - Posterior talofibular: dislocation
  - Anterior tibiofibular: high ankle sprain

Anterior Talofibular Ligament Tear

Calcaneofibular Ligament Tear

Anterior Inferior Tibiofibular Ligament Tear

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Tibiotalar Joint: effusion
- Anterior evaluation most sensitive
- Plantar flexion
- Hyperechoic fat pad displaced by anechoic or hypoechoic fluid
- Sensitivity: MRI > US > PF

AJR 1998; 170:1231
**Septic Joint:**

- Anechoic or hypoechoic distention of joint recesses
- May be hyperechoic if complicated
  - Possible synovitis
- US or color Doppler cannot distinguish between septic and aseptic effusion*

*Strouse et al. Radiology 1998; 206:731

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**Synovitis: color flow**

RA Ankle
- No flow

RA ankle
- Positive flow

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**Rheumatoid Arthritis**

Erosion + Synovitis

Normal

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**Bursitis:**

- Specific bursa:
  - Retrocalcaneal
  - Superficial tendo-Achilles
- Adventitious bursa
  - Sites of pressure contact
  - Plantar aspect of foot
Bursitis and Erosion: Rheumatoid Arthritis

Gout:
- Joint effusion / synovial hypertrophy
- Double contour sign:
  - Monosodium urate crystal icing on cartilage
- Tophi:
  - Hyperechoic with hypoechoic rim
- Erosions:
  - Adjacent to tophi
  - Medial 1st metatarsal head

Gout: tophus and intra-articular microtophi

Gout: Double Contour Sign

Gout: tibialis posterior tendon

Outline:
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Plantar Fibromatosis:
- Hypoechoic mass or masses
- Plantar subcutaneous tissues
- May invade aponeurosis
- Non-specific: except if bilateral

J Clin Ultrasound 1991; 19:578

Morton Neuroma:
- Hypoechoic 5 mm mass
  - Sensitivity: 100% ; Specificity: 83%
- Digital nerve continuity
  - Excludes other causes for mass
- Compression:
  - Produces symptoms
  - Bursa (compressible) vs. neuroma (not compressible)

Redd et al. Radiology 1989; 171:415
Quinn et al. AJR 2000; 174:1723

Morton Neuroma: nerve continuity
Proximal Distal
Longitudinal

Dynamic: Morton Neuroma + Bursa
Dorsal Mulder's Maneuver
Take Home Points

• Know where tendon pathology is commonly located
• If concern for infection: aspirate
• Gout: specific findings
• Dynamic imaging
  – Peroneal subluxation
  – Achilles tear
  – Morton neuroma

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