Ankle Ultrasound: Diagnosis and Intervention

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Outline:
• Tendon Pathology
• Ligament Pathology
• Inflammation
• Masses

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

Tenosynovitis: ankylosing spondylitis

Tendon Sheath: injection
• Short axis to tendon
• Anterior or posterior
• Deep to tendon:
  – Decreased risk of depigmentation, fat atrophy
• 100% accurate


Tendon Sheath: injection

Tibiap PF

PTT
**Tendinosis**

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

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**Partial-thickness Tear: tibialis posterior**

**Peroneus Brevis Split Tear**

**Peroneal Retinaculum**

*Rosenberg et al. AJR 2003; 181:1551*

**Peroneal Subluxation:** *dynamic imaging*
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 Bone Joint Surg Am 2008; 90:992
J Foot Ankle Surg 2009; 48:323

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: fenestration

- Sagittal
Achilles: hyperosmolar dextrose

Achilles Tendon
- Randomized controlled: 54 patients
- PRP versus saline injection
- No significant difference in outcomes
  - At 24 weeks
  - At 1 year
  - *Both groups: eccentric physical therapy

1 de Vos RJ et al. JAMA 2010; 303:145

Achilles Tendon: partial-thickness tear

Achilles Tendon: complete tear
- Full-thickness fiber disruption
- Herniation of hyperechoic fat into tendon gap
- Posterior shadowing at torn tendon ends
- Non-surgical management:
  - >5 mm diastasis: worse outcomes
  - >10 mm diastasis: higher re-tear rate

1 Hartgerink, P et al. Radiology 2001; 220:406

Achilles Tendon: full-thickness tear

Achilles Tendon: complete tear
- Dynamic imaging: look for
  - Widening of gap with passive dorsiflexion
  - Lack of tendon movement across tear
  - Determine if ends approximate
- Pitfall: misinterpretation of intact plantaris as Achilles fibers
Achilles Tendon: *dynamic imaging*

Long Axis

Achilles Tendon: *healing tear*

Prox Distal

Longitudinal

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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

Calcaneofibular Ligament Tear

Patient #1
- Normal

Patient #2
- Short Axis

Inferior Tibiofibular Ligament
- Several bands
- Accessory inferior band (Bassett ligament)
  - Seen in 80 – 90%; more horizontal
  - Potential site of impingement

Calcaneus

Anterior Inferior Tibiofibular Ligament Tear

Fibula
Tibia

Longitudinal
Axial T2w

Maisonneuve Fracture

Transverse
Normal
Fibular Fracture

Durkee, J Ultrasound Med 2003; 22:1369

Deltoid Ligament Tear

Talus

Normal
Spring Ligament Complex

- Calcaneonavicular ligament
  - Superomedial
  - Perpendicular to distal PTT
  - Mediplantar oblique
  - Inferoplatar longitudinal

Harish, Skeletal Radiol 2007; 36:221

Spring Ligament Complex:

- Superomedial component
- Normal: hyperechoic, 2.8 – 3.4 mm thick

Harish, Skeletal Radiol 2007; 36:221

Superomedial Calcaneonavicular Ligament

- Associated with PTT dysfunction
- Abnormal: hypoechoic, thick > 4 mm, thinned or disrupted

Harish, J Ultrasound Med 2008; 27:1145

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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

Effusion: tibiotalar joint

Sagittal
**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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**5th Metatarsal Phalangeal Joint: septic**

- Sagittal
- Coronal

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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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**Ankle Joint**

- Anterior joint recess
- In plane
- Transducer: sagittal
- Needle: inferior to superior

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**Bursitis and Erosion: Rheumatoid Arthritis**

- Achilles
- Calcaneus
- Erosions
Retrocalcaneal Bursa
- Injection
- Medial to lateral
- Short axis to Achilles
- Needle perpendicular to ultrasound beam

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

Tibiotalar Joint Effusion: gout

Gout: tophus and intra-articular microtophi

Gout: Double Contour Sign

Tophi
- Ultrasound\(^1\): specific
  - Hyperechoic heterogeneous with hypoechoic rim
  - “wet clump of sugar” appearance
  - Variable shadowing: even without calcification
- MRI\(^2\): non-specific
  - T1w: low to intermediate
  - T2w: heterogeneous mixed signal
  - Heterogeneous enhancement

\(^1\)Fernandes et al. Skeletal Radiol 2011; 40:309
Gout: tibialis posterior tendon

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Soft Tissue Ganglion:
- Well-defined, lobular
- Often multilocular
- Hypoechoic to anechoic
- Increased through-transmission
- Joint or tendon sheath communication

Ganglion Cyst: tarsal tunnel syndrome

Dynamic Evaluation
- Compression
  - Between transducer and palpation
  - Bursae (dorsal) compress, neuromas (plantar) do not
- Sonographic Mulder Sign
  - Scan plantar: coronal plane
  - Neuroma displaces: plantar
  - Palpable click

Torriani M et al. AJR 2003; 180:1121
Zanetti M et al. Radiology 1997; 203:516

Dynamic imaging: Mulder’s Maneuver
Take Home Points

- Effusion: anterior recess
- If concern for infection: aspirate
- Gout: specific findings
- Dynamic imaging
  - Peroneal subluxation
  - Achilles tear
  - Morton neuroma

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