Objectives

- Outline technique for scanning the posterior, medial, lateral, and anterior ankle
- Review normal appearance and abnormalities of ankle tendons (tendinosis, tenosynovitis, tear)
- Review abnormalities of ankle ligaments (sprains)
- Review plantar fascia abnormalities, Morton neuromas, foot joint arthropathy

Technique: Ankle scanning

- Posterior
- Medial
- Lateral
- Anterior

Technique

- High frequency linear transducers
- 10 MHz or higher
- “Hockey stick” (15-17MHz) helpful

Technique

- Posterior
  - Achilles tendon
  - Retrocalcaneal bursa, retroAchilles bursa
Ultrasound Appearance of Normal Tendons

- echogenic
- fibrillar, striated pattern in long axis
- no internal vascular flow
- anisotropy – artifact, tendon appears hypoechoic

Ankle Tendon Anisotropy (transverse image)

Achilles Tendon

- most commonly injured tendon
- no sheath
- normal AP thickness 5-6 mm

Normal Achilles Tendon Insertion - longitudinal

Normal Achilles Tendon - transverse

probe position for longitudinal view Achilles
**Tendinosis ("tendinitis")**
- thickened, heterogeneous tendon
- nodular hypoechoic areas
- interstitial tears (small anechoic areas)
- +/- vascular flow
- +/- calcifications

**Midsubstance Achilles Tendinosis**

**Achilles Tendinosis**

**Achilles Insertional Tendinosis**

**Partial Achilles Tendon Tear**
- may be a difficult clinical diagnosis
- hypoechoic/anechoic defect
- may be increased flow in the tear

**Partial Thickness Tear at the Achilles Insertion**
**Partial Intrasubstance Achilles Tear**

**Complete Achilles Rupture**
- "weekend warriors" (usually have underlying tendinosis)
- anechoic gap in tendon, retraction
- volume loss
- hematoma and fat may occupy torn area

**Full Thickness Achilles Tear**

**Pitfall in Achilles Tears:**
- do not mistake plantaris tendon for intact Achilles fibers
- small tendon at the medial aspect of the Achilles tendon

**Retrocalcaneal Bursitis**

**Technique for the Medial Ankle**
**Medial Ankle – Flexor Tendons**

- Posterior tibial tendon (PTT)
- Flexor digitorum longus tendon
- Neurovascular bundle
- Flexor hallucis longus tendon

**Posterior Tibial Tendon (PTT)**

- Normal PTT 1.5 - 2 x size of FDL
- Image in two segments
  - Above and behind medial malleolus
  - From medial malleolus to navicular insertion

**Normal Distal PTT**

**Posterior Tibialis Tendon (PTT) Abnormalities**

- Tendinosis
- Tenosynovitis
- Partial tear
- Full thickness tear
**Posterior Tibialis Tendinosis**

- Inflammation of tendon sheath
- US: Abnormal fluid and/or thickening of tendon sheath
- +/- doppler flow

**Partial Tear of PTT**

- Medial malleolus
- Transverse
- Longitudinal

**Full thickness PTT tear: EFOV**

**Patient with medial ankle pain after fracture fixation**

**Screw impinging on PTT**
Lateral Ankle

- Peroneus longus tendon
- Peroneus brevis tendon
- Anterior talofibular ligament
- Calcaneofibular ligament
- Anterior tibiofibular ligament

Peroneal Tendons - Technique

Normal Peroneal Tendons (transverse)

Normal Peroneal Tendons: Longitudinal

Brevis is near the Bone

Normal Distal Peroneus Brevis

Peroneus Brevis “Split” Tear
Peroneus Brevis Interstitial Tear

Avulsion Fracture at Peroneus Brevis insertion (base of 5th metatarsal)

Peroneal Tendon Subluxation/Dislocation
- injury to peroneal retinaculum
- tendons exit groove anteriorly
- usually elicited with dorsiflexion and eversion

Peroneal Tendon Dislocation

Peroneal Intrasheath Subluxation
- exaggerated motion of the peroneal tendons within peroneal retinaculum
- can be associated with pain and popping sound/sensation
- can predispose to tenosynovitis and tears
Intrasheath Peroneal Subluxation

Ultrasound – ankle ligaments

Normal ligaments:
- echogenic
- fibrillar

Anterior Talofibular Ligament (ATFL)

- most commonly injured ankle ligament
- spectrum of injury from mild sprain to complete tear
- may see associated avulsion fracture

ATFL sprain

Ligament Sprains:
- hypoechoic
- +/- thick
- loss of fibrillar pattern

Normal Calcaneofibular Ligament (CFL)

peroneal tendons (anisotropy)

CFL sprain

- abnormal signal/loss of fibrillar pattern
CFL sprain (comparison with normal side)

- Left CFL sprain (thick, hypoechoic)
- Normal right CFL

Anterior Ankle Technique

- Transverse
- Longitudinal

Normal Ankle Joint (longitudinal)

- Tibia
- Talus

Ankle Joint Effusion

- Tibia
- Talus

Anterior Ankle – extensor tendons

- Anterior ankle joint
- Tibialis anterior tendon
- Extensor hallucis longus
- Extensor digitorum longus

Tibialis Anterior Tendon Tear (full thickness)

- Retracted tendon
- Distal tendon
- Torn, retracted tendon
**Foot: Plantar Fasciitis**
- Painful condition, common in runners
- US diagnosis:
  - thickening of fascia (>4mm) at calcaneal attachment
  - heterogeneity
  - partial tears
  - calcification/calcaneus spurs

**Plantar Fascia: Anatomy**

**Normal Plantar Fascia**
- calcaneus to toes
- longitudinal

**Plantar Fasciitis**
- thick plantar fascia (>4mm), tender
- hypoechoic, +/- anechoic interstitial tearing
- +/- vascular flow

**Plantar Fibromas**
- hypoechoic masses
- emanate from the plantar fascia
distal to calcaneal attachment (vs. fasciitis)
- can be multiple, heterogenous, +/- vascular flow
tender or nontender
Small plantar fibroma

Key to distinguishing from fasciitis is location! Fibromas are usually distal to the calcaneal attachment of the fascia.

Foot Joints-Metatarsal Phalangeal Osteoarthritis

Intermetatarsal (Morton) Neuroma

- fibrous tissue around digital nerve
- imaged from the plantar or dorsal aspect of the interspace
- usually requires 12 mHz probe
- hypoechoic, noncompressible, tender

Plantar Wart

- involve epidermis and dermis
- hypoechoic, grow inward
- usually painful
- absent, moderate, or high vascularity

Conclusions

- US is an effective tool for diagnosing a range of foot and ankle abnormalities
- First line modality for imaging:
  - Tendons, especially dynamic abnormalities
  - Ligaments
  - Plantar fasciitis
  - IM neuromas

Thank you!