Joint, Ligament, Nerve Entrapments

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Outline
• Joint pathology
  – Effusion, infection, inflammatory arthritis
• Ligament pathology
  – Anterior talofibular, calcaneofibular, tibiofibular
• Nerve entrapment
  – Tibial nerve
  – Morton neuroma

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

Jacobson, JA et al. AJR 1998; 170:1231

Pitfall: normal hyaline cartilage

Effusion: tibiotalar joint

Aspiration
Intraarticular Body

Synovitis: anterolateral impingement

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

Septic Joint: talonavicular

Septic Joint: work up
- If anechoic fluid: aspirate
  - Avoid overlying cellulitis and tenosynovitis
- If hypoechoic / heterogeneous:
  - Aspirate and lavage if needed
- If no distention:
  - Depends on clinical suspicion
  - Follow-up in 24 hours or lavage
Complicated Fluid vs. Synovium
• Both may appear hypo- or isoechoic
  Findings that suggest effusion:
  • Displacement with transducer pressure
  • Joint recess collapse w/ joint movement
  • Negative flow on color Doppler imaging

Inflammatory Arthritis
• Non-specific findings:
  – Joint effusion
  – Synovitis: hyperemia
  – Erosions: pitfalls
• Rely on history, lab values, and
distribution of abnormalities

Inflammatory Arthritis:
• Gout: 1st MTP joint, others (tarsal)
• Rheumatoid:
  – MTP joints (especially 5th)
  – PIP and 1st IP joints
• Seronegative: reactive arthritis
  – Variable joint distribution
  – Inflammatory enthesopathy

Gout:
• Monosodium urate crystals:
  – Negative birefringence
• Stages:
  – Asymptomatic hyperuricemia
  – Acute gouty arthritis
  – Interval asymptomatic phase
  – Chronic tophaceous gout

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: synovitis

Gout: Double Contour Sign

Gout: tophus

Rheumatoid Arthritis

Rheumatoid Arthritis

• 5th metatarsal head
  - Most common site for involvement
  - Supplement dorsal evaluation with lateral and plantar view

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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

Patient #1

Patient #2

Long Axis

Ligament Tear:

- Anterior inferior tibiofibular ligament:
  - Look for interosseous membrane tear if absent lower fibular fracture
  - Maisonneuve fracture

Maisonneuve Fracture

Transverse Normal Fibular Fracture

Durkee, J Ultrasound Med 2003; 22:1369

Deltoid Ligament Tear

Deltoid Ligament Tear: remote

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**Tibial Nerve (TN)**

- Bifurcates in tarsal tunnel (distal tibia)
  - Medial plantar nerve (MPN)
  - Lateral plantar nerve (LPN)
- Plantar nerves divide into interdigital nerves
  - Motor branches: muscles of sole of foot
  - Sensory: digits (via common and proper plantar digital nerves)

Martinoli, RadioGraphics 2000; 20:S199

**Tarsal Tunnel Syndrome**

- Entrapment of tibial nerve
  - Ganglion cyst: most common
  - Varicose veins, tenosynovitis
  - Trauma, deformity, coalition, idiopathic
- Tibial nerve:
  - May appear normal
  - May be hypoechoic and swollen

Nagaoka, J Ultrasound Med 2005;24:1035

**Ganglion Cyst: tarsal tunnel syndrome**

Axial  Sagittal

**Tarsal Tunnel Syndrome: Varices**

**Long Axis**  **Short Axis**

Medial plantar nerve impingement from ganglion cyst originating from middle facet of anterior subtalar joint
**Morton Neuroma:**
- Interdigital nerve entrapment
- Edema, fibrosis, necrosis
- 3rd intermetatarsal space > 2nd
- Sharp, burning pain from metatarsal head to toes
- Females: pliable foot, high-heeled narrow-toed shoes


**Hypoechoic 5 mm mass**
- Sensitivity: 100%; Specificity: 83%
- Accuracy equal to MRI
- Nerve continuity: sagittal plane

**Intermetatarsal bursa**
- Associated with neuroma
- “Neuroma-bursal complex”

Quinn T et al. *AJR* 2000; 174:1723

**Technique:**
- Interdigital space
  - Transducer:
    - Plantar
    - Dorsal
  - Normal digital nerve difficult to visualize
  - Correlate with symptoms

**Morton Neuroma**

**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
Dynamic imaging: Mulder’s Maneuver

Take Home Points

• Joint
  – Anterior recess
  – Effusion versus synovitis
  – Aspirate if concern for infection
• Ligament: anatomy
• Nerve entrapments
  – Tarsal tunnel syndrome
  – Morton: dynamic

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