Knee, Ankle, and Foot: Normal and Abnormal Features with MRI and Ultrasound Correlation

Jon A. Jacobson, M.D.
Professor of Radiology
Director, Division of Musculoskeletal Radiology
University of Michigan

Disclosures

- Consultant: Bioclinica
- Advisory Board: Philips
- Book Royalties: Elsevier
- None are relevant to this talk

Note: all images from the textbook Fundamentals of Musculoskeletal Ultrasound are copyrighted by Elsevier Inc.

Outline

- Knee
  - Joint effusion
  - Extensor mechanism
  - Baker cyst
- Ankle and Foot
  - Achilles
  - Peroneal tendons
  - Morton neuroma

Joint Effusion

- Suprapatellar recess
  - Superior
    - Prefemoral & quadriceps fat pad separation
    - Distends with partial knee flexion
  - Medial and lateral to patella
    - Distends with knee extension
    - Transducer pressure displaces joint effusion

Suprapatellar Recess and Gutters

Outline
- Knee
  - Joint effusion
  - Extensor mechanism
  - Baker cyst
- Ankle and Foot
  - Achilles
  - Peroneal tendons
  - Morton neuroma
Patellar Tendinosis:
• Jumper’s knee
• Hypoechoic swelling
• Mucoid degeneration, possible interstitial tearing
• Hyperemia: neovascularity
• No inflammatory cells

Radiology 1996; 200:821

Patellar Tendon: tendinosis
color Doppler power Doppler

Patellar Tendon: full-thickness tear

Patellar Tendon: full thickness tear
Prox Distal
Longitudinal

Knee Bursae

Prepatellar Bursa: aseptic fluid

Patella
ART
PT
Outline
• Knee
  – Joint effusion
  – Extensor mechanism
  – Baker cyst
• Ankle and Foot
  – Achilles
  – Peroneal tendons
  – Morton neuroma

Baker Cyst:
• Semimembranosus-medial gastrocnemius bursa
• 50% over age of 50 have communication with knee joint
• Cyst communication to posterior knee between SM-MG tendons required
AJR 2001; 176:373

Anatomy: posterior
From: Netter’s Atlas of Human Anatomy
Baker Cyst

Transverse Longitudinal

Baker Cyst: intraarticular body

Transverse Sagittal PDw

Baker Cyst: rupture

Outline

- Knee
  - Joint effusion
  - Extensor mechanism
  - Baker cyst
- Ankle and Foot
  - Achilles
  - Peroneal tendons
  - Morton neuroma

Achilles Tendon:

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

Paratenonitis: Achilles

Longitudinal
Tendinosis: Achilles

Longitudinal power Doppler

Achilles Tendon: partial-thickness tear

Long Axis

Courtesy of Jon Halperin, San Diego

Achilles Tendon: full-thickness tear

Sagittal T2w

Full-thickness Tear: Achilles

Long Axis, extended field of view

Calcaneus

Plantaris

Short Axis

Achilles Tendon: dynamic imaging

Long Axis

Achilles Tendon: healing tear

Prox

Distal

Longitudinal
Outline

- Knee
  - Joint effusion
  - Extensor mechanism
  - Baker cyst
- Ankle and Foot
  - Achilles
  - Peroneal tendons
  - Morton neuroma

Peroneus Brevis Split Tear

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

Peroneal Retinaculum

Superior Peroneal Retinaculum Injury

Neustaedter et al. AJR 2004; 183:985
Rosenberg et al. AJR 2003; 181:1551
**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

**Outline**

- Knee
  - Joint effusion
  - Extensor mechanism
  - Baker cyst
- Ankle and Foot
  - Achilles
  - Peroneal tendons
  - Morton neuroma

**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

*From: Martinoli, RadioGraphics 2000: 20:S199*
Morton Neuroma

- 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

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

Take Home Points

- Knee effusion:
  - Suprapatellar and medial/lateral recesses
- Extensor mechanism: dynamic evaluation
- Baker cyst: must see neck to diagnose
- Achilles: dynamic imaging
- Peroneal: dynamic, subluxation
- Morton neuroma: dynamic
Syllabus on line and other educational material:
www.jacobsonmskus.com
Twitter handle: @jacobsn