Lower Extremity Ultrasound with MRI Correlation

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

Outline

• Hip
  – Effusion
  – Trochanteric pain syndrome
  – Iliopsoas snapping
• Knee
  – Extensor mechanism
• Ankle and Foot
  – Achilles and peroneal tendons
  – Gout
  – Morton neuroma

Hip: anterior recess

• Anterior and posterior layers
  – Fibrous tissue + minute layer of synovium
  – Hyperechoic
  – Each 2 - 4 mm thick

Radiology 1999; 210:499

Hip Effusion: misconception

• It is incorrect to assume that joint fluid may not be seen anterior due to gravity
• Native hip: joint fluid distributes around femoral neck
  – In no cases was fluid only seen posterior
  – Exception: after hip surgery
• US cannot distinguish aseptic from septic joint

Moss et al. Radiology 1998; 208:43
Joint injection

- Anterior recess
- In plane
- Transducer:
  - Parallel to femoral neck
  - Consider curvilinear
- Needle: distal to proximal
- 97% accuracy¹

¹Smith J. J Ultrasound Med 2009; 28:329

Hip Labrum

- Normal:
  - Hyperechoic, triangular
- Degeneration: hypoechoic
- Tear:
  - Anechoic cleft
  - Most common anterior
  - Possible paralabral cyst
  - Sensitivity 82%, specificity 66%*


Labral Tear and Paralabral Cyst

Iliopsoas Bursa:

- Hip joint communication in 10%
  - Increased with hip joint pathology
- May extend cephalad into abdomen
- May be mistaken for abscess:
  - Look for hip joint communication

Radiology 1995; 197:853

Iliopsoas Bursal Fluid

Total Hip Arthroplasty:

- Metal components demonstrate posterior reverberation
- Artifact occurs deep to prosthesis away from fluid collection (unlike MRI, CT)
Hip Arthroplasty:

- Pseudocapsule distention: > 3.2 mm: suspect infection*
- Extra-articular fluid collection:
  - Suspect infection
  - Not visualized with arthrography if non-communication

*AJR 1994; 163:381

Hip Arthroplasty: infection

- Infection

Metal-on-Metal Arthroplasty: pseudotumor

- Pseudotumor

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Trochanteric Pain Syndrome:

- Most commonly caused by gluteus minimus and medius tendon abnormalities\(^1\)
- Trochanteric bursitis: uncommon
  - 20% of symptomatic patients\(^2\)
  - Not actually inflamed\(^3\)
  - Not associated with pain\(^4\)

\(^1\)Eur Rad 2007; 17:1772
\(^2\)Long SS et al. AJR 2013; 201:1083
\(^3\)Clin Rheumatol 2008; 14:82
\(^4\)Skeletal Radiol 2008; 37:903
Greater Trochanter

Greater Trochanter

Greater Trochanter

Greater Trochanter

Greater Trochanter

Gluteal Tendon Pathology:

- Tendinosis: hypoechoic, no defects
- Partial tear: anechoic clefts
- Complete tear: discontinuous tendon
- >2 mm cortical irregularity is associated with tendon tear
  - Positive predictive value = 90% (xray)*

*Steinert et al. Radiology 2010; 257:754
Calcific Tendinosis: Gluteus Medius

Gluteus Medius Fenestration

Trochanteric Bursitis

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Iliopsoas Complex

Snapping Hip Syndrome: iliopsoas


From: Deslandes et al. AJR 2008; 190:576
**Snapping Hip Syndrome: iliopsoas**

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**Quadriceps Tendon: full-thickness tear**

- **Longitudinal**
- **Sagittal PDw**

**Quadriceps Femoris Tear:**

- **Long Axis**

**Patellar Tendinosis:**

- Jumper’s knee
- Hypoechoic swelling
- Mucoid degeneration, possible interstitial tearing
- Hyperemia: neovascularity
- No inflammatory cells

**Patellar Tendon: tendinosis**

- Radiology 1996; 200:821
Platelet-Rich Plasma: who cares?

- Many high-profile athletes claim effectiveness
- Patients are requesting this treatment
- Everyone is doing it
- It does work, but maybe not better than other treatments

Platelet Rich Plasma

- One of many available systems
- Double syringe system
- Leukocyte poor
- No anticoagulant needed
- Venous draw: 15 ml
- Place directly in centrifuge: 5 min
- 2 - 5 ml PRP
- Platelet concentration: 200 – 500K

PRP: proximal patellar tendon

Patellar Tendon: full-thickness tears

Patellar Tendon: full thickness tear

Pre-procedure

PRP injection
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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

Long Axis

Courtesy of Jon Helperin, San Diego

Achilles Tendon: full-thickness tear

Sagittal T2w

Achilles FTT + Intact Plantaris

Transverse Longitudinal

Plantaris
Achilles Tendon: *dynamic imaging*

Achilles Tendon: *healing tear*

Peroneus Brevis Split

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

Neustadter et al. AJR 2004; 183:985

Peroneal Retinaculum

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

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**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
Gout: Double Contour Sign

From: Thiele RG, Rheumatology 2007; 46:1116

Gout: tophus

1st Metatarsophalangeal Joint

Gout: tibialis posterior tendon

Gout: patellar tendon

1st MTP Joint
Ankle Joint

Gout: tophus and intra-articular microtophi

1st Metatarsophalangeal Joint
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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

- Transverse
- Coronal T1w

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

- Hip joint: screen for fluid anterior
- Trochanter pain syndrome: not bursitis!
- Iliopsoas snapping: dynamic evaluation
- Extensor mechanism (knee): not tendinitis
- Achilles and peroneals: dynamic imaging
- Gout: specific findings
- Morton neuroma: dynamic imaging

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for syllabus and other MSK US educational material
Twitter handle: @jacobson