Ultrasound of Hip Pathology and Intervention

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
- Not relevant to this talk

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

Pathology:
- Joint abnormalities
- Bursal pathology
- Muscle and tendon injury
- Snapping hip syndrome
- Miscellaneous pathology

Hip: anterior recess
- Anterior and posterior layers
  - Fibrous tissue + minute layer of synovium
  - Hyperechoic
  - Each 2 - 4 mm thick

Hip Effusion:
- Separation of anterior and posterior layers
- Capsule distention at femoral neck > 7 mm or difference of 1 mm from opposite side
- Extension & abduction improves visualization
- Do not internally rotate hip: capsule thickens

Radiology 1999; 210:449
Scand J Rheumatology 1989; 18:113
Acta Radiologica 1997; 38:667

Hip Joint: septic effusion

Radiology 1999; 210:499

Footnotes:
1Radiology 1999; 210:449
2Scand J Rheumatology 1989; 18:113
3Acta Radiologica 1997; 38:667
**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

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% accuracy


**Joint Injection**

- Femoral neck target
- Preferred over head
- High volumes
- Less extra-articular contrast


**Hip Effusion:**

- Cannot predict infection by ultrasound
- Negative power color Doppler does not exclude infection*
- Guided aspiration

* AJR 1998; 206:731

**Synovial Hypertrophy: Infection**

Longitudinal color Doppler
Pigmented Villonodular Synovitis

Juvenile Idiopathic Arthritis

Hip Labrum
- Normal: Hyperechoic, triangular
- Degeneration: hypoechoic
- Tear: anterior
  - Anechoic cleft
  - Sensitivity 82%, specificity 60%, accuracy 80%*

Labral Tear

Labral Tear and Paralabral Cyst
- Associated with labral tear
  - Full-thickness or detachment
- Anechoic to hypoechoic
- Multilocular

Labrum: PRP
- Platelet-rich plasma injection
- Inject into labral tear (yellow arrow)
- Efficacy unknown

Paralabral Cyst
- Ultrasound-guided aspiration
- 18 – 20 gauge spinal needle
- Steroid injection


[Images and diagrams of hip structures with annotations for each condition and procedure]
Femoroacetabular Impingement
- Pincer-type: deep acetabulum
- Cam-type
  - Broad irregular femoral neck
  - Possible cortical irregularity at US
- Associated with anterior labrum tear
- Consider dynamic evaluation

Radiology 2005; 236:588

CAM Impingement

Note: labral tear (yellow arrow) and osteous bump (white arrow)

Courtesy of M. van Holsbeeck, Detroit, MI

FAI: Ultrasound
- Ultrasound can demonstrate a bony protuberance and non-spherical head associated with CAM FAI
- Alpha angle measurements
  - Buck et al.: unreliable
  - Lerch et al.: strong correlation with MRI


Femoroacetabular Impingement

Sagittal-oblique

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

Hip Arthroplasty:
- Ultrasound cannot differentiate small effusion from post-op change
- Suspect infection:
  - Pseudocapsule > 3.2 mm: suspect infection
  - Extra-articular fluid collection
  - Not visualized with arthrography if non-communication

1Weybright PN et al. AJR 2003; 181:215
2AJR 1994; 163:381
Hip Arthroplasty: infection

Superior Inferior

Sagittal

Teaching Point:
Always screen soft tissues about an arthroplasty prior to fluoroscopic joint aspiration

Metal-on-Metal Arthroplasty: pseudotumor

Pathology:
- Joint abnormalities
- Bursal pathology
- Muscle and tendon injury
- Snapping hip syndrome
- Miscellaneous pathology

Trochanteric Pain Syndrome:
- Most commonly caused by gluteus minimus and medius tendon abnormalities
- Trochanteric bursitis: uncommon
  - 20% of symptomatic patients
  - Not actually inflamed
  - Not associated with pain

Trochanteric Bursal Fluid + Glut Min Tear

Kong A et al. Eur Rad 2007; 17:1772
Long SS et al. AJR 2012; 201:1083
Sylva F et al. Clin Rheumatol 2008; 14:82
Blankenbaker DG et al. Skeletal Radiol 2008; 37:903
Trochanteric Bursitis

- Trochanteric: deep to gluteus maximus
- Subgluteus medius
- Subgluteus minimus
- Axial or coronal plane

Trochanteric Bursa: infection + gas

Iliopsoas Bursae

- Trochanteric: deep to gluteus maximus
- Subgluteus medius
- Subgluteus minimus
- Axial or coronal plane

Iliopsoas Bursa

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

Radiology 1995; 197:853

Iliopsoas Bursal Fluid

- Axial T1w post-gadolinium

Iliopsoas Bursa

- Oblique-axial plane:
  - Superior to femoral head
  - Lateral to medial
  - Inject between tendon, ilium
- Pain relief = successful iliopsoas surgical release

1Dauffenbach J et al. J Ultrasound Med 2014; 33:405
2Blankenbaker DG. Skeletal Radiol 2006; 35: 565
Ischial or ischiogluteal Bursa

- Uncommon
- “Weaver’s Bottom”
- Between ischial tuberosity and gluteus maximus

Pathology:
- Joint abnormalities
- Bursal pathology
- Muscle and tendon injury
- Snapping hip syndrome
- Miscellaneous pathology

Muscle and Tendon Injury

- Tear:
  - Anechoic or hypoechoic defect
  - Partial-thickness tear
  - Full-thickness tear: retraction

- Tendinosis:
  - Hypoechoic, enlarged
  - No inflammation (not tendinitis)

Tendinosis: Gluteus Minimus

Peritendon Steroid Injections

- Gluteal:
  - 72% showed improvement at 1 month$^1$
- Hamstring:
  - 24% had symptom relief beyond 6 months$^2$

$^1$Labrosse JM et al. AJR 2010; 194:202
$^2$Zissen MH et al. AJR 2010; 195:993
Tear: Gluteus Minimus

Tear: Gluteus Medius after THA

Tear: Gluteus Medius

>2 mm cortical irregularity depth (x-ray) = 90% positive predictive value for gluteus tendon tear

Steinert et al. Radiology 2010; 257:754

Semimembranosus: tendinosis

Conjoined Biceps Femoris-Semitendinosus: tendinosis

Semimembranosus Tear

Conjoined BF-ST tendon

Short Axis

Normal
Conjoined BF-ST Tendon: partial tear

Hamstring: complete tear with retraction

Fenestration: pelvis
- 22 tendons in 21 patients
- Gluteus medius (11), hamstring (8), gluteus minimus (2), tensor fascia lata (1)
- Marked or some improvement: 82%

Gluteus Medius: fenestration

Gluteus Maximus and Minimus
- Randomized controlled: 30 patients
- PRP versus fenestration alone
- Significant improvement at weeks 1 and 2
- Approximately 80% had long term improvement: up to 1 year follow-up
- No difference between treatment groups

Sports Hernia?:

- A non-anatomic, non-diagnostic term attributed to many causes of groin pain
  - Tears or attenuation of inguinal structures
  - Bulge posterior wall of inguinal canal
  - Obturator nerve entrapment
  - Common aponeurosis abnormality:
    - Rectus abdominis and adductors tendons
    - Associated: pubic symphyseal instability, FAI

From: Radiographics 2008; 28:1415
Garvey JFW et al. Hernia 2010; 14:17
Hopkins JN et al. JESUS Reviews 2017; 5:1

Author: Joe Lemire, Hemisphere Magazine, Feb. 2015
Rectus Abdominis / Adductor Injury: “Sports Hernia”

Complete Tear: adductor longus

Calcific Tendinosis: rectus femoris

Aponeurosis Tear (Indirect Head): Rectus Femoris

Rectus Femoris Injury

Calcific Tendinosis
- Ultrasound-guided lavage and aspiration
- 20 gauge spinal needle
Aponeurosis Tear (Indirect Head):
Rectus Femoris

Rectus Femoris Tear: full tear, pseudomass

Pathology:
- Joint abnormalities
- Bursal pathology
- Muscle and tendon injury
- Snapping hip syndrome
- Miscellaneous pathology

Snapping Hip Syndrome
- Painful snap with hip motion
- Intraarticular
- Extraarticular:
  - Anterior: iliopsoas tendon
  - Lateral: iliobibial tract or gluteus maximus
Snapping Hip Syndrome: iliopsoas

- Image long axis to inguinal ligament superior to femoral head
- Extension of flexed abducted and externally rotated hip
- Abrupt movement of iliopsoas as iliacus muscle interposed between tendon and bone moves

Deslandes et al. AJR 2008; 190:576

Snapping Hip Syndrome: iliopsoas

- Transverse over greater trochanter
- Hip external rotation / flexion
- Abrupt motion of iliotibial tract or gluteus maximus over greater trochanter

Snapping Gluteus Maximus / Iliotibial Band

Pathology:
- Joint abnormalities
- Bursal pathology
- Muscle and tendon injury
- Snapping hip syndrome
- Miscellaneous pathology
Meralgia Paresthetica
- Sensory: anterolateral thigh
- Hypoechoic enlargement
- Ultrasound-guided steroid injection

Take-home points
- Joint effusion: anterior recess
- Bursae: know locations
- Tendons: bone landmarks and footprints
- Snapping hip: dynamic evaluation

Syllabus on line and other educational material:
www.jacobsonmskus.com
Twitter handle: @jacobson