Hip and Pelvis Imaging

Outline

- Imaging Techniques
  - Plain films
  - MRI
  - MRA
  - Sonography
- Cases

Outline

Radiographs

- OA
  - Fracture/Trauma

Routine MRI

- Stress fracture
- Nonspecific hip pain
- Pubalgia
- Muscle/tendon injuries
- Osteonecrosis
- Tumor

MR Arthrography

- Assess the intra-articular structures
  - Labrum
  - Cartilage
  - Intra-articular loose bodies
  - Ligaments
  - Capsule

Sonography

- Snapping hip
- Bursitis
- Tendonopathy
- Labrum
**Hip Sonography**

- Lower frequency soundhead
  - 2.5 to 5 MHz
- Positioning
  - Anterior View
    - Pt is supine with leg in slight external rotation
  - Medial View
    - Pt is supine with hip externally rotated and knee in 45 deg of flexion (frog leg position)
  - Lateral View
    - Pt is sidelying with pillows between knees
  - Posterior View
    - Pt is prone with legs extended. Pillow under hips if needed for comfort

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**Structures of Interest - Hip**

- **Anterior View**
  - Femoral head and neck
  - Labrum
  - Iliopsoas muscle, tendon and bursa
  - Sartorius
  - Rectus femoris
  - Vastus lateralis, medialis and intermedius
  - Femoral nerve and artery

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**Femoral Head and Neck**

- **Labrum/Iliopsoas**

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**Quadriceps Group**

- **Femoral Nerve and Artery**
Structures of Interest - Hip

Medial View

- Distal iliopsoas
- Adductor group
- Pubic symphysis
- Rectus abdominus insertion

Greater Trochanter/Bursa/ITB

- Greater trochanter and bursa
- Glut max
- Glut med
- Glut min
- Tensor fasica lata
- Iliotibial band

Glut Med/Glut Min

- Glut max, med and min
- Hamstrings
- Sciatic nerve
- Piriformis
**Hamstring**

- Longitudinal
- Transverse

**HIP PATHOLOGY**

**Greater Trochanteric Bursitis**

**AIS Avulsion**

**Gluteal Tendon Pathology**

**Gluteal Tendon Tears**

- MRI
  - Sensitivity of 33-100%
  - Specificity of 92-100%
  - Positive predictive value of 71-100%
  - Negative predictive value of 50%
  - False-positives were common

- Ultrasonography
  - Sensitivity of 79-100%
  - Positive predictive value of 95-100%

*Westacott 2011*
Snapping Hip

Labral Cysts

Labral Tears

Normal Hip Imaging

HIP IMAGING ANATOMY
Radiography

- B AP Hip/Pelvis view
- Unilateral AP Hip view

For the AP view, the central ray is directed perpendicular to the inspion of the pelvis.

Acetabular Lines

L AP View

Oblique AP View

AP in ER View

Gluteal

Pelvis / B Hip AP View

Iliopubic line

Teardrop

Herniation Pit

Ilioischial Line

Obturator Internus

Sacrum

Manaster BJ. Radiographics. 2000

Iliac Wing

Manaster BJ. Radiographics. 2000
Lateral View (aka Frog View)

MRI anatomy: Muscles

- Coronal imaging

- Gluteus maximus
- Piriformis
- Sacrum
- Sacro-iliac joint
- Semimembranosus
- Greater and Lesser trochanters
- Psoas
- Iliacus
- Obturator internus
- Obturator externus and quadratus femoris
- IT band
- Gracilis
- Adductors
MRI anatomy: Muscles
- Axial Imaging
Patient Profile
- 60 yo female
- HPI
  - 10/10 walking at conference, sat on bench, went to get up and has severe pain x 4 hours, then resolved
  - Mid 11/10, rolled over in bed and felt sharp pain in L hip
- PMH: Osteoporosis
- Referred by PCP to address L hip pain and decreasing functional status
- Functionally
  - Increased pain with walking
  - AM stiffness
  - Inability to play golf or exercise

Evaluation/Plan of Care
- Differential Pathologic Diagnosis:
  - OA L hip
  - Stress Fx due to underlying h/o osteoporosis
- Referred to Orthopedist for medical work-up
  - Radiography
  - MRI
- Non-trauma Hip Pain Imaging Pathway
- www.imagingpathways.health.wa.gov.au
**Selection of Imaging Studies**
- Radiography
  - Integrity of joint structures
  - R/i or R/o DJD
- MRI
  - Integrity of soft tissue structures
  - R/i or R/o insufficiency fx

**Plain Films**
- 2010
  - AP & Lat
- 2011
  - AP B Hip / Pelvis
  - Unilateral AP

**Plain Films - 2010**
- AP Unilateral
- Lat View

**Plain Films 2011**
- AP Pelvis
- AP L Hip
Radiology
- Evidence Based Practice
  - Least expensive study
  - Ability to assess osseous structures and evidence of pathology
- Radiograph - strong additional value
  - Those at high risk for progression of hip OA
- Kellgren - Lawrence Scores
  - Strongest predictor for progression of hip OA
  - Pts with existing hip pain

Roemer et al: Osteoarthritis Cartilage. 2011

MRI - T1 Coronal
- Evidence Based Practice
  - Possible associations between MRI-detected pathology and clinical sx
  - Severe OA
    - Strong association with radiographic finding


MRI T2 Coronal

Use of Imaging Studies
- Differential Pathologic Diagnosis
  - Confirmation of Hip OA
- Appropriate PT management
  - Joint Distraction vs. Glides
  - Core Strengthening
- Surgical Candidate
  - Pt decided to wait and utilize conservative PT management
**Patient Profile**
- 25 yo male
- Training for Boston Marathon
- Referred for dx of L post-medial shin splints by PCP
- During history, reported increasing R hip pain over past 5 weeks which also limited his ability to run.

**PT Examination**
- R/i post-medial shin splints
- Examination of R hip:
  - ROM WNL except for c/o pain with OP into hip flexion, ER>IR
  - Muscle Performance 5/5 + pain with flexion
  - + Scour Test
  - + Anterior Labral test

**Evaluation/Plan of Care**
- Differential Pathologic Diagnosis:
  - Anterior labral tear
  - DJD R hip
- Referred to Orthopedist for medical work-up
  - Radiography
  - MRI (with/without contrast)

**Selection of Imaging Studies**
- Radiography
  - Integrity of joint structures
  - R/i or R/o DJD
- MRI
  - Integrity of soft tissue structures
  - ? Acetabular Cyst vs. Labral Tear
Radiography

- Evidence Based Practice
  - Least expensive study
  - Ability to assess osseous structures and evidence of pathology

MRI - T2 Weighted

- Evidence Based Practice
  - Strong correlation between MR imaging and pathology

MR Arthrography

- Exploits the natural advantages gained from joint effusion
- Use of Contrast

MRI Arthrography

- Evidence Based Practice
  - T2-weighted images
    - Sensitivity: 75-85%
    - Specificity: 94-97%
  - 40 patients
    - Sensitivity: 50 & 79%
    - Sensitivity: 77 & 84%
Use of Imaging Studies
- Differential Pathologic Diagnosis
- Confirmation of Anterior Labral Tear
- Not appropriate PT management
- Surgical Candidate

Osseous Injuries
- Stress Reaction Response
- Stress (Fatigue) Fx
- Insufficiency Fx

Hip Fx Imaging Pathway

Stress reaction (response)
- Represents microtrabecular fracture
- Normal or near normal radiographs
- Bone marrow edema pattern on MR
- Typically on inferomedial aspect of femoral neck
- No discrete linear component

www.imagingpathways.health.wa.gov.au
Fatigue (Stress) fracture

- MR
  - Round or ovoid hypointensity on T1 and hyperintensity on T2
  - Associated linear signal abnormality
  - Linear component may be most visible on T1 or T2
Bilateral Acetabular Roof Fractures