MR Imaging in Athlete’s Hip/Pelvis

Tara Lawrimore, MD FRCPC
Department of Radiology
Musculoskeletal Division
Massachusetts General Hospital
Harvard Medical School
No disclosures
MR and Hip Pain in the Athlete

- MRI protocol, anatomy
- Bones:
  - fracture, marrow disorders
- Extra-articular:
  - bursae, muscles, tendons
- Intra-articular:
  - cartilage, labrum, lig. teres, joint and synovium, plicae
MR Protocols

• Routine Hip Protocol
• MR Arthrography Protocol
• Specialized: Athletic Pubalgia Protocol
MRI : Routine Hip protocol

- Local surface coil
- Bilateral hips, FOV 36 cm
  - Coronal STIR (5000/34/150)
- Unilateral hip, FOV 16 cm
  - Oblique axial, coronal, sagittal FS PD FSE (2800/90)
  - Coronal T1 (500/16), axial PD (2500/17)
- 3D imaging, SPACE
MRI: Routine Hip protocol

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Osseous stress injury

failure of skeleton to w/stand *submaximal* forces acting over time
Osseous stress injury

**Fatigue fracture:**
normal bone, abnormal forces

**Insufficiency fracture:**
abnormal bone, normal forces
Fatigue fracture

- nearly 70% in runners
  - among athletes
- new activity
- ↑’d mileage
- new shoes, surface
Fatigue fracture

- difficult XR diagnosis
  - periosteal RXN, callus
- T2, STIR: fx line
  - high-lighted by BME
- T1: fx line obscured
Unilateral fracture
Met v. fracture? no line... met
Transient osteoporosis

- weight-bearing bone
- subchondral edema
  - dissipates distally
- joint effusion
- ddx: subchondral fx, early ON
Bursae

- Greater trochanteric (subgluteus maximus):
  - between greater trochanter, glut. max., IT tract
  - greater trochanteric pain syndrome
  - acute, repetitive trauma, gluteal tendon tears
Bursae

- Iliopsoas
  - largest bursa
  - communicates in 10-15% with hip joint
  - medial to iliopsoas, anterior to hip joint
  - repetitive trauma
  - inflammatory conditions (RA)
Iliopsoas bursitis
Muscles and tendons

- Gluteals
- Iliopsoas
- Hamstrings
- Rectus femoris
- Quadratus femoris: ischiofemoral impingement
Gluteal tendons

- Gluteus medius and minimus: hip abductors
  - greater trochanteric pain syndrome
  - rotator cuff of hip
    - gluteus medius: sup.-post. facet, lateral facet
    - gluteus minimus: anterior facet

Pfirrmann CW et al, Radiology 2001;221:469-77
Iliopsoas

• Iliacus and psoas muscles form iliopsoas tendon
• Insertion: lesser trochanter
• Hip flexion, lateral rotation
• Tendinopathy, tear
• Avulsion, detachment of lesser trochanter
  – elderly patients: spontaneous, osteoporosis, neoplasm
• Hematoma, myositis ossificans
Myositis ossificans
Snapping hip

- Coxa saltans
- Snapping, clicking with hip movement
- External and internal causes
  - iliopsoas tendon snapping over iliopectineal line
  - edema, bursitis
Snapping psoas
Hamstrings

- **Biceps femoris, semitendinosus:** conjoined tendon
  - postero-medial ischial tuberosity
- **Semimembranosus**
  - antero-lateral ischial tuberosity
- **Adductor magnus “hamstring head”**
  - inferior to hamstring origin
- **Sacrotuberous lig.**
- **Strains, tendinopathy, partial tear, avulsion**
Hamstring strain, biceps fem.
Ischiofemoral impingement

- Narrowing of ischiofemoral space
  - ischial tuberosity and lesser trochanter
- Quadratus femoris muscle
  - edema, partial tear, fatty infiltration
- Hamstring tendons
  - edema, partial tear

Torriani et al. AJR 2009;193:186-90
Rectus femoris

- Quadriceps: rectus femoris, vastus lateralis, intermedius, medialis
- Straight (direct head): anterior-inferior iliac spine
- Reflected (indirect) head: more posterior, superior lip of acetabulum
- Hip flexor, leg extensor
- Strain, partial tear, tear, avulsion, hematoma
Rectus femoris, direct head
Rectus femoris, reflected head
MR Arthrography Protocol

• Unilateral hip, FOV 16 cm
  – Oblique axial, coronal, sagittal FS T1 FSE (700-750/17)
  – Axial PD FSE (1900/25)
  – Coronal T1 FSE (650/17), FS T2 FSE (5000/50)
Cartilage

- Intermediate SI
  - thick superior, thin posterior
- Sports-related, FAI: ant-sup. acetabulum
  - delamination
- + labral tears
- Contrast outlines defects, articular margins
- Subchondral cysts
Labrum

- Fibrocartilage (↓SI)
  - thick posterior, thin anterior
- Acetab. labrum = glenoid labrum
  - sublabral contrast, displacement
- Sports-related, FAI: ant-sup
  - sagittal, oblique axial
- Paralabral cyst
Ant-sup labral tear
Lig. teres

- arises from acetabular fossa
- inserts into fovea capitis
- blends in with transverse lig.
- stability, proprioception
- 4-15% of sport related injuries
- partial, complete tears, avulsions
Joint capsule

- **Proximal attachment**: along osseous rim of acetabulum, near base of labrum → perilabral recess
- **Distal attachment**: femoral neck, base of trochanters
- **Thickening of capsule**:
  - iliofemoral lig. (strongest)
  - ischiofemoral lig.
  - pubofemoral lig.
- **Deep circular layer**: zona orbicularis
- **Tears**: leak of contrast, post. hip dislocation
Hip plicae

- Synovial plicae:
  - reflections of synovial membrane
  - interface of articular surfaces
- Synovial fluid production, stability
- Hip pain: synovitis, entrapment
Synovium

- Capsule lined with highly vascularized synovium
- Inflammation, neoplasms
  - RA
  - amyloidosis
  - PVNS
  - synovial chondromatosis
Specialized: Athletic Pubalgia Protocol

- Coronal STIR, T1 SE, Axial T2 FSE fat sat FOV 28-36cm
- Axial Obl PD, T2 FSE FOV 20cm
- Sag PD, T2 FSE FOV
Athletic pubalgia

- Adductor longus injury
- Common adductor-rectus abdominus dysfunction
- Osteitis pubis
- “Sportsman’s hernia”
Checklist:

– BONE
  • Fracture, marrow disorders

– EXTRA-ARTICULAR
  • Muscles and tendons – strains, tears, degeneration, friction syndromes, myositis ossificans, others

– INTRA-ARTICULAR
  • Cartilage, labrum, ligamentus teres, plicae, synovial disorders

– PUBALGIA
  • Specialized imaging
Thank you!