MR of the Pelvis and Hip

- Technique
- AVN
- Transient bone marrow edema
- Pelvic trauma
  - Bony
    - Stress
    - Occult
- Arthritis
  - Labrum
- Bursa
- Tendons
- Muscles
- Pediatric hip disorders
- Tumors
Technique

• Supine

• Prone if buttock mass or sacral ulcer

• Elevate femur parallel to tabletop
## Pelvis/Hip MR protocol

<table>
<thead>
<tr>
<th>Plane</th>
<th>Seq</th>
<th>TR/TE</th>
<th>FOV</th>
<th>Slice</th>
<th>Matrix</th>
<th>NEX</th>
<th>Time</th>
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<tbody>
<tr>
<td>Localizer</td>
<td>FMPIR</td>
<td>3500/17/160</td>
<td>40</td>
<td>5</td>
<td>128</td>
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<tr>
<td>Coronal</td>
<td>T1 SE</td>
<td>600/14</td>
<td>36</td>
<td>5</td>
<td>192</td>
<td>1</td>
<td>4:50</td>
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<td>Sagittal</td>
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<td>4</td>
<td>256</td>
<td>1</td>
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<tr>
<td>Axial</td>
<td>T2 FSE-fs</td>
<td>3000/90</td>
<td>36</td>
<td>5</td>
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<tr>
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<td>36</td>
<td>5</td>
<td>192</td>
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<td>5:12</td>
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Hip MR Arthrography

Indications

- Labral tear
- Paralabral ganglion
- Preoperative assessment of DDH
- Intraarticular bodies
Hip MRA technique

- Local anesthesia

- Anterolateral approach to femoral head-neck junction

- Confirm needle position with <1 cc contrast

- Inject 12 cc of diluted Gd-DTPA
MR arthrography

- Anterolateral approach
- Inject 12-15 cc of 1:200 Gd-DTPA
- 3 planes of imaging with T1 fat-sat
- Coronal IR or T2-w FSE
Normal variants

- Epiphyseal scar
- Synovial herniation pit
- Fovea
- Trabecular bands
- Intertrochanteric marrow
Physeal scar

- Normal finding, can be present at all ages

- Normal remnant of epiphyseal line

- Crescentic low density band at head-neck junction
Synovial herniation pit

- 1-2 cm
- Round or oval lytic lesion
- Anterior femoral neck
Fovea

- Depression on central surface of the femoral head
- Devoid of cartilage
- Ligamentum teres femoris arises from this depression
Avascular necrosis (AVN)

- Avascular necrosis
- Aseptic necrosis
- Osteonecrosis
- Ischemic necrosis
- Bone infarction
Stages of AVN

- Cell death
  - Hematopoietic<Fat
  - <Mesenchymal

- Cell proliferation adjacent to necrosis

- Revascularization and resorption of necrotic segment

- Reossification by creeping substitution
# Arlet-Ficat staging

<table>
<thead>
<tr>
<th>Stage</th>
<th>Condition</th>
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<tbody>
<tr>
<td>1</td>
<td>Normal radiographs</td>
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<tr>
<td>2</td>
<td>Lysis and sclerosis</td>
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<tr>
<td>3</td>
<td>Subchondral fracture</td>
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<tr>
<td>4</td>
<td>Collapse</td>
</tr>
<tr>
<td>5</td>
<td>Secondary osteoarthritis</td>
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AVN

• MR is the most sensitive method for noninvasive early detection

• Controversy about need for early detection

• Early therapeutic options limited
Avascular necrosis

- Line, band or ring of low signal
- Double-line sign
- Deformity
- Marrow edema
• Extent of disease used to predict likelihood of collapse

• Coronal image

• Extent of weight-bearing surface involved
Idiopathic bone marrow edema

- Middle-aged, male predominance
- Last trimester of pregnancy
- Left hip involved in 2/3 of cases
- Unknown etiology
- Self-limited
Idiopathic marrow edema

- Geographic signal loss on T1w in femoral head and neck
- Signal loss extends to intertrochanteric line
- High signal on T2w and STIR
- No arcuate or linear bands of low signal
- No deformity
Edema: differential diagnosis

- Very early avascular necrosis
- Osteomyelitis
- Osteoarthritis
- Stress fracture
Pelvic trauma

- Stress fracture
  - Fatigue
  - Insufficiency

- Occult fracture

- Soft tissue injury
MR of occult fracture

- Normal or equivocal radiographs
- High clinical suspicion
- Major weight-bearing region
Occult fracture

- Additional radiographs
- Fluoroscopy
- Scintigraphy
- Conventional tomography
- Computed tomography
- Magnetic resonance imaging
MR of occult fractures

- Coronal STIR of entire pelvis
- Smaller FOV images of injured area
  - T1 (or PD FSE)
- Entire study less than 15 minutes
Labrum

• Attached directly to osseous rim

• Triangular, thickest posterosuperiorly

• Blends with transverse ligament at acetabular notch
Labral tears

• Traumatic or degenerative

• Pain, locking or premature osteoarthritis

• Higher incidence in patients with hip dysplasia

• Associated with supr acetabular ganglion
Labral tear

• T1 images only show swelling of labrum

• T2 images show high signal in labrum

• MR arthrography most accurate
Supracetabular ganglion

- Benign cystic lesion in acetabular roof or soft tissue lateral to labrum
- May contain gas, may erode bone
- Associated with hip dysplasia and labral tears
Bursal anatomy

• Communicating bursae
  – Iliopsoas

• Noncommunicating bursae
  – Trochanteric
  – Subgluteal
Soft tissue injury

- Muscle strain
- Hematoma
- Tendon tear
Myotendinous avulsions

- Greater trochanter
  - Gluteus medius
  - Gluteus minimus

- Ischium
  - Hamstrings
Gluteal tendon tear

- Elderly
- Tear of gluteus medius or minimus tendon
- “Rotator cuff tear of the hip”
Hamstring avulsion

- Young athlete
- Elderly patient
Pediatric hip disorders

- Developmental dysplasia
- Proximal focal femoral deficiency
- Transient synovitis
- Legg-Calve-Perthe's disease
- Slipped capital femoral epiphysis
Legg-Calvé-Perthes disease

- Idiopathic necrosis of femoral head in children
- Ages 4-7