MRI of Hip Pain: AVN and Traumatic Injuries

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Disclosure

• No financial disclosures
• Off-label intra-articular use of Gadolium contrast will be discussed
Overview

- Anatomy
- MR technique
- Pathology
  - Pediatric
  - Osseous
  - Musculotendon
Sciatic n.

Piriformis
• Our Protocol:
  - Coronal T1
  - Coronal STIR/FS T2
  - Axial T1
  - Axial T2 Fat-Sat
  - Hi Res Coronal FS T2
  - Hi Res Sagittal FS Proton Density
PEDIATRIC HIP

Legg-Calvé-Perthes disease
  – AVN

• Slipped Capital Femoral Epiphysis
  – SCFE

• Avulsions

• Developmental Dysplasia
  – DDH

• Septic arthritis

• Osteoid osteoma
Legg-Calvé-Perthes
Legg-Calvé-Perthes

8 months later
Legg-Calvé-Perthes Disease

- Idiopathic osteonecrosis of femoral head
- 4-8 yo
- 10-20% bilateral, but not synchronous
- Rare in African-Americans
- Small capital epiphysis: flat, sclerotic and fragmented
- Metaphyseal “cysts”
- Broad neck
- Variable prognosis
SCFE
"SCFE"
Slipped Capital Femoral Epiphysis
Slipped Capital Femoral Epiphysis
Radiographic Signs

- Malalignment of epiphysis
- Widened physis
- Irregular physis
- Diminished height of epiphysis
- Klein’s line abnormal: not intersecting epiphysis
- MRI: edema, wide physis on T1
Slipped Capital Femoral Epiphysis
Demographics

• 10-14 years-old
• M:F 2.5:1
• More common in African-Americans
• Overweight
• Can run in families
• Bilateral 30%, usually not synchronous
Slipped Capital Femoral Epiphysis

AVN More Likely:

- Unstable
- Acute onset of sx / trauma
- Noticeable reduction
- Anterior physeal separation
SCFE: Anterior Physeal Sep.

Ballard et al. JBJS (Br) 2002:1176-79
“Pre-SCFE”
“Pre-SCFE”
Avulsions
AVULSION
Typical Locations

Iliac crest: Obliques
ASIS: Sartorius
AIIS: Rectus
GT: Glutei
LT: Iliopsoas
Ischial tub: Hamstrings
ASIS Avulsion
Lesser Trochanter Avulsion
Pre-Avulsion: Apophysitis
Pre-Avulsion: Apophysitis
ADULT: OSSEOUS ABNORMALITIES
Osteonecrosis (AVN)
Osteonecrosis (AVN)

Mild: <15%
Moderate: 15-30%
Severe: >30-%
Osteonecrosis: Causes
“PLASTIC RAGS”

- Pancreatitis
- Lupus
- Alcohol
- Steroids
- Trauma
- Idiopathic (Legg-Calvé-Perthes)
- Caisson disease, collagen vascular

- Radiation, Rheumatoid arthritis
- Amyloidosis
- Gaucher disease
- Sickle cell disease
Osteonecrosis (AVN)
Osteonecrosis (AVN)

Grading:
Ficat, Steinberg
Osteonecrosis?
Insufficiency Fracture!
Insufficiency Fracture!
Transient Osteoporosis of the Hip
Transient Bone Marrow Edema Syndrome

Courtesy of Ken Schreibman, MD PhD
TOH: Transient Osteoporosis

- Rapid development of osteoporosis
- Spontaneous
- Self-limited
- Middle-aged males
- Pregnant/post-partum females (left)
- Fractures may occur
- RMO: Knee, ankle, foot

MRI findings: Edema, effusion. No double-line sign.
Stress Fractures
Femoral Neck: Fatigue
Stress Fractures
Femoral Neck: Fatigue
Elderly
Hip pain after a fall...
Fem neck insufficiency fx
Occult Fracture?

88 ♀ Fell

"Focal marrow edema w/o fx line"

Yes: Incomplete fx

9 d later
Occult Fracture?

Muscle Injury!
Insufficiency Fractures: Alendronate (Fosamax)

52 ♀, RA. 9 years Fosamax
Insufficiency Fractures: Alendronate (Fosamax)

Chan SS et al. AJR 2010; 194:1581-86
Adult “Hip” Pathology In Athletes

- Adductor/gracilis syndrome
- Avulsions
- Bursitis
- Labral tears
- Muscle/tendon injury

- Osteitis pubis
- Sacroiliac dysfunction
- Snapping hip
- Sportsman’s hernia
- Stress fractures (fatigue)
Adult “Hip” Pathology in Athletes

- Adductor/gracilis syndrome
- Osteitis pubis
- Sportsman’s hernia

“Athletic Pubalgia”
Athletic Pubalgia

- Osteitis pubis
- Adductor injury
- Rectus abdominis aponeurosis injury

Pubalgia Protocol

- Axial T2 Fat Suppressed
- Sagittal T2 Fat Sat
Pubalgia Protocol

- Axial T2 fat suppressed
- Sagittal T2 fat sat
- Oblique axial PD
Pubalgia Protocol

- Axial T2 fat suppressed
- Sagittal T2 fat sat
- Oblique axial PD
- Oblique axial FS T2
Pubalgia Protocol

- Axial T2 fat suppressed
- Sagittal T2 fat sat
- Oblique axial PD
- Oblique axial FS T2
- Oblique coronal T1
- Oblique coronal STIR
Pubalgia Protocol
Osteitis Pubis
Osteitis Pubis

- Painful condition of the symphysis pubis
- Self-limited, but very painful
- Etiology: overuse injury with repeated stress, shear forces, microtrauma, ?AVN, instability
- Other assoc’s: spondyloarthrop, pregnancy, SI dysfunction
- MRI:
  - Pubic bone edema, fluid in joint
  - Erosions
  - Disc extrusion superiorly/posteriorly
  - Sclerosis and osteophytes if chronic, cysts
Osteitis Pubis
Adductor Injury
Adductor Injury

Secondary cleft sign
Athletic Pubalgia
Athletic Pubalgia
MUSCLE/TENDON INJURY
Muscle/Tendon Injury
Partial Tear Hamstring Origin
Muscle/Tendon Injury: Partial Tear Iliopsoas
Muscle/Tendon Injury
Iliopsoas Strain

Sagittal Proton Density
Bursitis: Iliopsoas

6 months later...
Bursitis: Trochanteric
Gluteus minimus partial tear
Summary

- Pediatric: L-C-P, SCFE, avulsions
- Adult osseous: AVN, stress fx, athletic pubalgia
- Muscle/bursa: Hamstring, gluteus min./med. tendinopathy