MR: Femoroacetabular Impingement

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MRI of FAI

- Concept, morphology
  - Cam impingement
  - Pincer impingement
- Technique
- Imaging findings
- Ischiofemoral impingement

FAI

- Abnormal abutment proximal femur - acetabulum
- Morphologic abnormalities
- Reduced joint clearance
- Mechanical stress, damage
- Cause of early OA in young patients
- Prevalence: 10-15%

Leunig M, Ganz R. Unfallchirurg 2005;108:9-17
Etiology

- No one knows
- Subclinical slipped capital femoral epiphysis
- Aberrant separation of physis of femoral head, greater trochanter
- New term for idiopathic OA

Pathomechanism

Femoral cause:
- Cam Impingement

Acetabular cause:
- Pincer Impingement

Combination of cam and pincer: 86%
Isolated cam, pincer: 14%

Cam impingement

- Non-spherical shape of femoral neck, osseous bump
- Squeezing of abnormal femoral neck into acetabulum
- 1. cartilage 2. labrum damage
- Young men

Pincer Impingement

- Over-coverage of femoral head by acetabulum
- Deep acetabular fossa
- Abnormal contact acetabular rim - femoral neck
- Acetabular ossification, labrum, cartilage damage
- Middle aged women

Imaging of FAI

- Confirm, suggest dx
- Morphologic abnormalities
- Extent of damage
- Exclude advanced OA
- R/o other lesions (DDH, stress fx)

MRI protocol regular

- 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 protocol Arthrogram

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

Cartilage Imaging - dGEMRIC

- Delayed Gd-Enhanced MRI (dGEMRIC)
- IV neg. charged GdDTPA²⁻: 30 min prior to imaging
- Detects GAG in cartilage
- Gd-DTPA²⁻ increased in abnl. cartilage ↓ T1
- T1-mapping
- Predictor of sx. success

Alpha angle

- Quantify concavity femoral head-neck junction

Oblique axial, sagittal

Normal alpha angle

Abnormal head-neck junction
Summary MRI findings

- Decreased femoral head-neck offset (incr. alpha angle)
- Acetabular retroversion
- Fibrocystic change ("Pitts Pit")
- Chondral fissures, defects, delamination
- Labral tears, labral hyperthrophy
- Subchondral edema/ cysts
- Capsular thickening, synovitis
- Os acetabuli, periacetabular ossicle

However ..... 

- Diagnosis of FAI depends on both clinical and imaging evidence
- Prevalence of FAI imaging findings is unknown among asymptomatic individuals
- Not all labral tears or chondral lesions are caused by FAI
- Not all patients with abnormal alpha angle or acetabular retroversion have FAI and require anatomical correction

Palmer WE, Radiology 2010;257:4-7
Ischiofemoral Impingement

- Narrowing of ischiofemoral space
  - Ischial tuberosity and lesser trochanter
- Abnormal quadratus femoris muscle
  - Edema, partial tear, fatty infiltration
- Hamstring tendons
  - Edema, partial tear

Summary

- FAI common etiology of OA

- Femoral (cam) or acetabular (pincer) abnormalities - combination

Summary

- Repetitive trauma
  - Mechanical wear of labrum, articular cartilage
  - Progressive OA
- MRI able to detect extent and severity of labral and cartilage damage
  - Underlying subtle anatomic variations of femoral head-neck junction, acetabulum