Radiographic Analysis of FAI

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Disclosures

“Neither I nor my spouse/partner has a relevant financial relationship with a commercial interest to disclose.”
New Patients

Previous Studies

Plain Radiographs
  ◦ New radiographs if none within six months

MRI
  ◦ Must also have radiographs
Getting started

Advanced MS Imaging
- MRI – 3 Tesla
- Arthrogram?
- Steroid Injection?
Getting Started

CT scan
- 3-D reformations
- 3-D printers

MRI
- 3-D reformations
Getting Started

Orthopedist

Physical therapist

Radiologist
  ◦ Must have go to person
  ◦ Teach each other –
    ◦ Share surgical pictures
    ◦ Share mistakes
Getting started

Plain radiographs
- AP Pelvis
- AP, Dunn Lateral of affected hip
- False Profile views
Getting started

MRI – 3 Tesla with arthrogram
CT Scan – 3-D with reformations
  ◦ Which Patients?
Radiographic Analysis for FAI

Position of the Hip Center
- Lateralized if distance from ilioischial line > 10mm
Radiographic Analysis of FAI

Head neck offset
- Usually determined on the Axial views or Lateral view
- Point where the head loses sphericity = alpha angle
  - Where prominence leaves the spherical part of head
  - Abnormal if > 42 degrees in females, 56 degrees in males

Normal

Moderate

Antero-lateral Prominence
Radiographic Analysis of FAI

Congruency

- conformity between the femoral head and acetabulum
- Symmetrical joint space

Congruent  Mildly Incongruent  Incongruent
Radiographic Analysis of FAI

Tonnis Grading 0-3

- Grade 1 – increased sclerosis of femoral head and/or acetabulum, Slight joint space narrowing
- Grade 2 - presence of small cysts, moderate joint space narrowing, loss of femoral head sphericity
- Grade 3 – Large cysts, severe joint space narrowing, severe deformity of head
Scoping tips

Some hips may be better done open
- Significant dysplasia
- Global retroversion of cup

Beware of the deep hip
- Coxa Profunda
- Coxa Protrusi
Plain Radiographs

**AP pelvis**
- Cross over
- Coccyx in line with pubic symphysis
- Superior border of pubis symphysis 1-3cm to tip of coccyx
  - Pelvic inclination appropriate
False Profile View

When hip dysplasia present

Standing film with pelvis rotated 65 degrees
- Vertical line running thru the femoral head
- Line from center of head to anterior most point of the sourcil
- Anterior center edge angle
  - < 20 dysplasia
Radiographc Morphology

Acetabular morphology
- AP Pelvis
- False Profile

Proximal femur / head neck view
- Dunn lateral
  - 45 and 90 degree
- Cross table lateral
- Frog lateral
  - Greater trochanter may obscure the head neck morphology

Cross-table Lateral
Frog Lateral
Acetabular Depth

- Normal
- Coxa profunda
- Coxa Protrusio
Acetabular Inclination

Determined by Tonnis Angle

- Normal 0-10 degrees
- Greater than 10 degrees have increased inclination
  - Dysplasia with possible dysplasia
- Less than 10 degrees have less inclination
  - Pincer

Center Edge Angle of Wiberg

- Lateral center-edge angle
- < 25 degrees dysplasia

Anterior Center-edge angle

- Angle of Lequesne - < 20 degrees dysplasia
Acetabular Version

AP of pelvis
- Cross over or figure of eight sign
  - Center of the femoral head is lateral to the posterior aspect of hip
  - Posterior wall deficiency

- Anterior overcoverage
  - Cross-over with no posterior wall deficiency
Anteroposterior Pelvic
Cross-table Lateral
45° Dunn
Frog-leg Lateral
False Profile
Technique for Assessing Tilt and Rotation of an AP Pelvic

Distance from the pubic symphysis to the tip of the coccyx should be 7-3 cm.

Obturator foramina should be symmetric in appearance.
Coxa Profunda on an AP View
Protrusio Acetabuli
Technique for Calculation of Acetabular Inclination and the Lateral Center-edge Angle
Technique for Calculation of Acetabular Inclination and the Lateral Center-edge Angle
Technique for Calculating Anterior Center-edge Angle on a False-profile
Anteverted Acetabulum
Retroverted Acetabulum
Spherical Femoral Head
Femoral Head with Perthes-like Deformity
Spherical Femoral Head on AP (Despite Clear Head-neck Offset on the Frog-leg Lateral)
Clear Head-neck Offset
Normal Position of Femoral Head

Distance less than 10 mm
Lateralized Femoral Head in a Patient with a Dysplastic Hip

Distance greater than 10 mm
Normal and/or Symmetric Concavities
Moderate Reduction in Head-neck Offset and/or Mild Cam Impingement
Antero-lateral Head-neck Prominence
Technique for Calculating the Alpha Angle on a Frog-leg Lateral Radiograph
Technique for Calculating the Head-neck Offset Ratio
Congruent Joint
Mildly Incongruent Joint
Incongruent Joint
Tönnis Grade 0
Tönnis Grade 1
Tönnis Grade 2
Tönnis Grade 3
Thank You

Sandra J. Reardon, Smithsonian Institution, National Museum of Natural History
Positioning for AP Pelvic

Figure 2A. Clohisy JC, Carlisle JC, Beaulé PE, Kim YJ, Trousdale RT, Sierra RJ, Leunig M, Schoenecker PL, Millis MB. A systematic approach to the plain radiographic evaluation of the young adult hip. J Bone Joint Surg Am. 2008 Nov;90 Suppl 4:47-66. doi: 10.2106/JBJS.H.00756
Positioning for AP Pelvic

Figure 2B. Clohisy JC, Carlisle JC, Beaulé PE, Kim YJ, Trousdale RT, Sierra RJ, Leunig M, Schoenecker PL, Millis MB. A systematic approach to the plain radiographic evaluation of the young adult hip. J Bone Joint Surg Am. 2008 Nov;90 Suppl 4:47-66. doi: 10.2106/JBJS.H.00756
Positioning for Cross-table Lateral with Limb in 15° of Internal Rotation

Positioning for 90° Dunn View with Hips Flexed 90° and Abducted 20°

Black arrow points to the crosshairs, centered at a point midway between the pubic symphysis & ASIS

Positioning for 45° Dunn View with the Hips Flexed 45° and Abducted 20°

Figure 5A. Clohisy JC, Carlisle JC, Beaulé PE, Kim YJ, Trousdale RT, Sierra RJ, Leunig M, Schoenecker PL, Millis MB. A systematic approach to the plain radiographic evaluation of the young adult hip. J Bone Joint Surg Am. 2008 Nov;90 Suppl 4:47-66. doi: 10.2106/JBJS.H.00756
Positioning for 45° Dunn View with the Hips Flexed 45° and Abducted 20°

Figure 5B. Clohisy JC, Carlisle JC, Beaulé PE, Kim YJ, Trousdale RT, Sierra RJ, Leunig M, Schoenecker PL, Millis MB. A systematic approach to the plain radiographic evaluation of the young adult hip. J Bone Joint Surg Am. 2008 Nov;90 Suppl 4:47-66. doi: 10.2106/JBJS.H.00756
Positioning for Frog-leg Lateral View with Hip Abducted 45°

Right hip
-Scope View: Anterolateral

Labrum

Transition zone

Anterior capsule

Anterior portal

Femoral head

Acetabular articular cartilage
False-profile view of the right hip is obtained with the pelvis rotated 65° in relationship to the bucky wall stand, with the foot on the affected side parallel to the radiographic cassette (shown with two black lines).