Regions Hospital

Acetabular Dysplasia: Evaluation and Management

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TRIA

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DISCLOSURES

- No disclosures relevant to this talk.

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OBJECTIVES

- Hip Dysplasia and Borderline Dysplasia
- Evaluation
- Imaging
- Treatment
- Outcomes
- Recommendations

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Adult Acetabular Dysplasia

- Defined as osseous deficiency of the acetabulum with abnormal coverage of the femoral head. [1,2]
- This can lead to overload of the rim and joint instability. [2]

1. Henak CR, Abraham CL, Anderson AE, Maas SA, Ellis BJ, Peters CL, Weiss JA. Patient-specific analysis of cartilage and labrum mechanics in human hips with acetabular dysplasia. Osteoarthritis Cartilage. 2014;22:210-217.
2. Klaue K, Durnin CW, Ganz R. The acetabular rim syndrome. A clinical presentation of dysplasia of the hip. J Bone Joint Surg Br. 1991;73:423-429.

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Borderline Acetabular Dysplasia

- Frank acetabular dysplasia commonly has a lateral center edge angle (LCEA) less than 17 degrees.[3]
- Borderline dysplasia (BD) is defined as a LCEA between 18^0 and 25^0.[3]
  - This definition varies and some surgeons use a higher cutoff (20^0)
  - **Treatment strategy of this patient group is controversial and has been a "hot topic" of research in the hip arthroscopy/hip preservation world.**
  - This is a separate topic onto itself.

3. S.J. Nho et al. (eds.), Hip arthroscopy and hip joint preservation surgery. Springer Science + Business Media New York 2015

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Evaluation of Patients with a Painful Hip

- Focused history and physical can reveal a lot of useful information in this cohort.
- A good way I find to think about patients with a painful hip is with the layers concept popularized by Dr. Brian Kelly at HSS.
- Radiographs are my primary imaging modality for painful hip workup including dysplasia and FAI.


The layer concept: utilization in determining the pain generators, pathology and how structure determines treatment

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Brian Kelly Hip Layers Concept

4. Draovich P, Edelstein J, Kelly BT, The Layer Concept: Utilization in Determining the Pain Generators, Pathology and How Structure Determines Treatment. Curr Rev Musculoskelet Med. 2012 Mar; 5(1): 1-8.

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Layer 3: (Iliopsoas)

- Based on its anatomic position, origins and insertion, the iliopsoas is the only periarticular muscle that can contribute to stability and movement of the trunk.[3]
- The psoas tendon's close relationship to the anterior hip capsule allows it to function as a dynamic and static stabilizer during hip motion.[3]
- Fabricant et al. demonstrated inferior clinical outcomes in patients undergoing psoas tendon lengthening in patients with higher (greater than 25 degrees) femoral anteversion.[6]
  - Highlights importance of stabilizing effect of psoas tendon, particularly in patients with Layer 1 pathologies.

3. S.J. Nho et al. (eds.), Hip arthroscopy and hip joint preservation surgery. Springer Science + Business Media New York 2015.
6. Fabricant PD et al. Clinical outcomes after arthroscopic psoas lengthening: the effect of femoral version. Arthroscopy. 2012; 28 (7): 695-71.

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Layer 4: Neurokinetic Layer

- Comprised of the thoracolumbar plexus, lumbopelvic tissue and lower extremity structures.
  - Layer responsible for blood supply and innervation to the surrounding tissues.

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Impingement vs Instability

- Determine if the patient's symptoms are due to impingement or instability (can be both).
  - Impingement (pain with FADIR, positive impingement sign)
    - Pain with prolonged sitting.
  - Instability (positive anterior hip instability on exam).
    - Anterior apprehension test.
    - Ultrasound evaluation?
    - Pain with prolonged standing.

Can Dynamic Ultrasonography of the Hip Reliably Assess Anterior Femoral Head Translation?

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Instability

- Anterior apprehension test.
  - Extension, abduction, external rotation with the contralateral hip flexed.
    - Elicits feeling that the hip is going to “pop out” from the patient.
    - Signifies deficient anterior acetabular coverage of the femoral head and/or deficient anterior capsule (Iliofemoral ligament).

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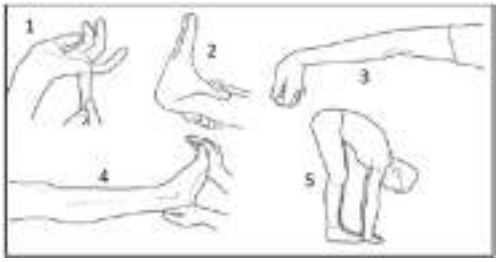
Beighton Score

- Assessment of Beighton Score
  - Highly important in borderline dysplastic patients.
    - Naal FD, Hatzun G, Muller A, Impellizzeri F, Leunig M. Validation of a self-reported Beighton score to assess hyper mobility in patients with femoroacetabular impingement. Int Orthop. 2014; 38(11): 2245-2250.



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Radiographs

- AP pelvis (standing)
- Dunn lateral
- Frog leg lateral
- False profile

A Systematic Approach to the Plain Radiographic Evaluation of the Young Adult Hip

By John C. Clohisy, MD, John C. Carlisle, MD, Paul E. Beaulé, MD, Young-Jo Kim, MD, Robert T. Trousdale, MD, Rafael J. Sierra, MD, Michael Leunig, MD, Perry L. Schoenecker, MD, and Michael B. Millis, MD

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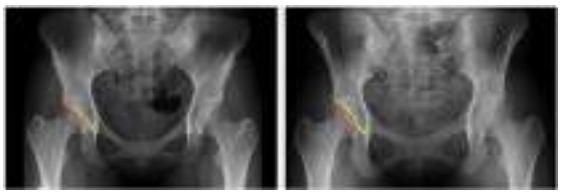
AP Pelvis (Standing)



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Concomitant Pathology

- Make sure you evaluate the proximal femoral pathology beyond the sphericity of the femoral head (cam)
  - Version highly critical, particularly excessive femoral anteversion.
  - McKibbon Index
    - Sum of acetabular version and femoral version. ”Normal” is around 30 degrees.
    - Values over 60 degrees are considered unstable.
      - Tonnis D, Heinecke A. Acetabular and femoral anteversion: relationship with osteoarthritis of the hip. J Bone Joint Surg Am. 1999; 81:1747-1770.
- Intra-articular pathology frequently present.
  - Anterosuperior labral tears, concomitant cam pathology in the setting of dysplasia.

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Labral Hypertrophy in Hip Dysplasia

- Labral hypertrophy
  - 86% of dysplastic patients.
    - Leunig M, et al. Magnetic resonance arthrography of labral disorders in hips with dysplasia and impingement. Clin Orthop Relat Res. 2004; 418:74-80.
- LCEA of hips with labral hypertrophy in ANCHOR group significantly lower than hips without labral hypertrophy.
- If a patient has labral hypertrophy, they are more likely to have labral pathology.
  - Sankar WN, et al. Labral Morphologic Characteristics in Patients with Symptomatic Acetabular Dysplasia. AM J Sports Med. 2015;43 (9):2152-2156.
- Labral hypertrophy >4mm, in an impingement cohort, significantly associated with radiographic and physical exam findings of subtle hip dysplasia and microinstability.
  - Nwachukwu BU, et al. Labral hypertrophy correlates with borderline hip dysplasia and microinstability in femoroacetabular impingement: a matched case-control analysis. HIP Int. 2019;29(2):198-203.

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Treatment Options

- Physical Therapy
- Hip arthroscopy (Isolated arthroscopy has a high failure rate in patients with LCEA less than 20 degrees)
  - Not recommended in truly dysplastic patients
  - Can be an option in select patients with borderline dysplasia.
- Periacetabular osteotomy +- hip arthroscopy

- Matsuda DK, Gupta N, Khatod M, et al. Poorer arthroscopic outcomes of mild dysplasia with cam femoroacetabular impingement versus mixed femoroacetabular impingement in absence of capsular repair. Am J Orthop (Belle Mead NJ) 2017;46:E47-E53.
- Fukui K, Briggs KK, Trindade C, Philippon MJ. Outcomes after labral repair in patients with femoroacetabular impingement and borderline dysplasia. Arthroscopy 2015;31:2371-2379.

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Operative Indications

- Significant symptoms affecting daily life
- Classic acetabular dysplasia deformity
  - Lateral center-edge angle less than 20 degrees
  - Tonnis angle greater than 10 degrees
  - Anterior center-edge angle less than 20 degrees

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Operative Indications

- Relative indications
  - Microinstability due to ligamentous laxity, capsular deficiency, excessive femoral anteversion
  - Pincer impingement due to global acetabular overcoverage or acetabular retroversion.

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Capsular Management

- Unrepaired capsulotomies can lead to iatrogenic hip instability.

10. Harris JD. Capsular Management in Hip Arthroscopy. Clin Sports Med 35 (2016) 373-389.

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Periacetabular osteotomy

- Periacetabular Osteotomy
  - Can include hip arthroscopy to address concomitant intra-articular pathology
  - Can do concurrent femoral derotational osteotomy to address femoral version abnormalities.

12. Dumont DG et al. Hip Instability Current Concepts and Treatment Options. Clin Sports Med 25 (2016) 435-447.

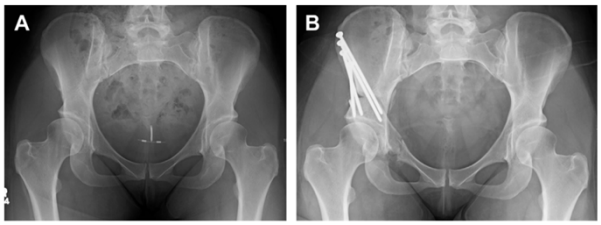

Fig. 5. (*A*) Anteroposterior pelvis demonstrating bilateral acetabular dysplasia. (*B*) Bernese-type PAO is effective for improving femoral head coverage and inherent hip stability in cases of acetabular dysplasia.

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12. Dumont DG et al. Hip Instability Current Concepts and Treatment Options. Clin Sports Med 25 (2016) 435-447.
13. Spiker AM et al. Modifications to the Hip Arthroscopy Technique When Performing Combined Hip Arthroscopy and Periacetabular Osteotomy. Arthroscopy Techniques. 2017. 6 (5): 1857-1863.

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Periacetabular osteotomy Outcomes

- Factors associated with poor outcome include older age, severity of OA, evidence of labral pathology, and poor acetabular index postoperatively (insufficient correction).
- Periacetabular Osteotomy Outcomes
  - Only multicenter prospective cohort study looking at outcomes after PAO is by the ANCHOR group (99.2% survival at 2 years and improved PROs).
  - Multiple retrospective studies report outcomes of PAO
    - Bernese experience has longest follow-up of 30 years with conversion rate to THA or arthrodesis of 12.4% at 10 years and 39.5% at 20 years. At 30 years, 30% of hips were asymptomatic.
  - Boston Children's reported cumulative survival of 76% at 10 year follow up and 74% at 18 year follow up.
  - Troelsen et al described similar results from another high-volume PAO center with 82% of hips surviving 10 years following surgery

14. Clohisy JC et al. Patient reported outcomes of periacetabular osteotomy from the prospective ANCHOR cohort study. J bone Joint Surg am. 2017; 99 (1): 33-41.
15. Lerch TD et al. One-third of hips after periacetabular osteotomy survive 30 years with good clinical results, no progression of arthritis or conversion to THA. Clin orthop Related Res. 2017;475 (4): 1154 -1168.
16.Matheney T et al. Intermediate to long-term results following the Bernese periacetabular osteotomy and predictors of clinical outcome.
J Bone Joint Surg Am; 2009;91(9):2113-2123.
17. Troelsen et al. Medium-term outcome of periacetabular osteotomy and predictors of conversion to total hip replacement
Dan Med J. 2012;59 (6):B4450.

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Recommendations when treating patients with Hip Dysplasia

- Always evaluate evidence of ligamentous laxity
  - Beighton Score
  - Particularly important in patients with borderline dysplasia
- Evaluate the patient to see if they are having Impingement or instability.
  - Can have both.
  - Look for symptoms of FAI (Positive FADIR)
  - Look for symptoms of instability (Positive anterior hip apprehension test).

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Success of PAO is Dependent on Multiple Factors

- Improvement, and ideally normalization of biomechanics of the hip joint.
  - Radiologic correction of acetabular dysplasia and maintenance of congruence postoperatively
  - Correction as needed of associated proximal femoral deformities
- Health of the existing articular cartilage.
  - Younger patients will tend to have healthier cartilage
  - Presence of joint space on radiographs
  - No radiographic evidence of osteoarthritis (Tonnis 0 or 1)
  - Absence of labral and/or chondral damage on MRI (frequently not the case)
- Avoiding/Preventing complications.
  - Surgeon factor is very important. Hands on training important.
    - **Would recommend referral to hip preservation surgeon in cases of frank dysplasia and borderline acetabular dysplasia with more than one radiographic sign of dysplasia and ligamentous laxity.**
  - Optimal control of patient modifiable factors.
    - Weight, and other medical comorbidities (diabetes) is important to avoid wound-related complications.

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Recommendations when treating patients with “borderline” Hip Dysplasia

- Hip arthroscopy
  - Patients with impingement symptoms with only one radiographic sign of acetabular under-coverage and no evidence of ligamentous laxity
- Periacetabular osteotomy +- hip arthroscopy
  - Patients with symptoms of instability
  - Patients with multiple radiographic signs of acetabular under-coverage
  - Patients with ligamentous laxity

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Periacetabular osteotomy

Intraop Images curtesy of Young-Jo Kim, MD, PhD
Boston Children's Hospital

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Periacetabular osteotomy

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Periacetabular osteotomy

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Periacetabular osteotomy

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Periacetabular osteotomy

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Periacetabular osteotomy

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Periacetabular osteotomy

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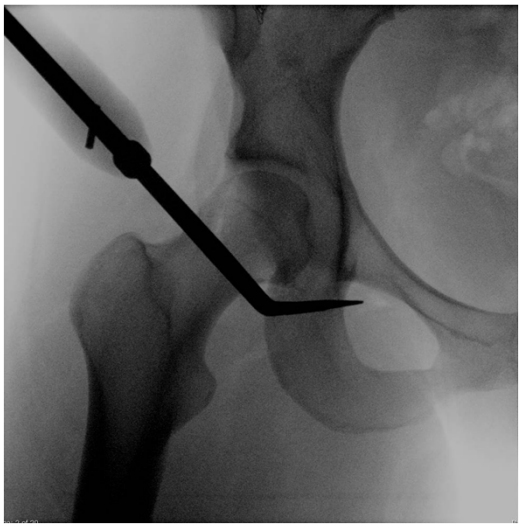
Periacetabular osteotomy



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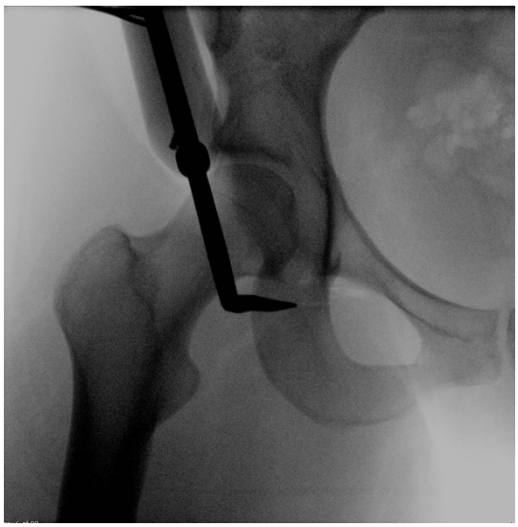
Periacetabular osteotomy



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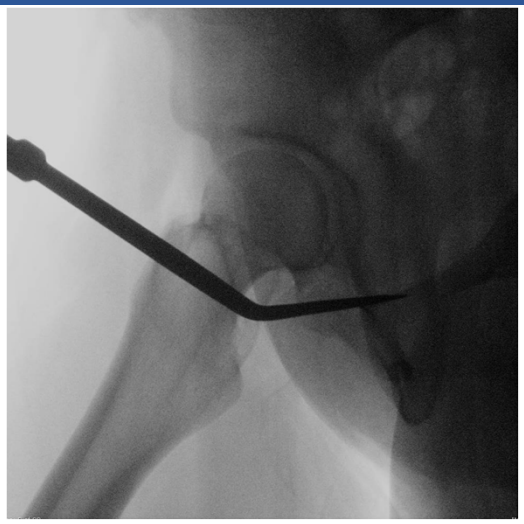
Periacetabular osteotomy



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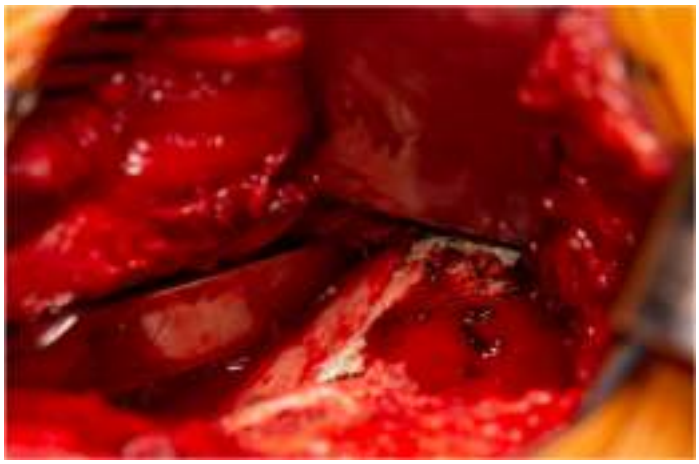
Periacetabular osteotomy



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Periacetabular osteotomy

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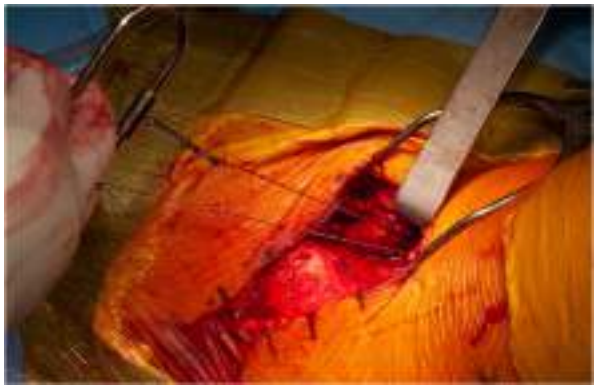
Periacetabular osteotomy



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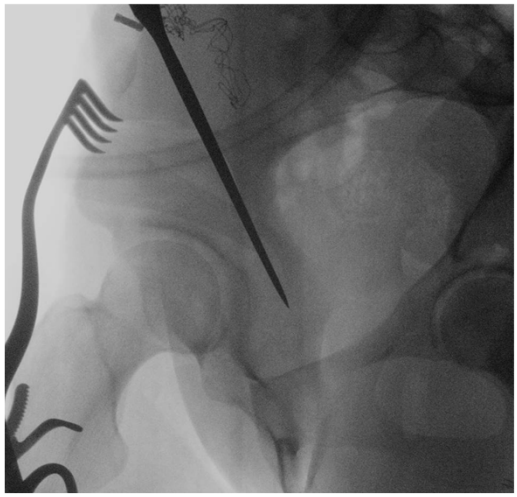
Periacetabular osteotomy



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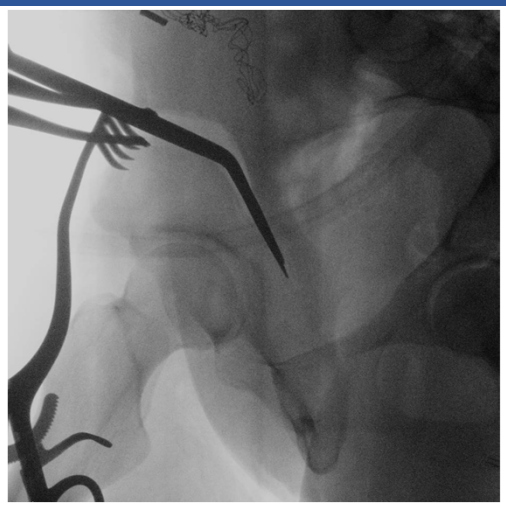
Periacetabular osteotomy



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Periacetabular osteotomy

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Periacetabular osteotomy

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Thank You!

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Case # 1

- HPI:
  - 20 year old female ice figure skater with ligamentous laxity (Beighton 7/9), left hip pain worse with prolonged standing and persistent symptoms despite 3.5 years of dedicated PT. Has had to discontinue skating due to the hip pain.
  - Patient reports some symptoms in deep flexion activity but not as severe as standing.
- Physical Exam:
  - Flexion: 130 degrees, IRF: 35, ERF, 50
  - Positive supine anterior apprehension and FADIR

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Case # 1

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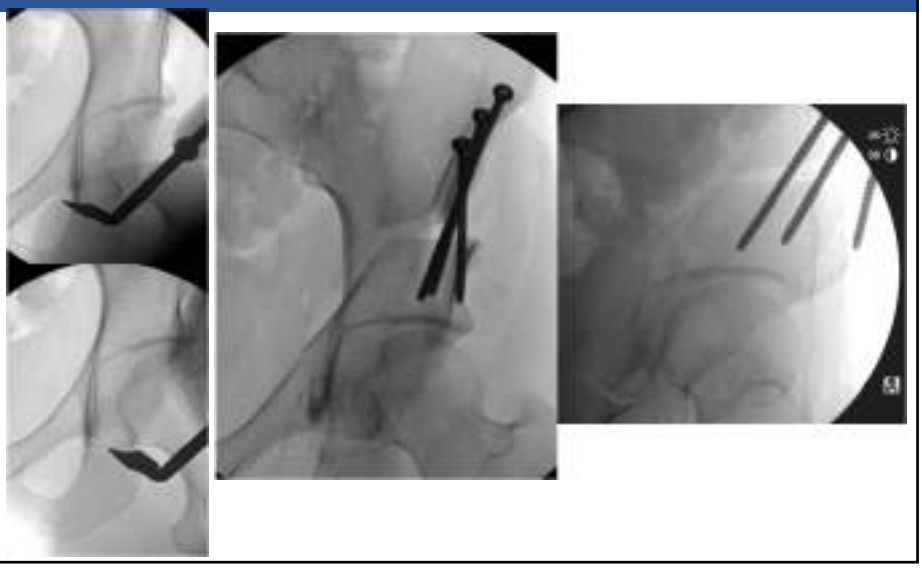
Case # 1



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Case # 2

- HPI:
  - 19 year old ballet dancer ice skater with ligamentous laxity (Beighton 8/9), bilateral hip pain (L>R) worse with prolonged standing and persistent symptoms despite 6 months of dedicated PT. Has had to discontinue dancing due to the hip pain.
  - Patient reports some symptoms in deep flexion activity but not as severe as standing.
- Physical Exam:
  - Flexion: 130 degrees, IRF: 30, ERF, 50
  - Positive supine anterior apprehension and FADIR

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Case # 2

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Case # 2

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