Femoroacetabular Impingement (FAI) & Labral Tears in Athletes: Diagnosis, Surgical Management & Return to Play

Chase D. Smith, MD

- I have no financial disclosures

Background

- Undergraduate: Auburn University
- Medical school: University of Arkansas
- Residency: Oklahoma University
- Fellowship: Sports medicine at Andrews sports medicine in Birmingham
- Practice:
  - Assistant professor Orthopedics Sports Medicine at University of Arkansas
  - Currently with Southern Bone and Joint Specialists

Objectives

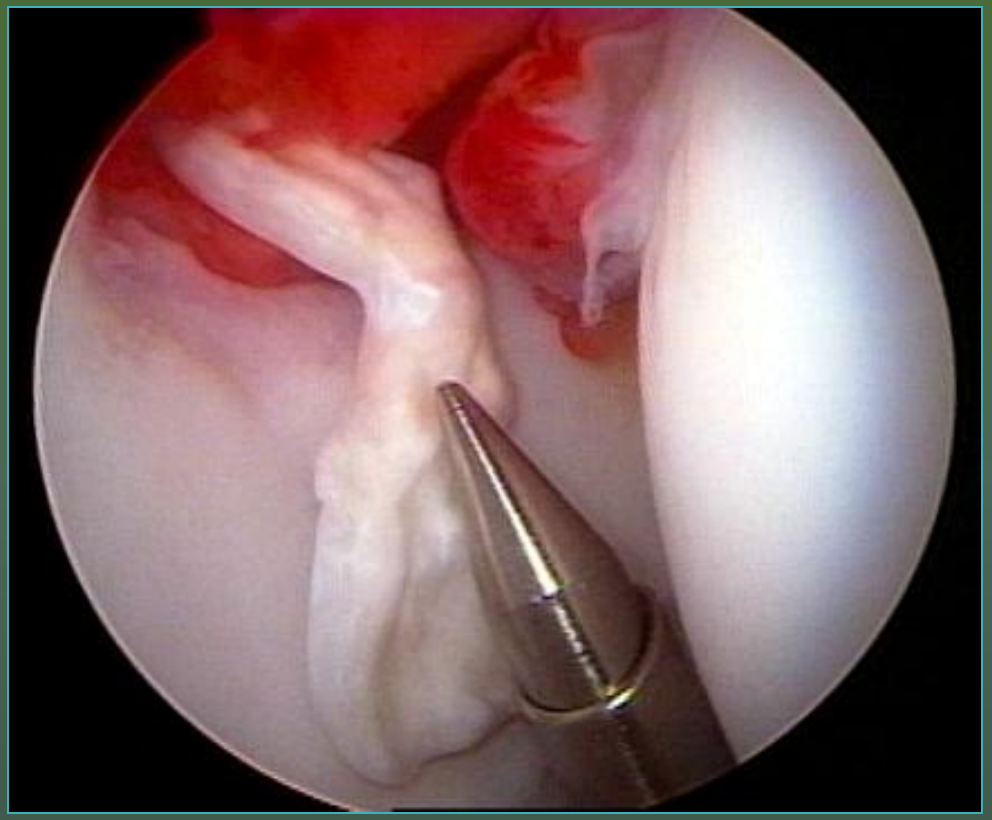
- Understand key hip anatomy & biomechanics
- Master history and physical exam clues
- Know when and how to image
- Recognize surgical indications & techniques
- Apply criteria-based RTP guidelines

Introduction

- Incidence of hip injuries has increased dramatically over the last decade…largely in part due to better recognition with improved imaging and arthroscopy
- Incidence of hip injuries in sports has been publicized in the media
- Better treatment options with biologics, arthroscopy, and advanced rehabilitation

Arthroscopy has defined numerous sources of disabling hip pain

- Among athletes 60% of intraarticular disorders initially misdiagnosed as extra-articular problem ("strain")[1]
  - Treatment average 7 months for extra-articular diagnosis



Anatomic Considerations: Labrum

- Labrum = sealing function and joint stability
- Contains proprioceptors and pain receptors
- Low healing potential because of decreased vascularity

Labrum Biomechanics

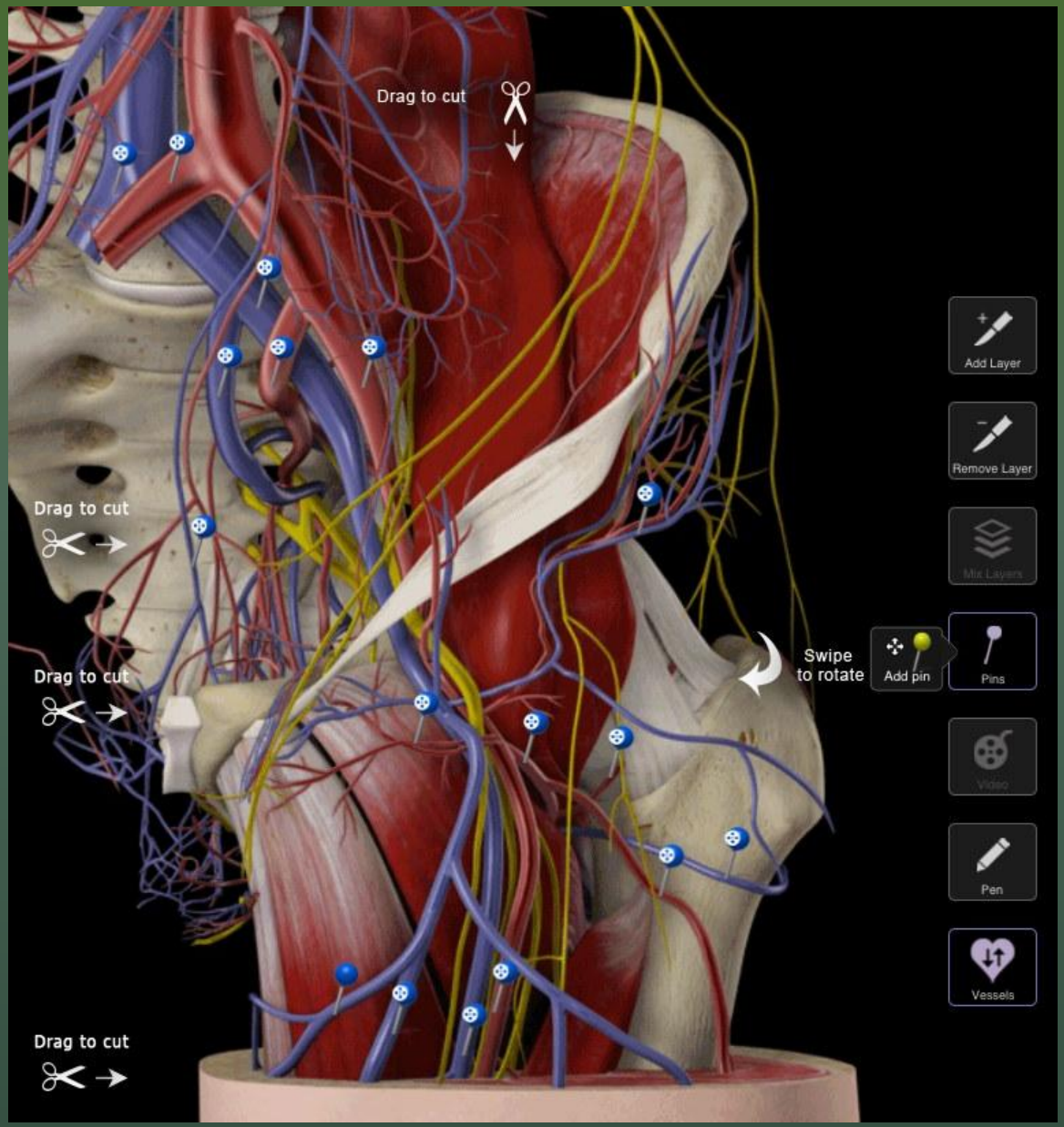
- Fergusen et al. (*J Biomech* 2003)
  - Absence of labrum significantly increases contact pressure of hip joint
  - Labrum has an important sealing function
    - Limits fluid expression from the joint space
    - Protects cartilage layers
  - Provides structural resistance to lateral motion of the femoral head within the acetabulum
    - Enhances joint stability
    - Preserves joint congruity
- Philippon et al. (*Clin Sports Med* 2001)
  - Labral capsular complex
    - Rotational instability of the hip associated with deficient labral tissue

Other Anatomic Considerations

- Ligamentum teres
  - Extracapsular structure
  - May have some stabilizing effect on the hip joint with a deficient labrum
    - Rao et al. *Clin Sports Med* 2001

- Psoas tendon
  - can be subjected to increased load in athletic activities
  - Psoas bursa communicates with the hip joint in the adult in approximately 20% of the population (Byrd. *Clin Sports Med* 2001)

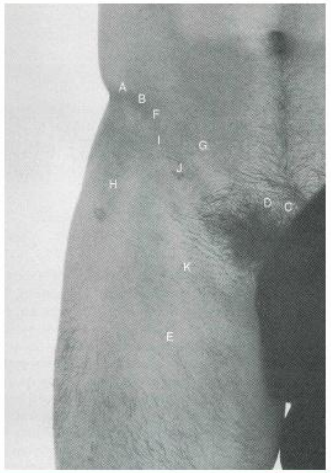
Hip Anatomy is Complex!



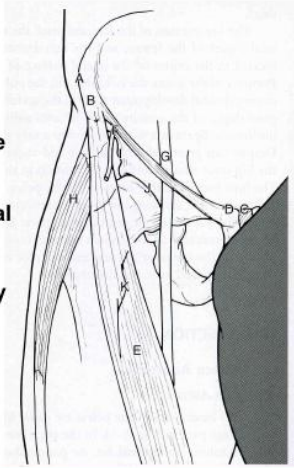
Anatomy

- Surface anatomy
- Muscular anatomy
- Joint anatomy
- Overlapping anatomy

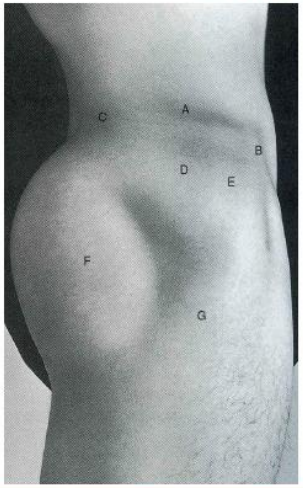
Surface anatomy - hip



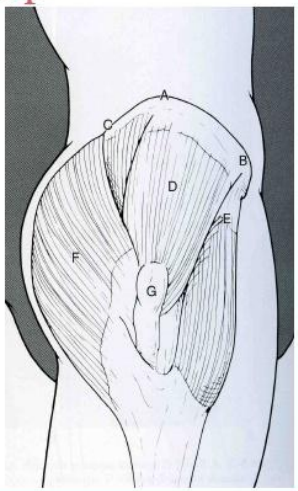
A. Iliac crest
B. ASIS
C. Pubic symphysis
D. Pubic tubercle
E. Sartorius
F. Lateral femoral cutaneous nerve
G. Femoral artery
H. Tensor fascia lata
I. AIIS
J. Hip joint
K. Lessor trochanter



Surface anatomy – hip

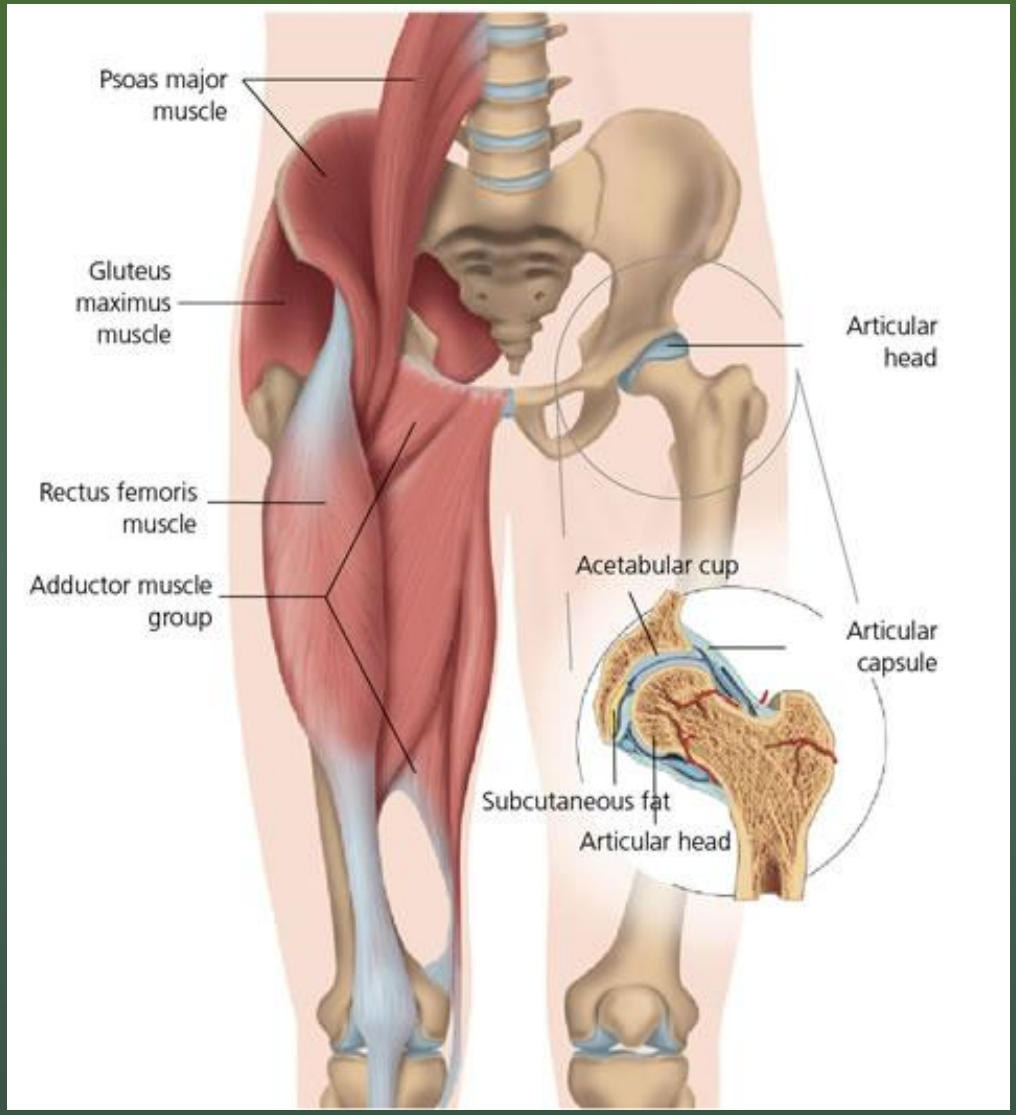


A. Iliac crest
B. ASIS
C. PSIS
D. Gluteus medius
E. Tensor fascia lata
F. Gluteus maxiums
G. Greater trochanter



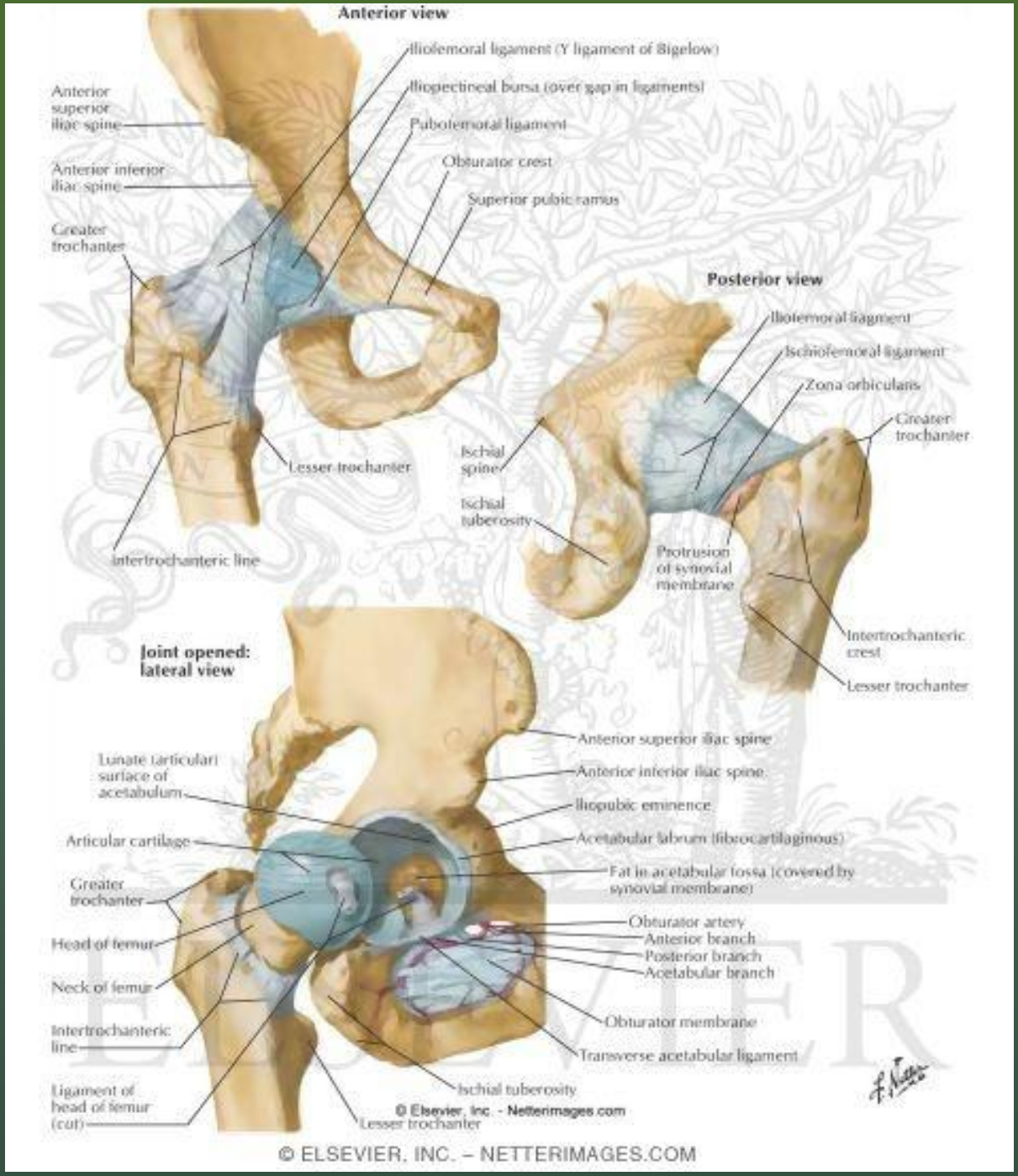
Anatomy

- Surface anatomy
- Muscular anatomy
- Joint anatomy
- Overlapping anatomy



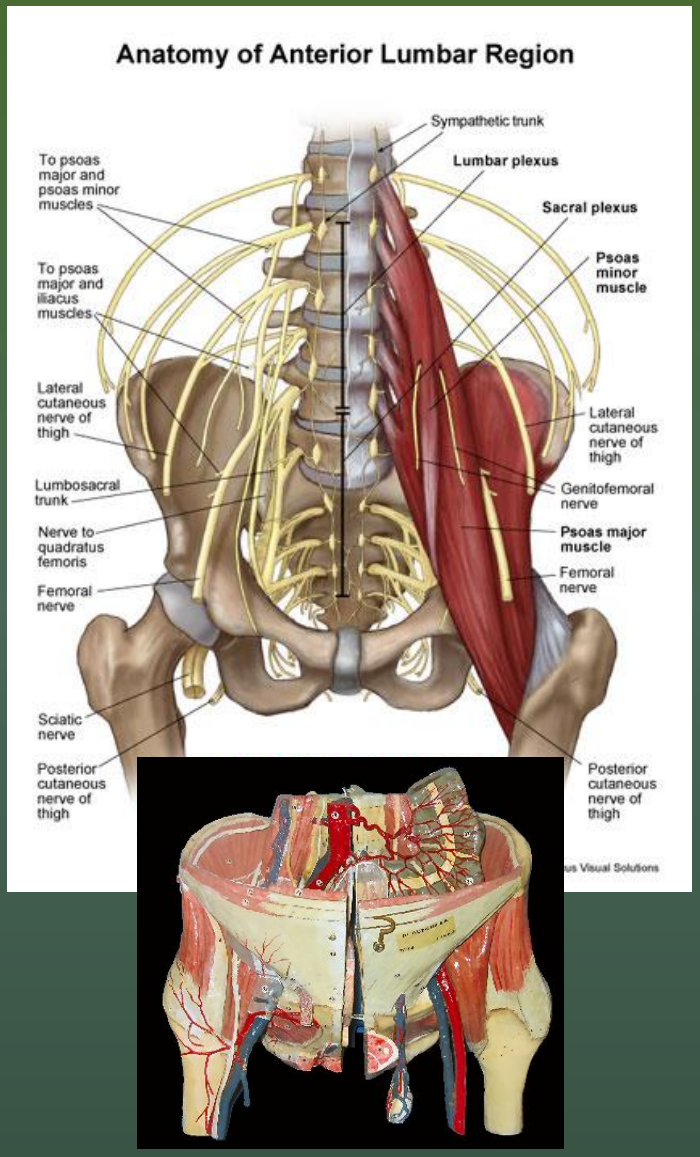
Anatomy

- Surface anatomy
- Muscular anatomy
- Joint anatomy
- Overlapping anatomy



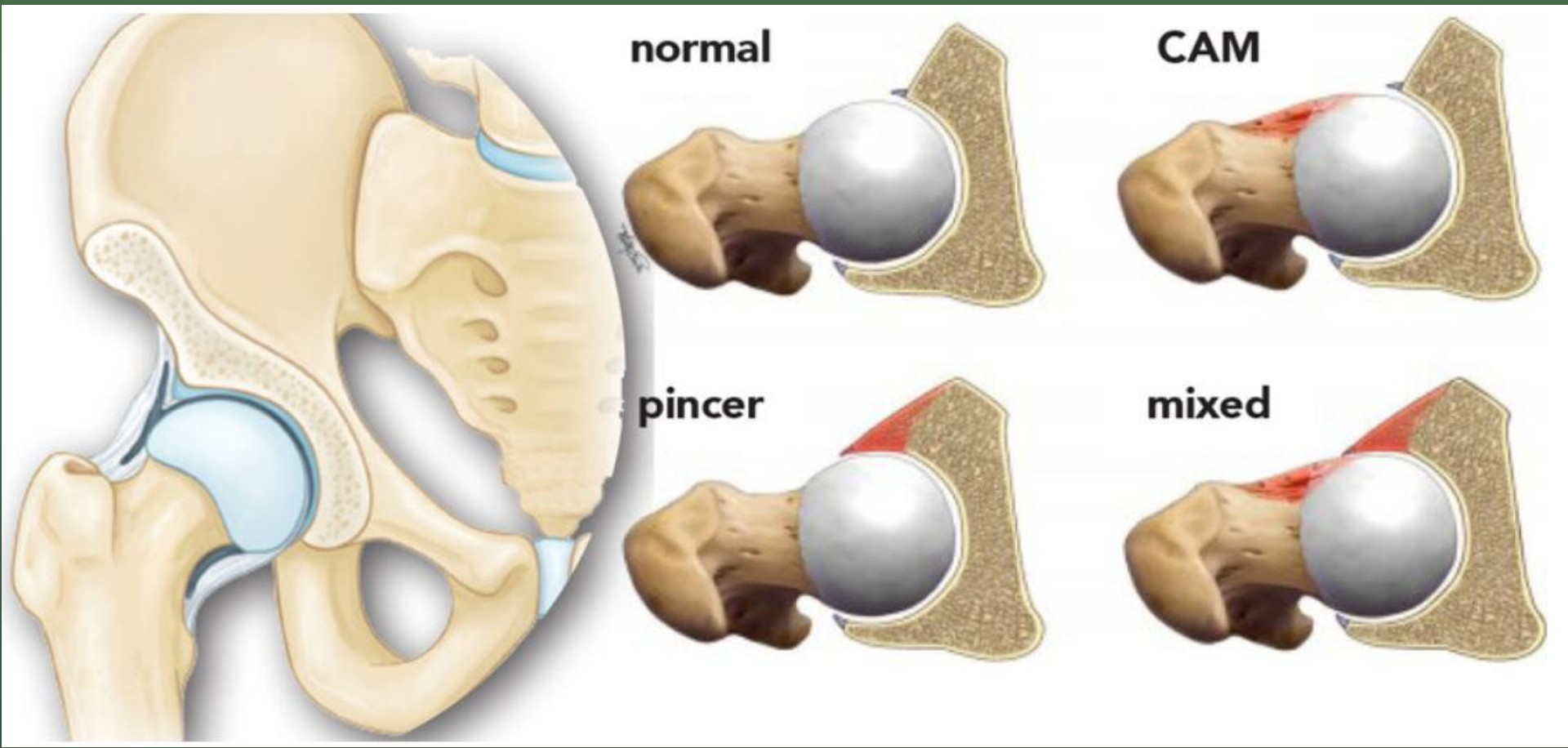
Anatomy

- Surface anatomy
- Muscular anatomy
- Joint anatomy
- Overlapping anatomy



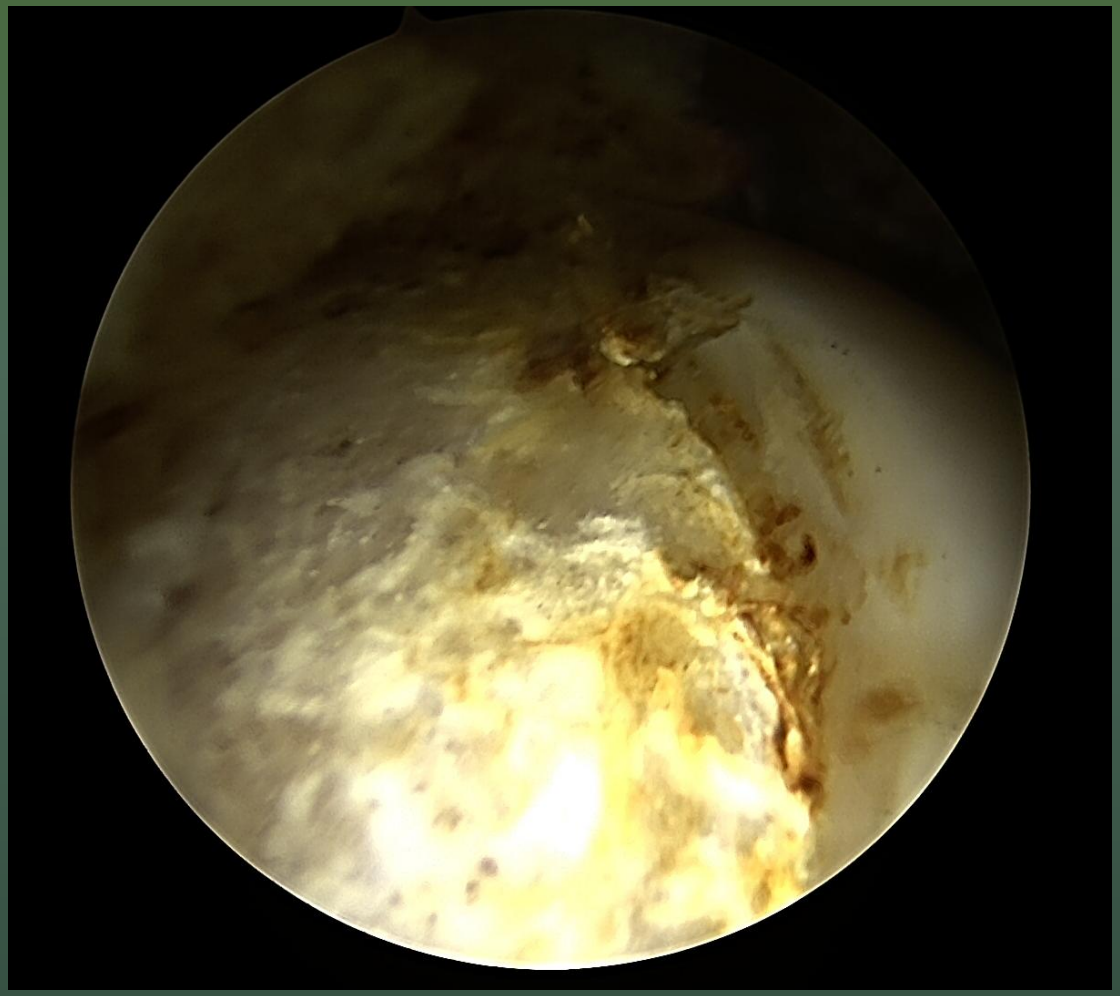
FAI Morphologies: CAM and Pincer

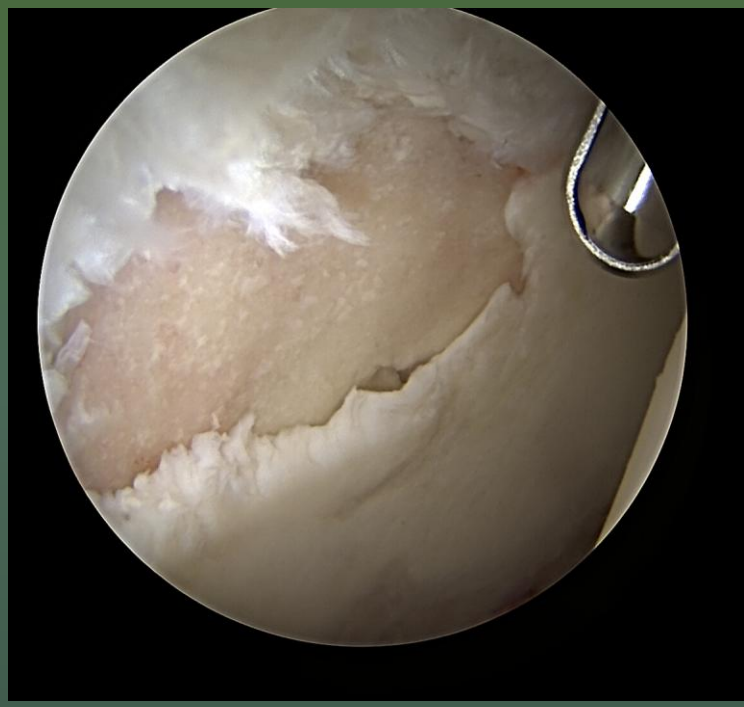
- CAM: Head-neck bump |



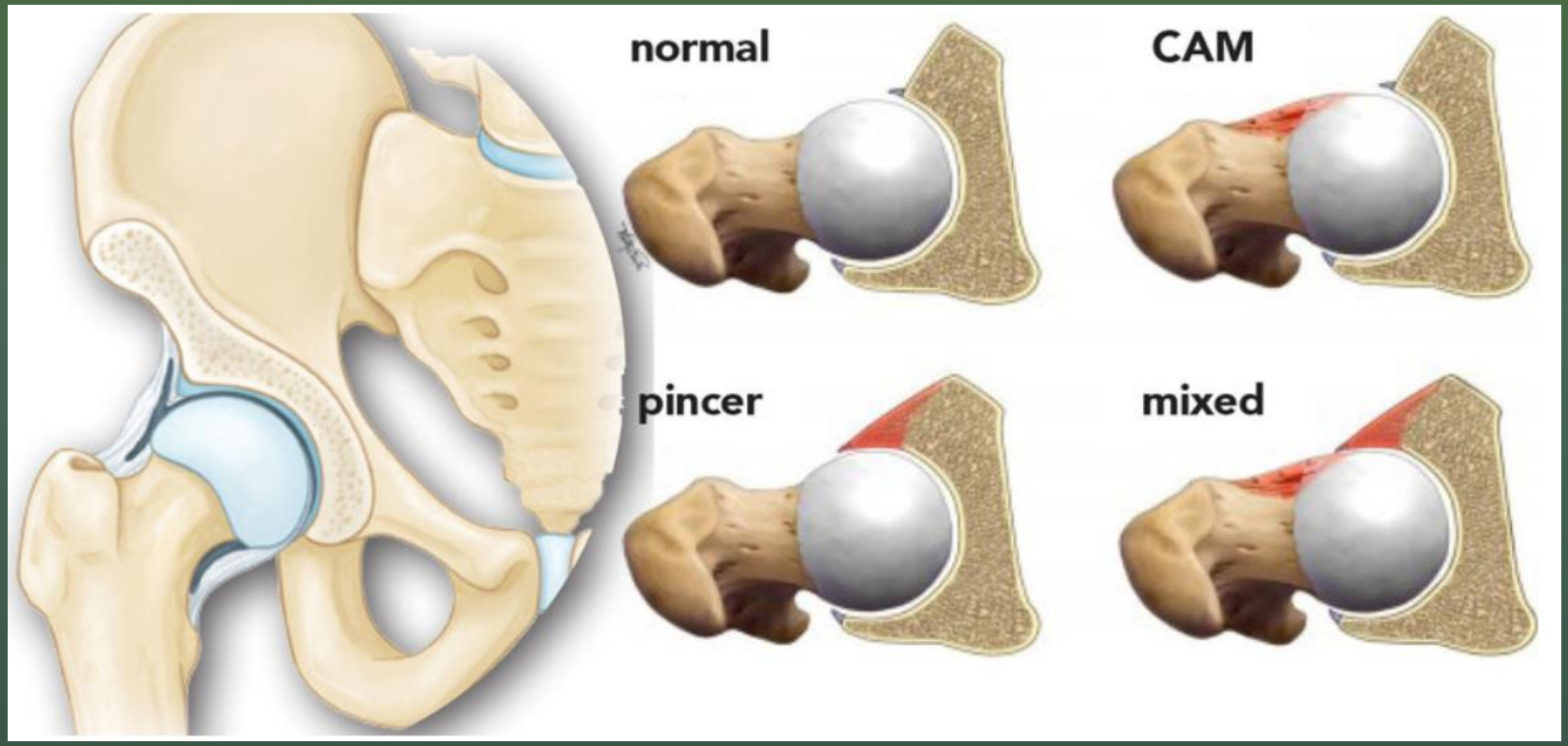
Cam Impingement

Cam deformity
Chondral delamination





Pincer: Rim overcoverage



Pincer Deformity

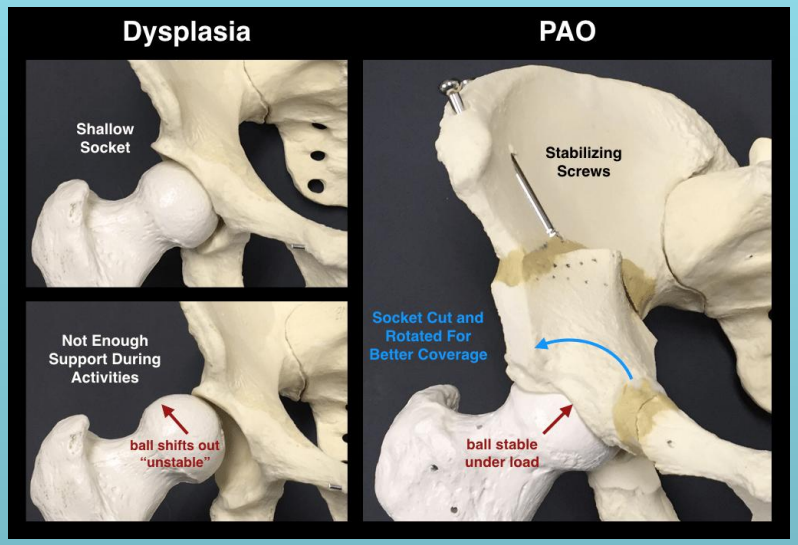
Hip Dysplasia

- Pain
- Instability
- "Extraarticular pain"
  - Psoas
  - Abductors
  - Back

Hip Dysplasia Treatment

PAO (peri-acetabular osteotomy

THA (total hip arthroplasty)



Biomechanics and Risk Factors

- Twisting and cutting sports stress the labrum
- CAM lesions increase shear
- Poor core strength = increased pelvic motion

Assessment of Hip Disorders

Goal is to first determine intra-articular versus extra-articular

Hip joint pathology may co-exist with extraarticular snapping hip, athletic pubalgia, lumbar spine disease, etc.

Chronic hip joint symptoms will secondarily lead to compensatory extraarticular findings (i.e. gluteal pain, abductor symptoms, bursitis, etc.)

Common History & Symptoms

Anterior groin pain (C-sign)

Mechanical symptoms: catching, locking

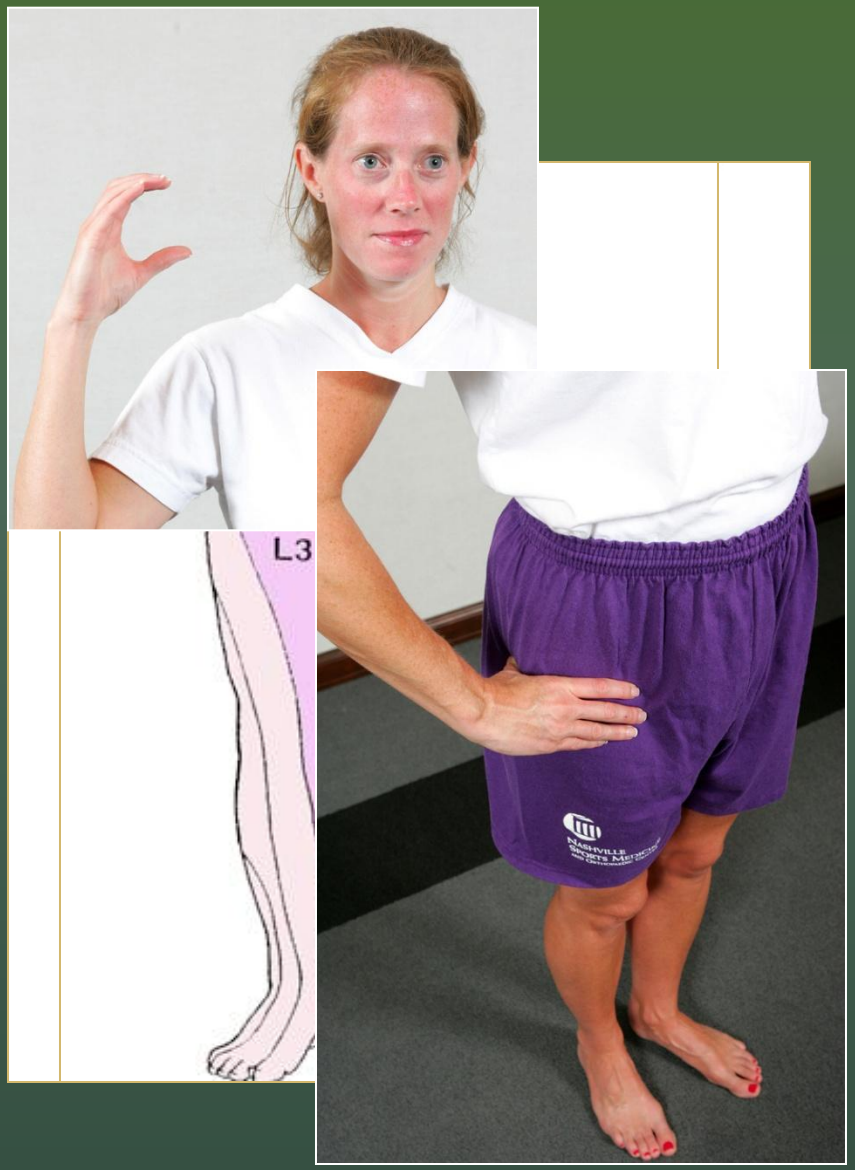
Pain with sitting, getting in/out of car

Presentation

- History of trauma variable…acute vs. chronic
- Mechanical symptoms: Sharp stabbing pain, catching, locking, giving way
- Characteristic exacerbating features
  - Straight plane activities relatively well tolerated
  - Torsional/twisting activities more problematic
  - Prolonged hip flexion (sitting) uncomfortable
  - Rising from seated position often painful (catching)
  - Inclines more difficult than level surfaces
  - Symptoms with entering/exiting automobile
  - Difficulty with shoes, socks, hose, etc.

Localization of Symptoms

- Classically anterior groin radiating to medial thigh
  - Principal innervation is L3
- "C-sign"[5]
  - Very characteristic of hip joint pathology
- Posterior pain
  - Rarely characteristic of hip joint pathology
  - Can occur (substantiated by relief with intraarticular injection)



Physical Exam

Log rolling

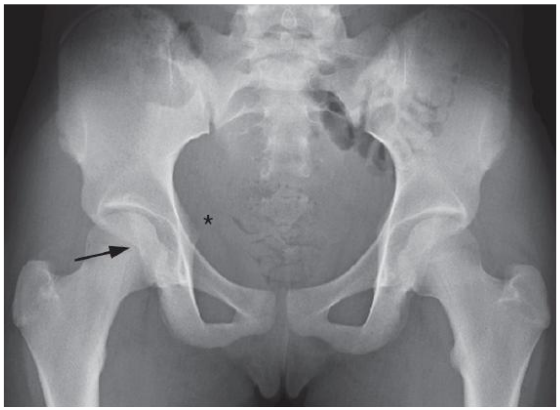
- Most specific for intraarticular pathology (less sensitive)[5]
- Rotates only the femoral head in relation to the acetabulum and capsule

Pain elicited with flexion/internal rotation ("Impingement" test) or abduction/internal rotation

- More sensitive and typically should produce anterior groin or deep anterolateral symptoms[5]
- Compare to uninvolved hip as normally may produce mild discomfort
- Should reproduce patient's symptoms (sharp pain, sense of catching, etc.)
- May produce a "click" (i.e. McMurray's)

Imaging

- AP Pelvis
  - Lateral center edge angle
  - Pistol grip deformity (CAM type FAI)
  - Cross-over sign (pincer type FAI)
- Lateral of involved hip
  - Measure alpha angle (CAM type FAI)
    - 50 degrees is a threshold for CAM
- False Profile view
  - If concerned for acetabular dysplasia
  - To assess anterior acetabular coverage

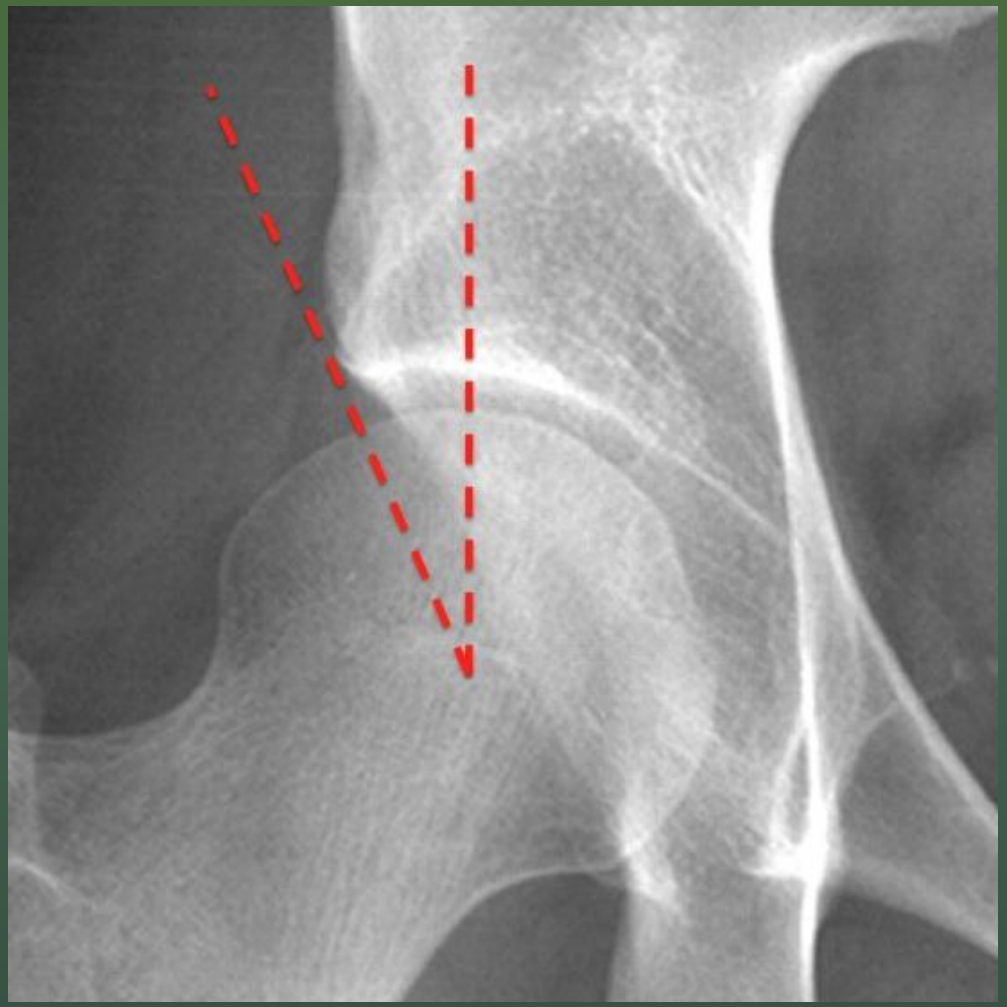


AP Pelvis – crossover sign (Pincer)

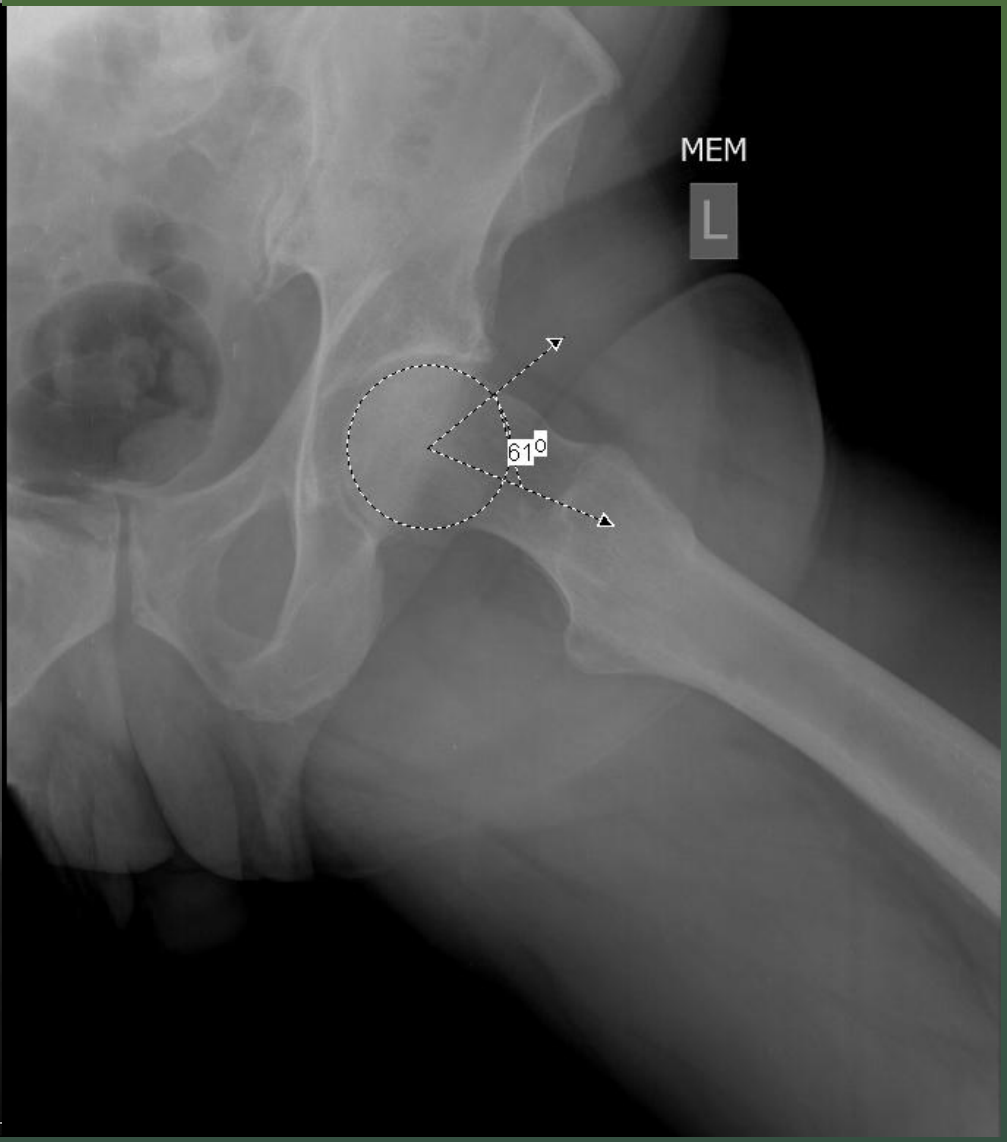
AP Pelvis – Pistol Grip (CAM)

Lateral Center Edge Angle

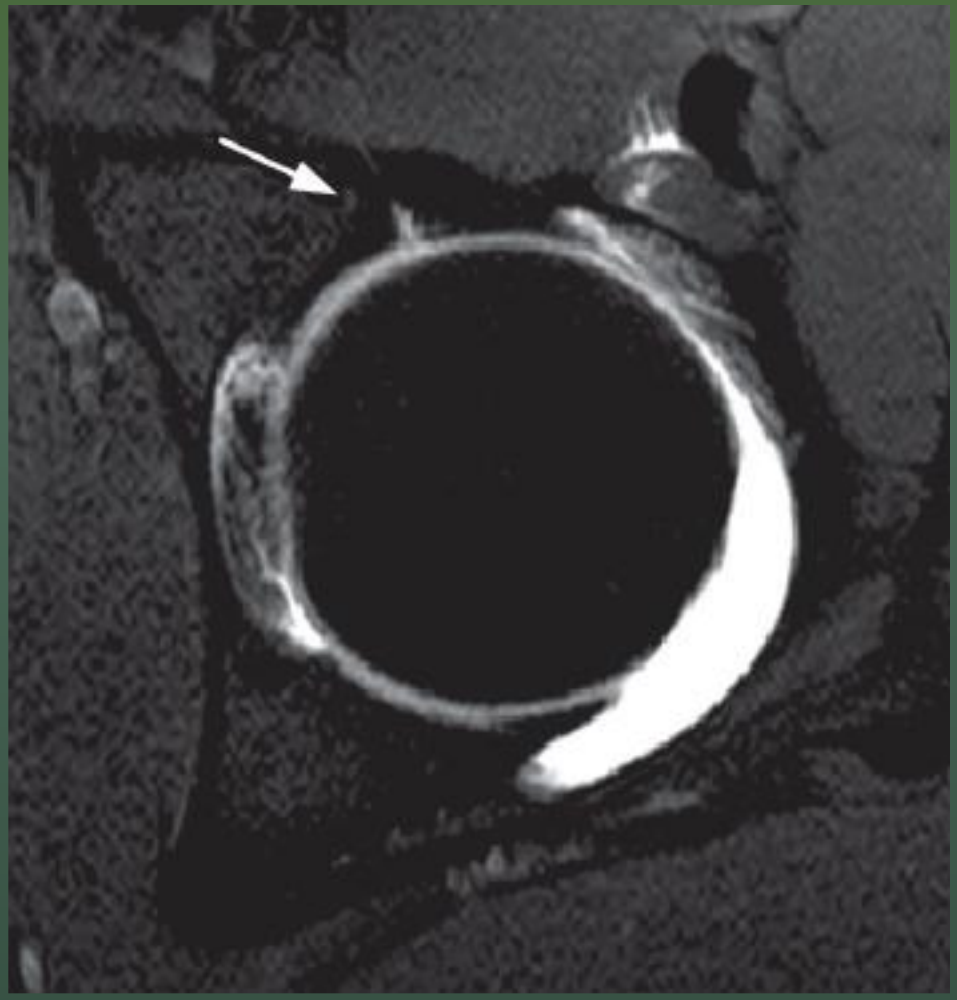
Lateral CEA < 20 associated with hip dysplasia



Lateral of Hip – Measure Alpha Angle

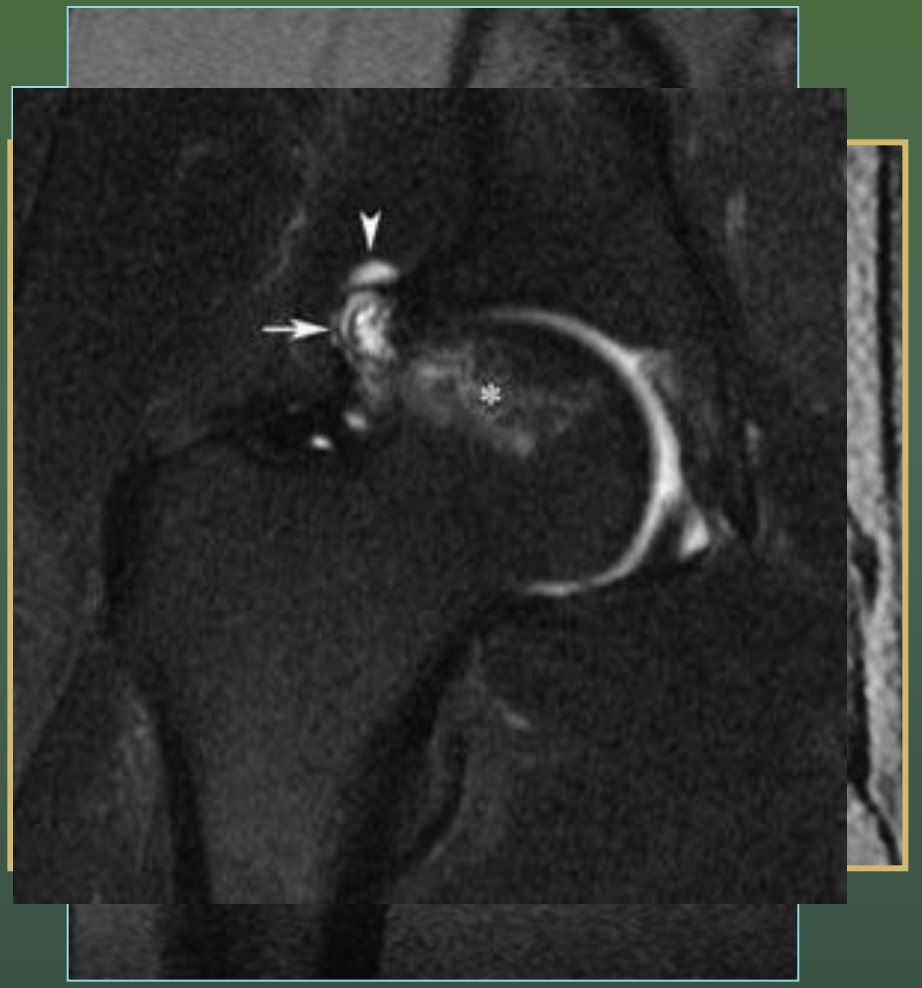


MRI



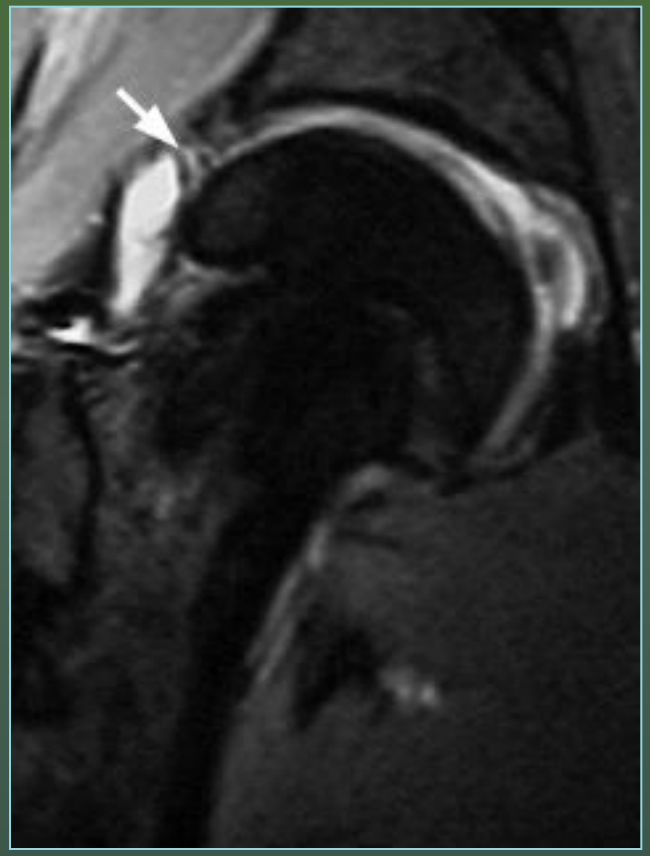
MRI

- MR arthrogram more sensitive[7]
  - Always include anesthetic
  - Response is 90% reliable indicator of joint pathology
- Indirect evidence most reliable finding
  - Effusion – specific for intraarticular process
  - Paralabral cyst – pathognomonic of labral pathology
  - Subchondral cyst – indicative of articular damage

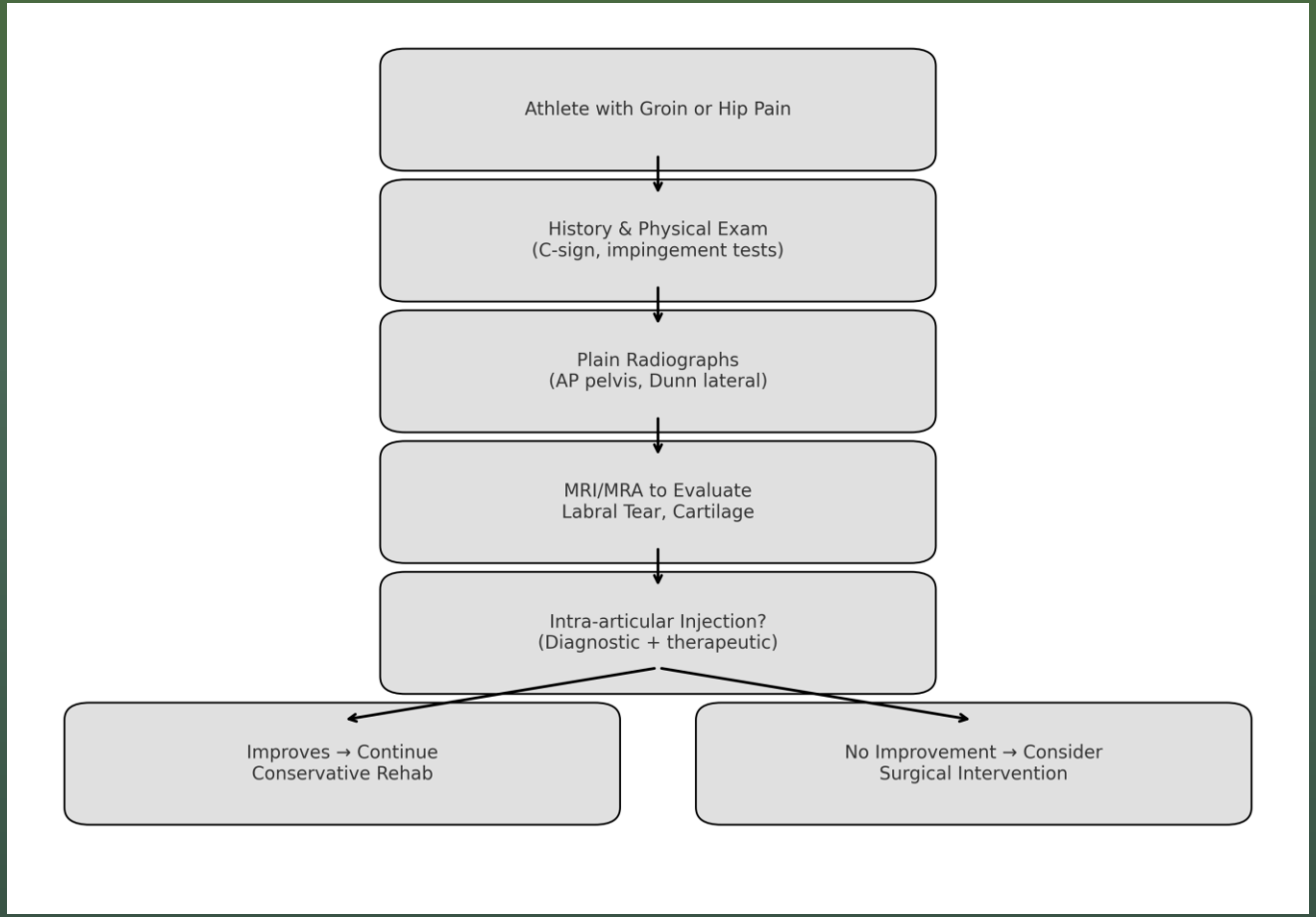


What to do with positive evidence of labral damage

- Is it significant?
  - False positives exist (20%)
  - Some become asymptomatic
- Keep the athlete informed
  - Not all need surgery
  - Injection may resolve
- Active rest
  - 2 weeks, reassess
- If symptoms manageable, go
  - If persistent, consider timing
- No evidence to support early intervention being better
  - Down side, may be unnecessary
  - Up side, earlier recovery
- How long to wait?
  - If acute pain resolves & mechanical symptoms persist…
    - Arthroscopy



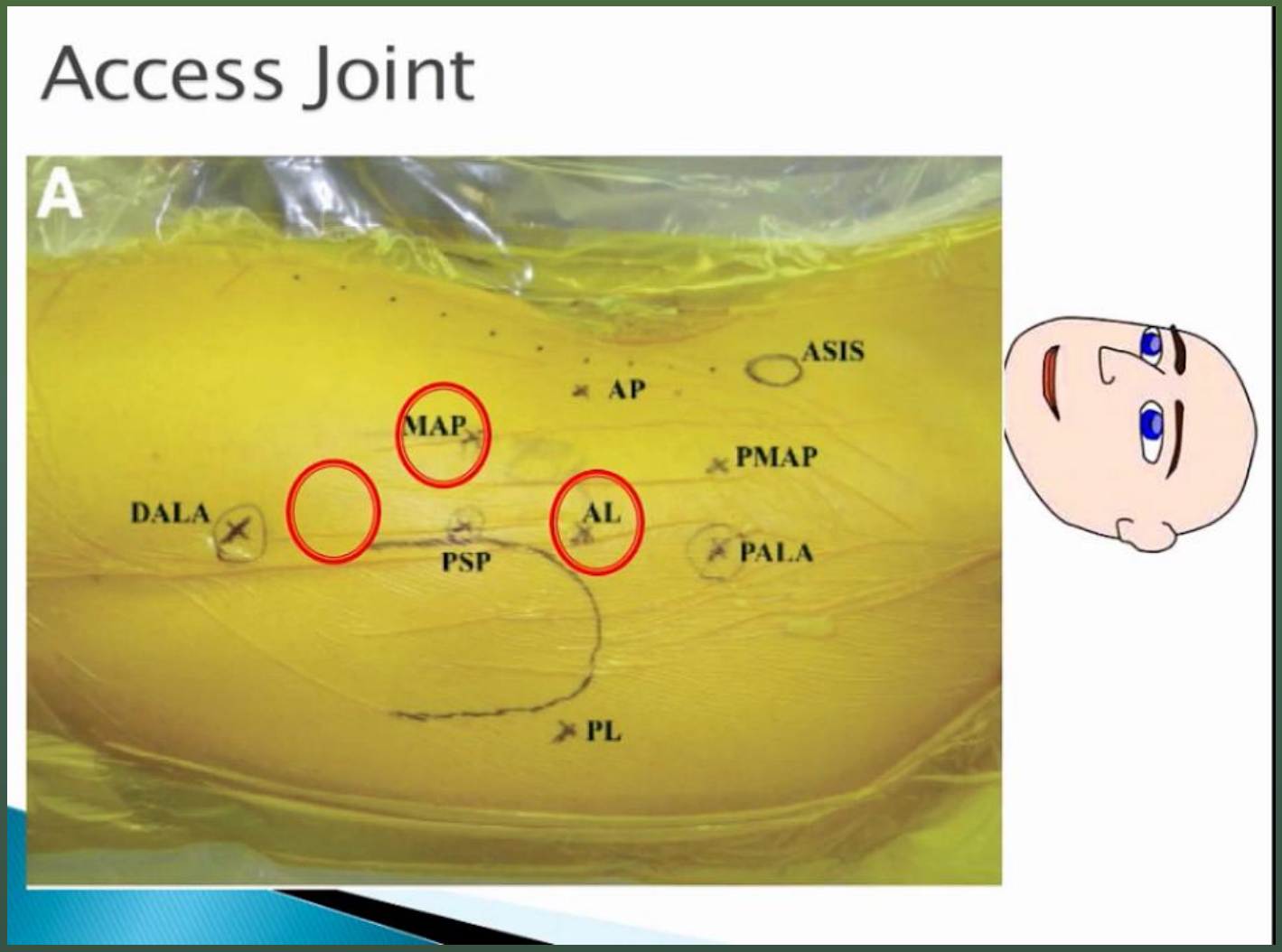
Management of FAI



My Setup

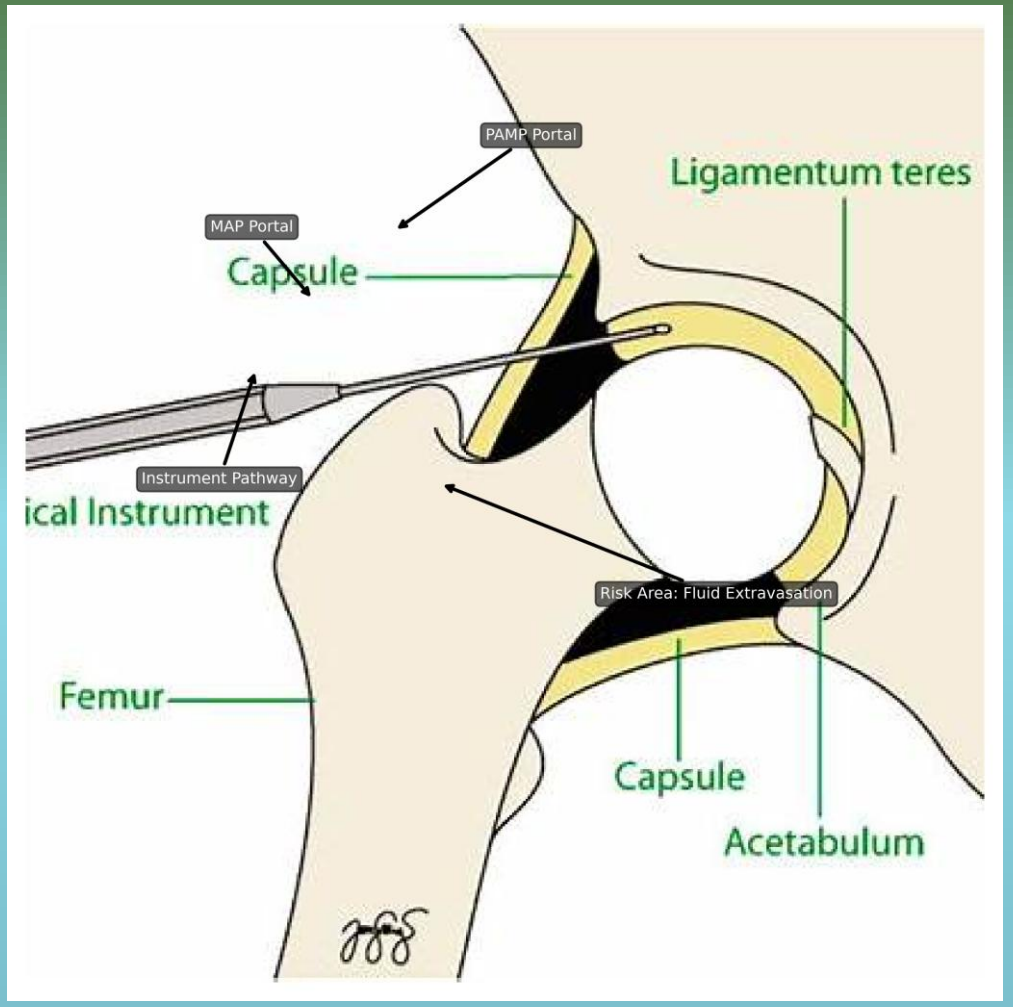

Traction in line with femoral neck
Well padded perineal post
50 pounds of traction

Portals



Surgical Complications

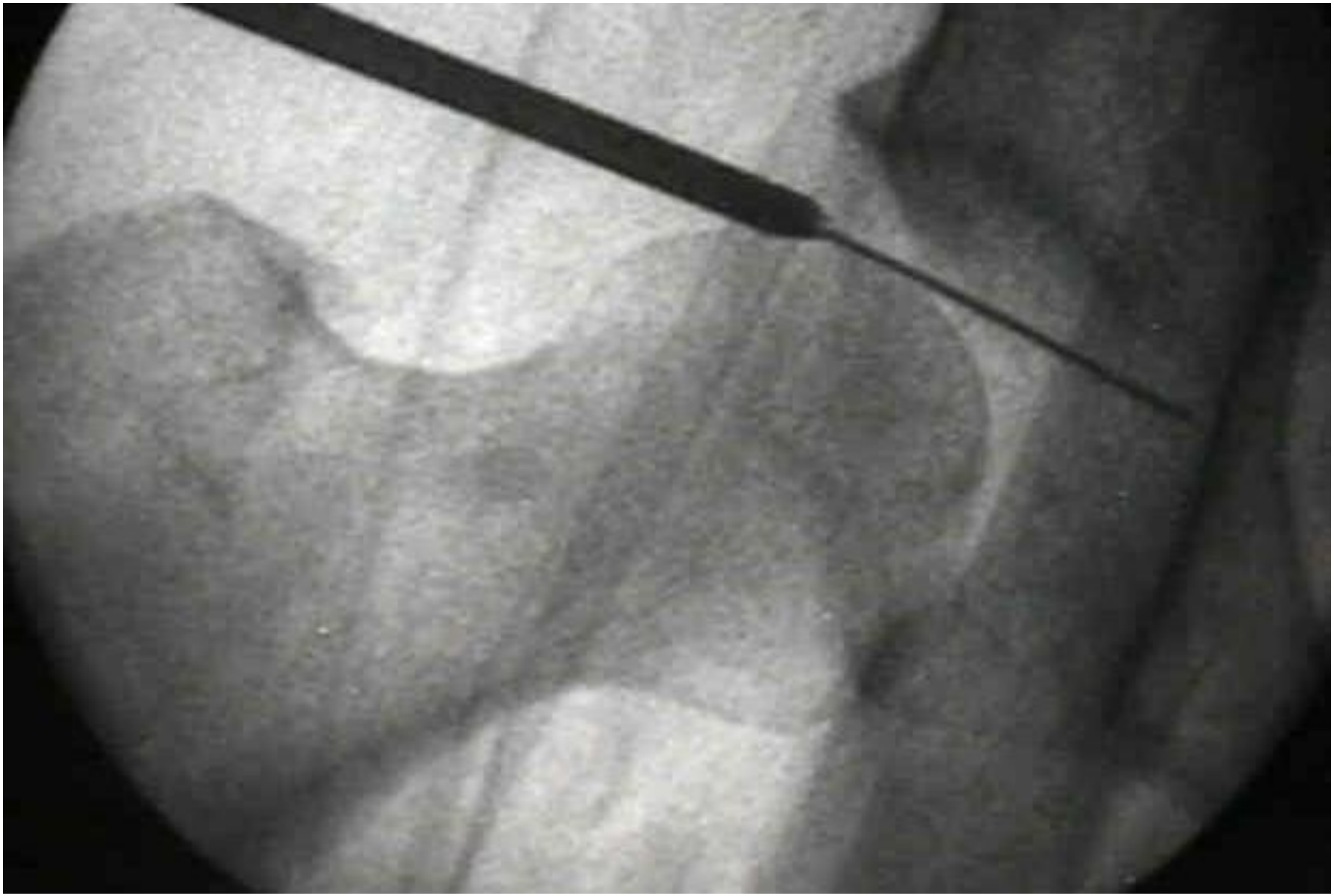
- • Pudendal neuropraxia (traction)
- Portal nerve risks
- • Chondral damage



Air Arthrogram

Insufflate the joint with fluid

Joint is tight, so the fluid should flow back



Select Injuries

- Impingement and labral tears
- Articular trauma & loose bodies
- Internal snapping hip
- External snapping hip

Labral Pathology

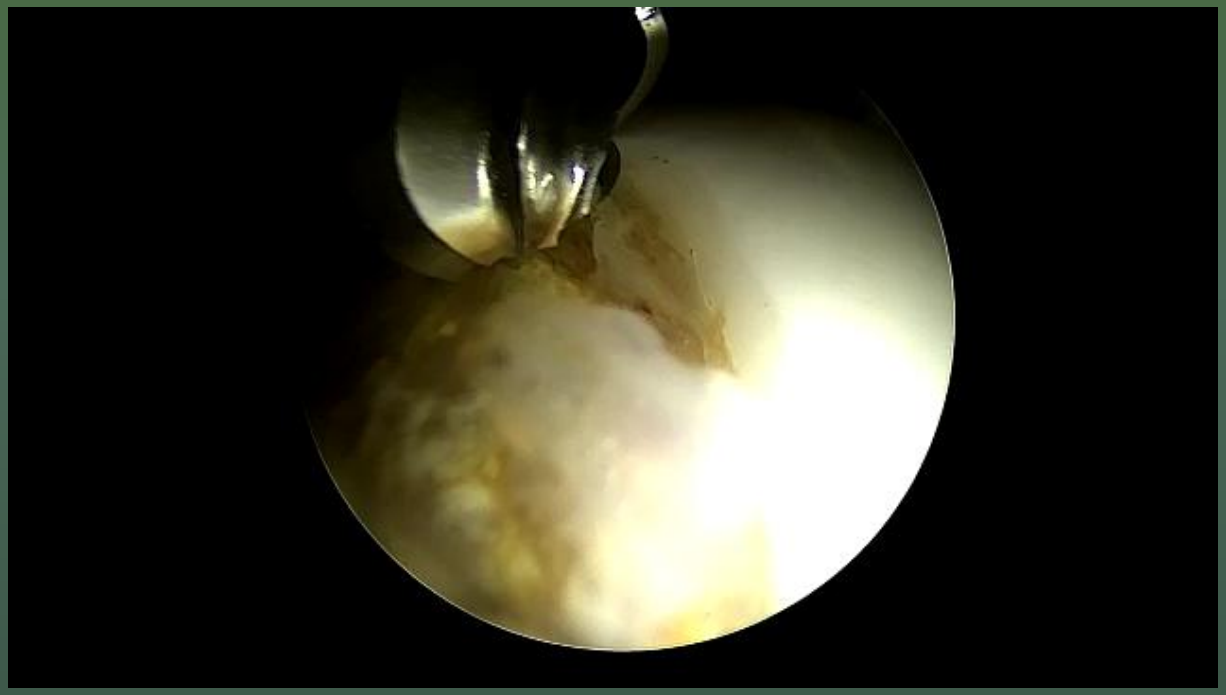
- Etiology
  - Twisting injury[8]
  - Macrotrauma (subluxation)
  - Microtrauma (FAI)
- Present in 61% of athletes undergoing arthroscopy[1]
- Lesion most likely detected on MRI[7]
- Management
  - Debridement, create stable zone
    - Leave as much stable tissue as possible
    - 82% success (nonarthritic)
    - 79% THR (arthritic) @ 10 yr f/u[10]
  - Repair
  - Reconstruction

Labral Debridement

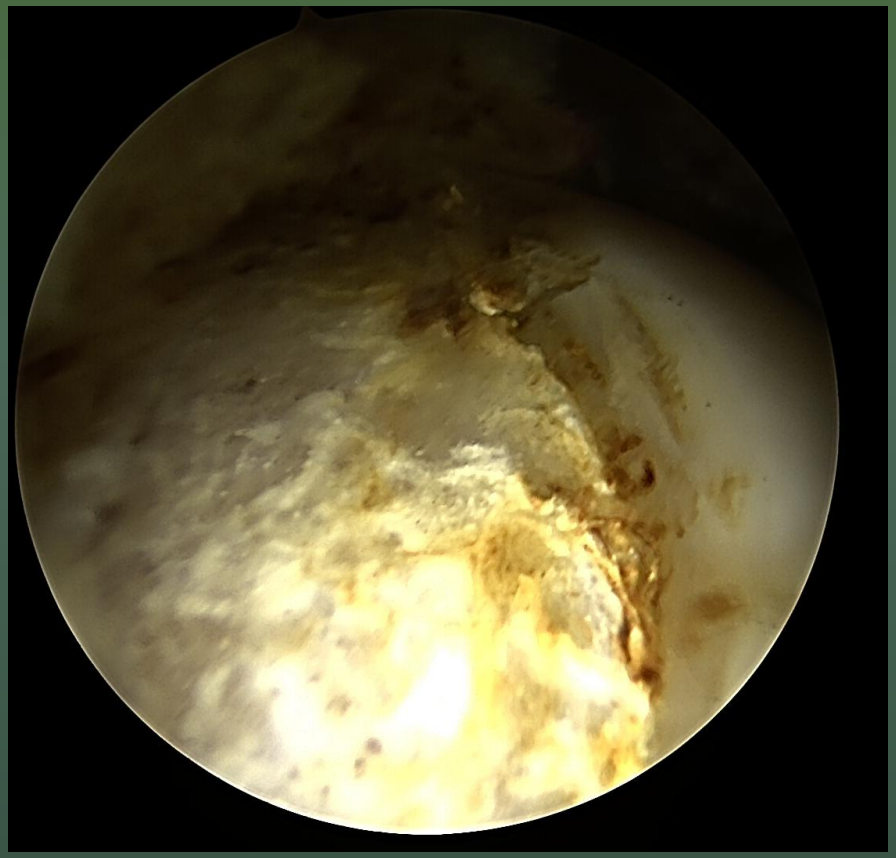
Labral Repair

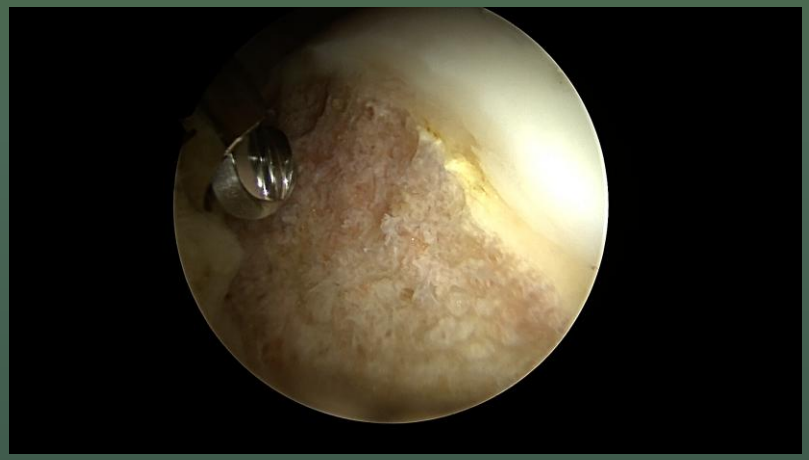
Labral repair

Cam Resection



CAM Resection





Hip Arthroscopy for Labral Tears

Review of Clinical Outcomes With 4.8-Year Mean Follow-Up

Atul F. Kamath,* MD, Roger Componovo,† MD, Keith Baldwin,* MD, MPH, MSPT, Craig L. Israelite,† MD, and Charles L. Nelson,†‡ MD

Vol. 37, No. 9, 2009

- 5.8% conversion to THA
- Better outcomes if: higher preop activity level, symptoms over 18 months
- Negative outcomes if: smoking, secondary gain
- Chondromalacia and osteoarthritis were not predictive of negative outcome
- 84% return to sport or equivalent level of preop activity

Does Primary Hip Arthroscopy Result in Improved Clinical Outcomes?

2-Year Clinical Follow-up on a Mixed Group of 738 Consecutive Primary Hip Arthroscopies Performed at a High-Volume Referral Center

Asheesh Gupta,* MD, John M. Redmond,* MD, Christine E. Stake,* DHA, Kevin F. Dunne,* BS, and Benjamin G. Domb,*†‡§ MD
Investigation performed at the American Hip Institute, Westmont, Illinois, USA

AJSM Vol. 44, No. 1, 2016

- Statistically significant increases in mHHS, Non-arthritic Hip Score, HOS-ADL score, HOS-Sport Specific Subscale
- 7.7% underwent revision arthroscopy
- 9.1% underwent THA
- Increased age
  - Risk factor for THA conversion, revision arthroscopy, change in NAHS < 10 points

Articular Trauma

- Etiology
  - Acute: shear vs. impaction
  - The "Lateral Impact Injury"
- MRI has low sensitivity[7]
  - Have strong suspicion!
- Nagging, persistent groin pain
- Good results with debridement of unstable fragments
  - +/- microfracture

Articular Trauma

Loose Bodies

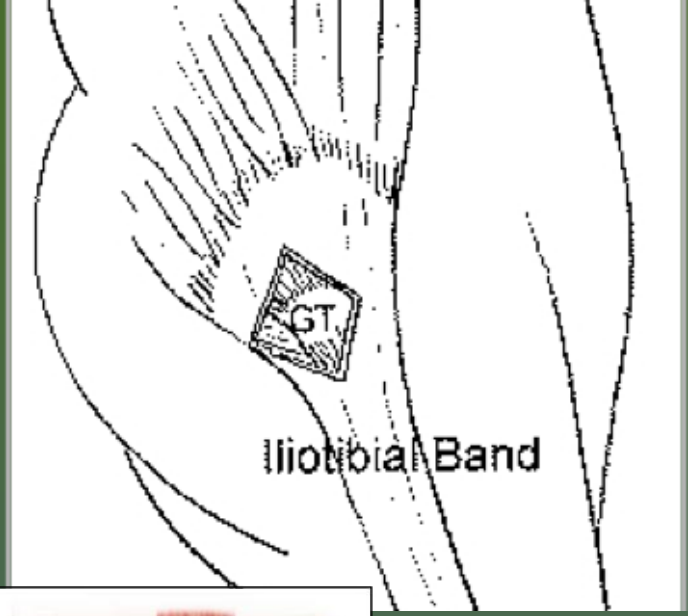
- Clearest indication for surgery[15]
- Etiology
  - Post-traumatic
  - Synovial chondromatosis

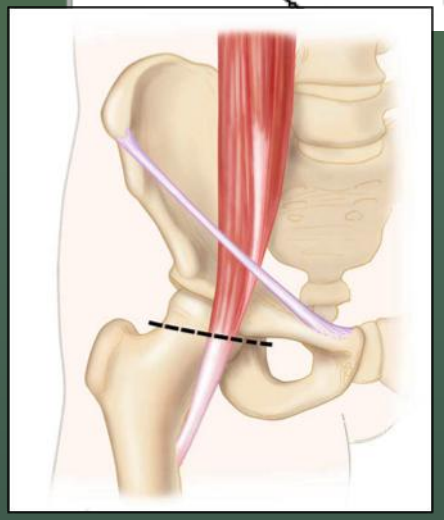
Snapping Hip: Internal vs. External

- Iliopsoas tendon (internal)
  - Characteristic audible clunk when bringing hip from flexion/ER to extension/IR
    - Displaces the iliopsoas over the iliopectineal eminence or over the femoral head
  - Pain in deep anterior groin
  - Confirmed with bursography
    - Marcaine/Dexamethasone
- IT Band (external)
  - Visible and palpable snap
  - "pseudosubluxation"
  - Hip extension to flexion
  - Pain laterally
- Both usually voluntarily reproducible

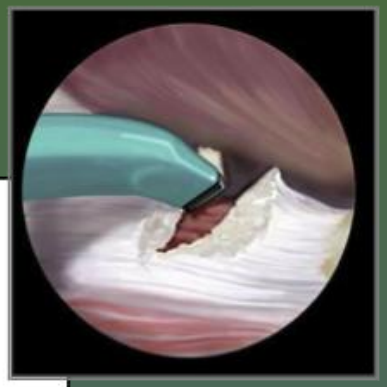
Snapping Hip

- Treat like bursitis/tendonitis
  - Activity modification
  - Stretching
  - NSAIDS
  - Cortisone injections into the psoas sheath
- Recalcitrant cases sometimes require surgery
  - Arthroscopic IP release
  - Sub-psoas decompression
  - Endoscopic ITB windowing

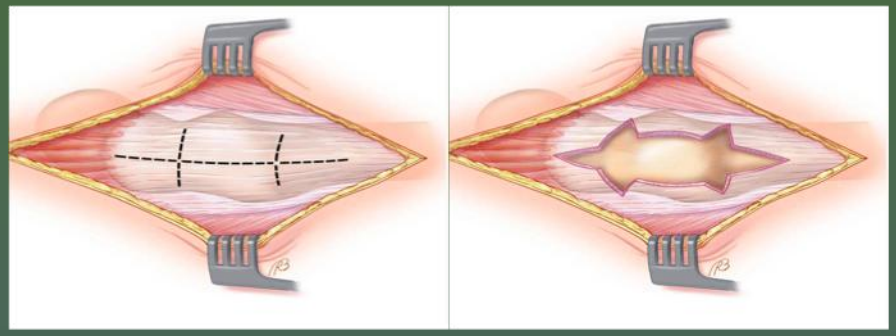


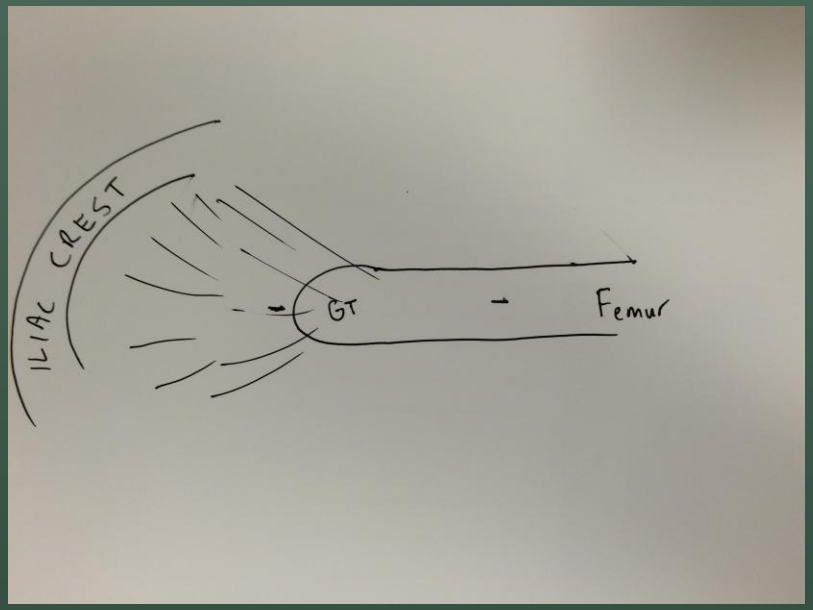


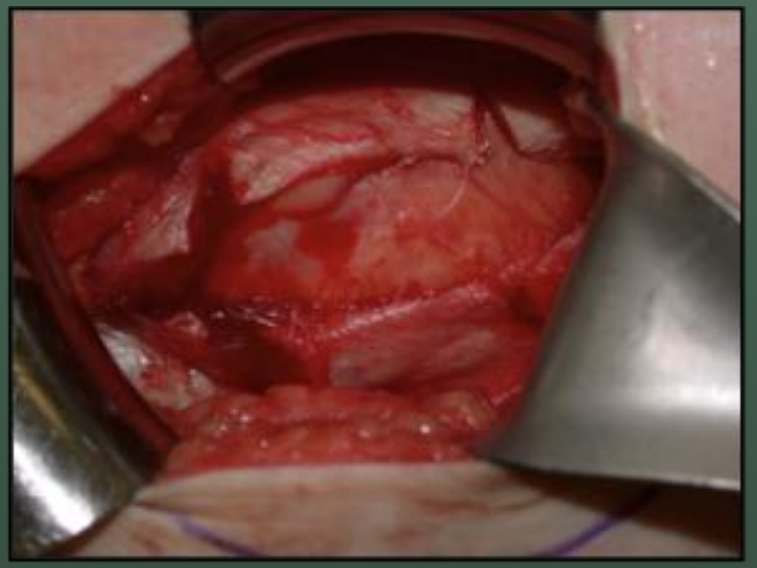
Iliopsoas Release



IT Band Release: Open vs. Endoscopic







Diagnostic Algorithm

- Groin pain →
- Hx & PE →
- X-rays →
- MRI or MRA if needed →
- Intra-articular injection →
- Conservative vs surgical pathway

Post-operative care

- All are WBAT with crutches for 2 weeks
- Hip Brace for first 4 weeks
  - Limitations
    - 60 degrees flexion
    - 30 degrees extension
    - Neutral abduction
- Begin ROM, hip/core strengthening immediately
- Advance as tolerated with non-repair cases
  - (generally over 6 to 16 weeks)
- More protective with repair/bony cases
  - (generally 16 to 24 weeks)
- Specific protocols for specific cases

Post-Operative Rehab Phases (FAI/Labral Repair)

Phase 1 (0–4 wks): Pain control, gentle ROM, glute/TA activation

Phase 2 (4–8 wks): Normalize gait, core strength, non-impact cardio

Phase 3 (8–16 wks): Strength progression, single-leg control, agility

Phase 4 (4–6+ mos): Sport-specific drills, return-to-play readiness

Return-to-Play Criteria After Hip Scope

- Pain-free with sport-specific movement
- Symmetrical ROM and strength (≥90%)
- Negative impingement tests (FADIR/Scour)
- Functional tests: Y-Balance, hop tests
- HOS-Sport > 85, mHHS > 90
- 2+ weeks full practice without limitations

Criteria-Based Return to Play

Visual protocol table:

Phase 1: 0-4 wks

Phase 2: 4-12 wks

Phase 3: 12-20 wks

Phase 4: 20+ wks

Phased Rehab Protocol (Post-FAI/Labral Repair or Debridement)

Phase	Timeline	Goals	Key Interventions
Phase 1 Protection & Early Mobility	0–4 weeks	Protect repair, reduce pain/inflammation, begin gentle ROM	- WBAT with crutches (wean ~2 weeks if no repair) - Brace limiting flexion <60° (for repair) - Circumduction, gentle PROM - Isometrics: glute sets, TA activation
Phase 2 Neuromuscular Re-ed & Core Stability	4–8 weeks	Normalize gait, improve mobility, restore core control	- Discontinue crutches when gait normalized - Core strengthening: plank series, side bridges - Stationary bike, elliptical (no incline) - Continue soft tissue and hip capsule mobility
Phase 3 Strength, Endurance, Dynamic Control	8–16 weeks	Build strength, restore functional motion patterns	- Double → single-leg strength progressions - Lateral band walks, hip bridges, resisted hip exercises - Agility drills without cutting - Begin low-level plyometrics (no twisting)
Phase 4 Return to Sport Prep	4–6 months+	Full strength, control, and sport-specific activity	- Controlled sprinting, cutting, change of direction - Full ROM and strength symmetry - Sport-specific training (e.g., ladder drills, reactive drills) - Psychological readiness evaluation (e.g. ACL-RSI adapted for hip)

Rehab Pearls for PTs and ATs

COORDINATE WITH SURGEON ON CARTILAGE STATUS AND PROCEDURE TYPE

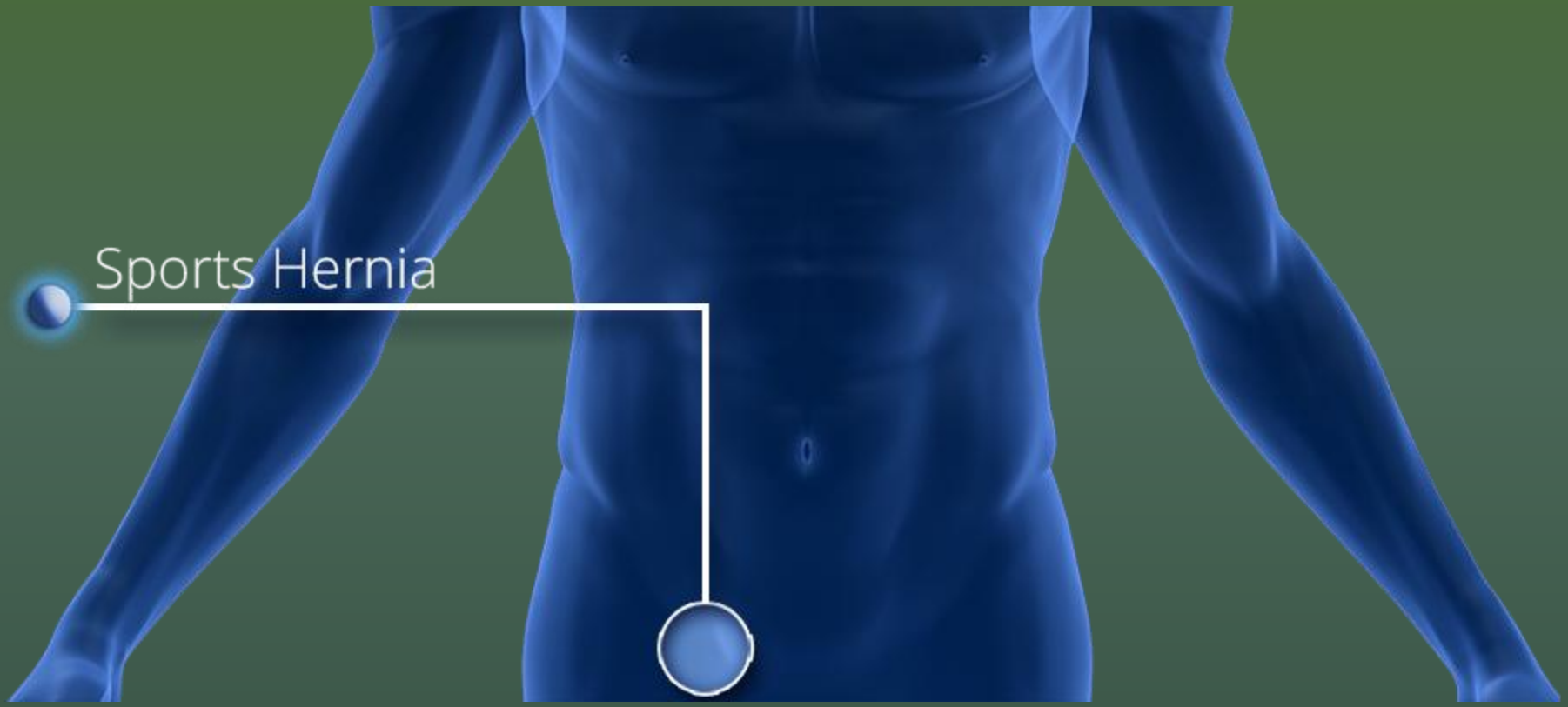
AVOID EARLY PIVOTING/TWISTING AFTER LABRAL REPAIR

PRIORITIZE LUMBOPELVIC CONTROL AND GLUTE ACTIVATION

SCREEN FOR EXTRA-ARTICULAR AND COEXISTING ISSUES (E.G. PUBALGIA)

MONITOR PSYCHOLOGICAL READINESS FOR RTP

Athletic Pubalgia – Sports Hernia



Historical Perspective

- Sports Hernia is NOT a hernia…
- Athletic groin injury (sentinel injury) that persists and mimics the pain pattern of a traditional inguinal hernia
- Complaints of exertional pain, lack of explosiveness or inability to sprint & cut
- Will typically migrate into the lower abdomen and therefore usually misinterpreted as an inguinal hernia
- Sportsman with hernia-like symptoms
    - SPORTS HERNIA

Groin Related Injuries

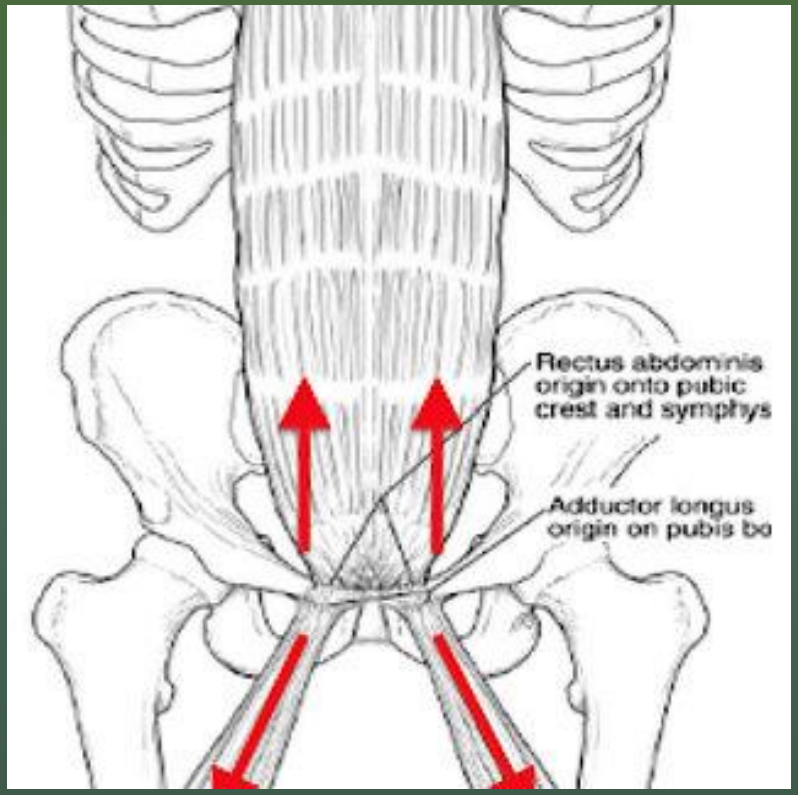
- Common in pivoting sports
  - Soccer, football, hockey[18]
- Acute: easier to manage
- Chronic: diagnostic challenge
  - Multisystem overlap
    - GI/GU/GYN/MSK
  - Utilize consultants & studies
  - Diagnostic injections can aid

Groups of Groin Disorders

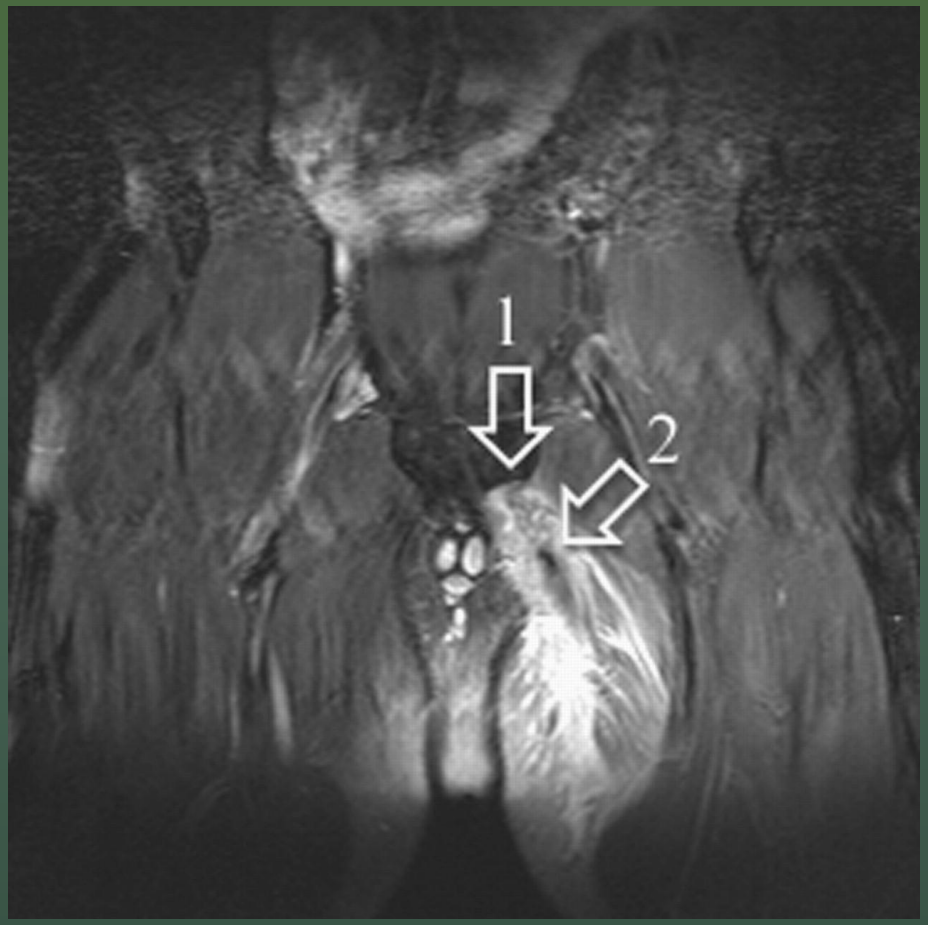
- Strains - #1 cause of groin pain
  - Adductor strains
  - Pelvic avulsions
- Occult groin injuries – no hard clinical signs
  - Athletic pubalgia/sports hernia
  - Osteitis pubis
- Classic hernias
  - Inguinal hernia with a classic bulge

Adductor injuries

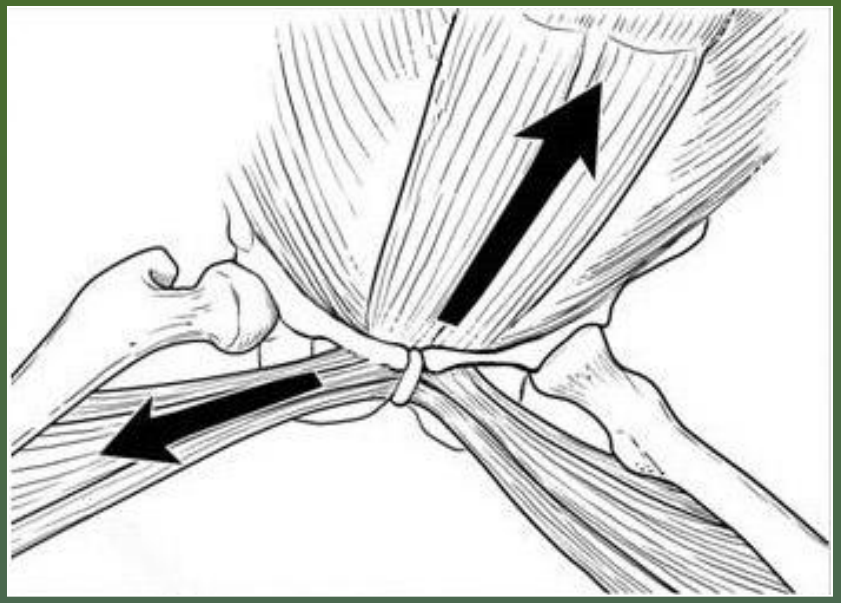
- Adductor brevis & longus most commonly involved
- ABD/ER hip against resistance
- Reproducible pain, usually localized to MTJ without pain over the RA or pubis
- Imaging
  - X-ray to rule out avulsions
  - MRI
- Treatment
  - Conservative is mainstay
  - Surgery rarely indicated
  - Orthobiologics?



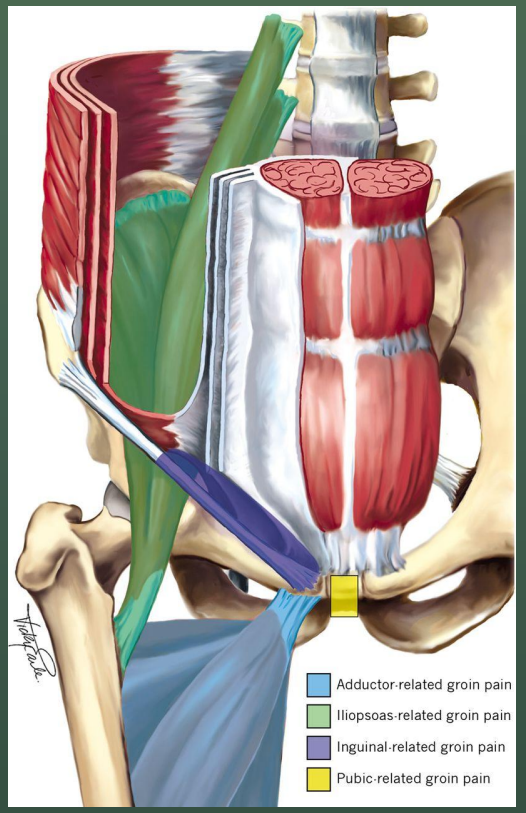
Adductor injuries



Athletic Pubalgia

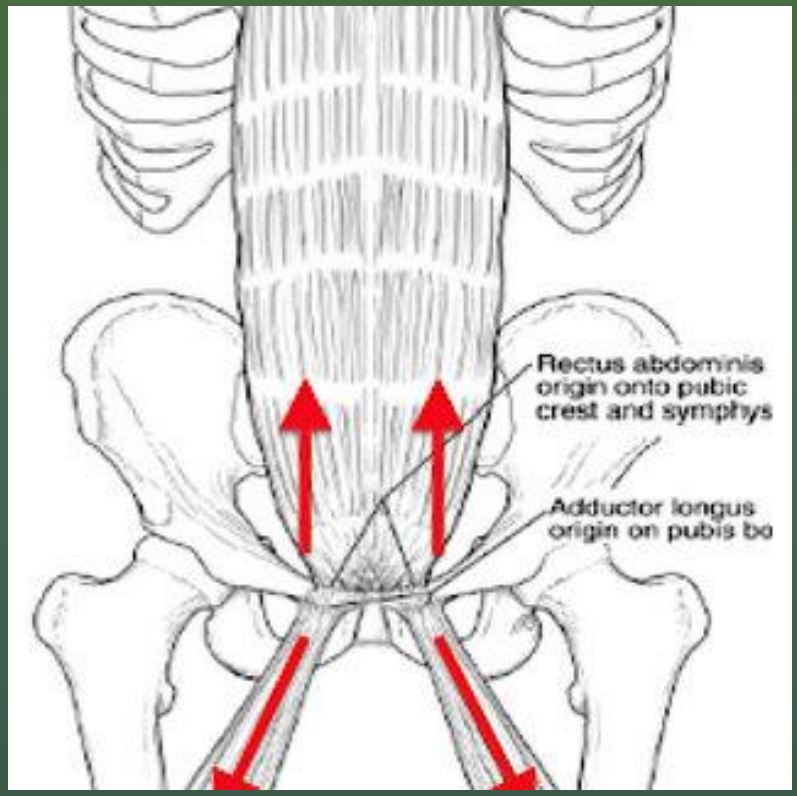


- Injury/strain to:
  - Posterior inguinal wall
  - Terminal rectus sheath
  - Adductor origin
- Pain distribution
  - Inguinal region
  - Lower abdominal area
  - Adductors
  - Referred pain
    - Scrotum
    - Medial thigh



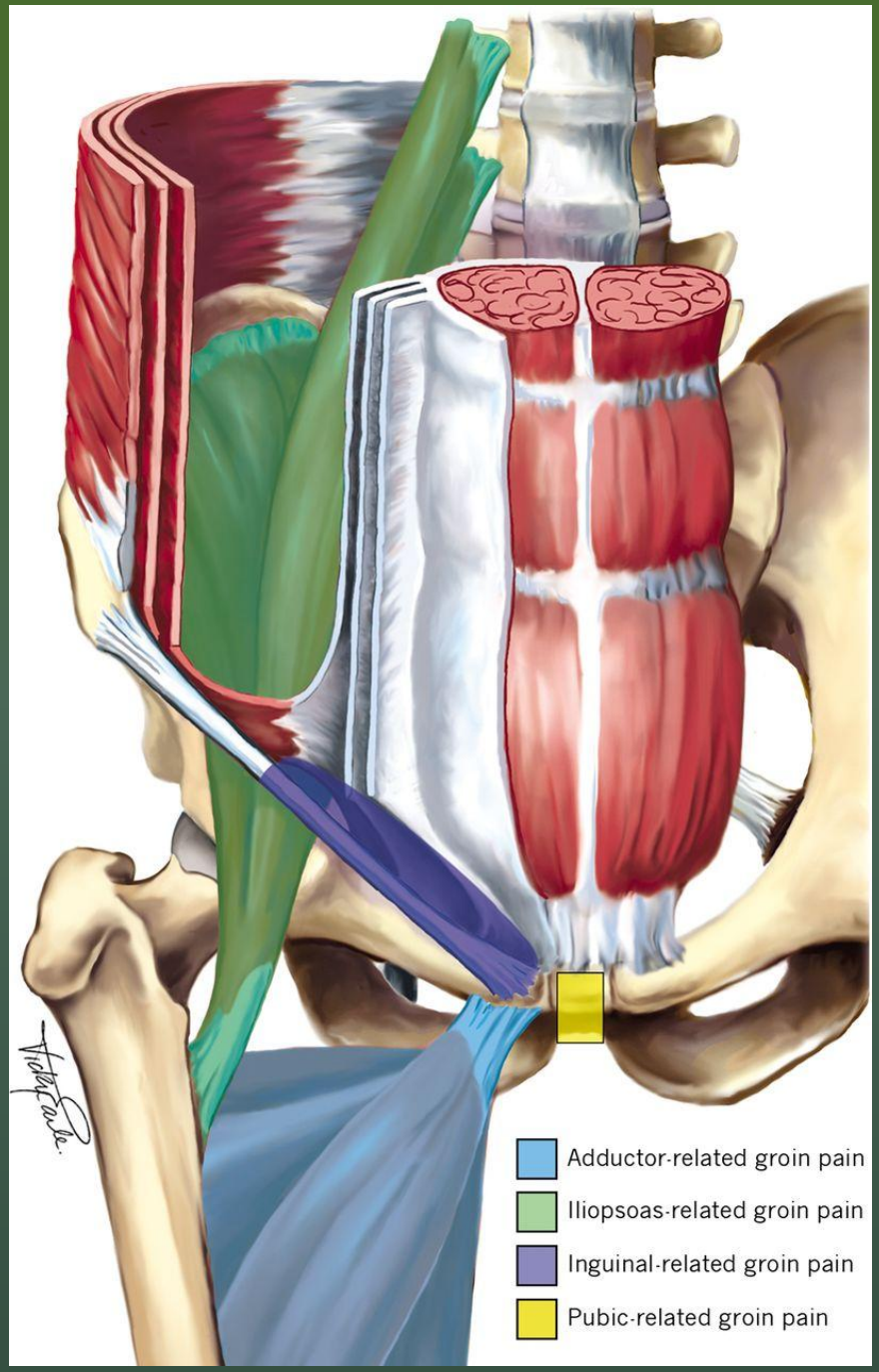
Athletic Pubalgia

- Pathophysiology
  - Repetitive, unsustainable loads on terminal abdominal insertions & adductor origin
    - Hip abduction & extension
  - Imbalance between rectus & adductor attachments
  - Reduced hip ROM (common with FAI) compensated by increased pelvic motion resulting in increased stress on pelvic stabilizers



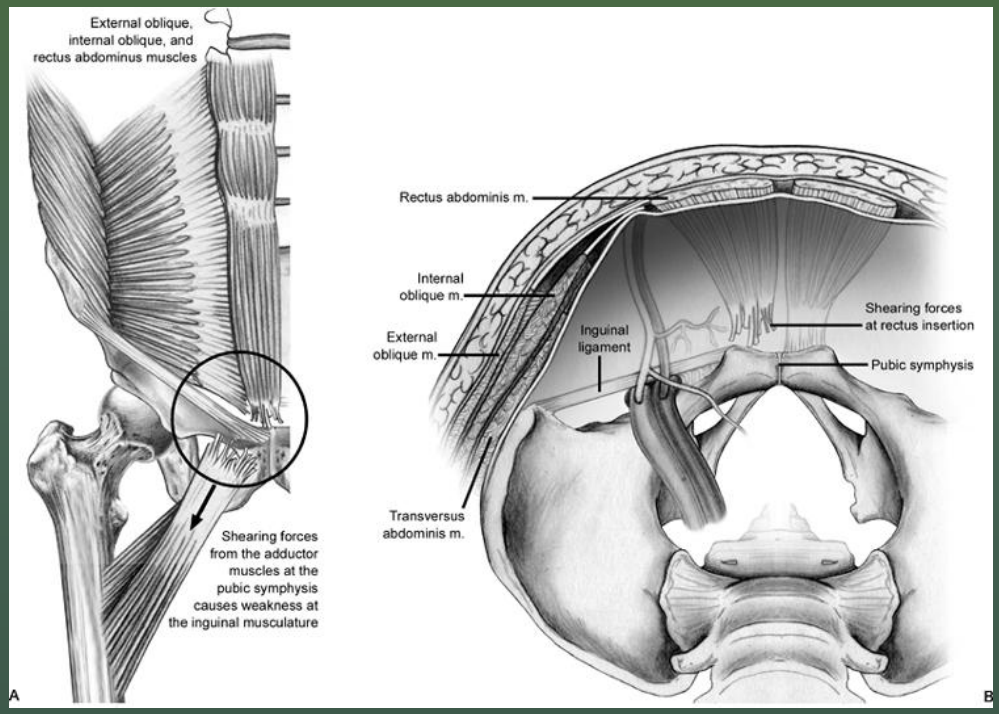
Athletic Pubalgia

- History
  - Exertional pain
  - Lack of explosiveness
  - Inability to sprint & cut
- Exam findings
  - Localized tenderness over the pubis and tendon attachments
  - Pain with resisted sit-ups and hip adduction
  - At times, difficult to reproduce on exam…
- Imaging
  - MRI with oblique axial cuts

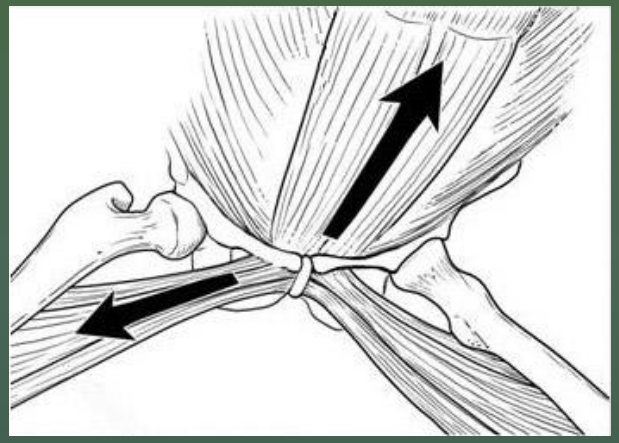


Athletic Pubalgia

- Treatment
  - NSAIDs
    - Indocin SR
    - Toradol 10 mg PO q 6 x 5 days
  - Active rest
  - Core training & flexibility
  - Injections +/- biologics
    - In office vs. sedation
  - Surgery in elite athletes
    - Mini-open, no mesh
    - Restore tension
    - Recovery weeks to months



Athletic Pubalgia



- Special considerations
  - Do not overlook concomitant pathology
    - FAI
    - Labral tear in hip
  - Use caution in females
    - Endometriosis
    - Ovarian cysts
  - Question diagnosis in the non-elite athlete

Case Examples

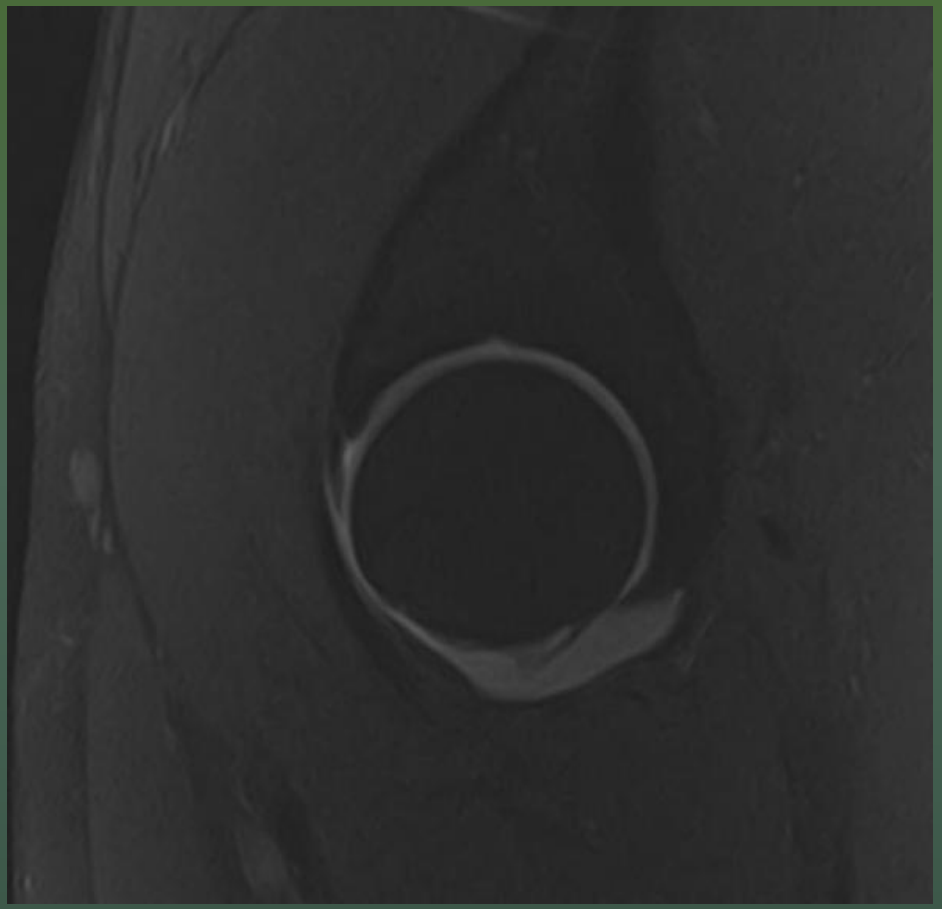
Case 1

- Division I football linebacker
- True freshman
- 4 star recruit
- Complains of snapping along his anterior hip, deep in groin
  - Associated with pain
  - Reproducible on exam
  - Can't get into his stance
  - Hurts with cutting
  - "Doc, I can't go"


R
MEM
STANDING


R
MEM
44°


M
ntrast



Case 1

- Underwent psoas sheath injection with corticosteroid
- Immediate relief
- Very happy
- Played the rest of the season…
- Until week 4, when he tore his ACL

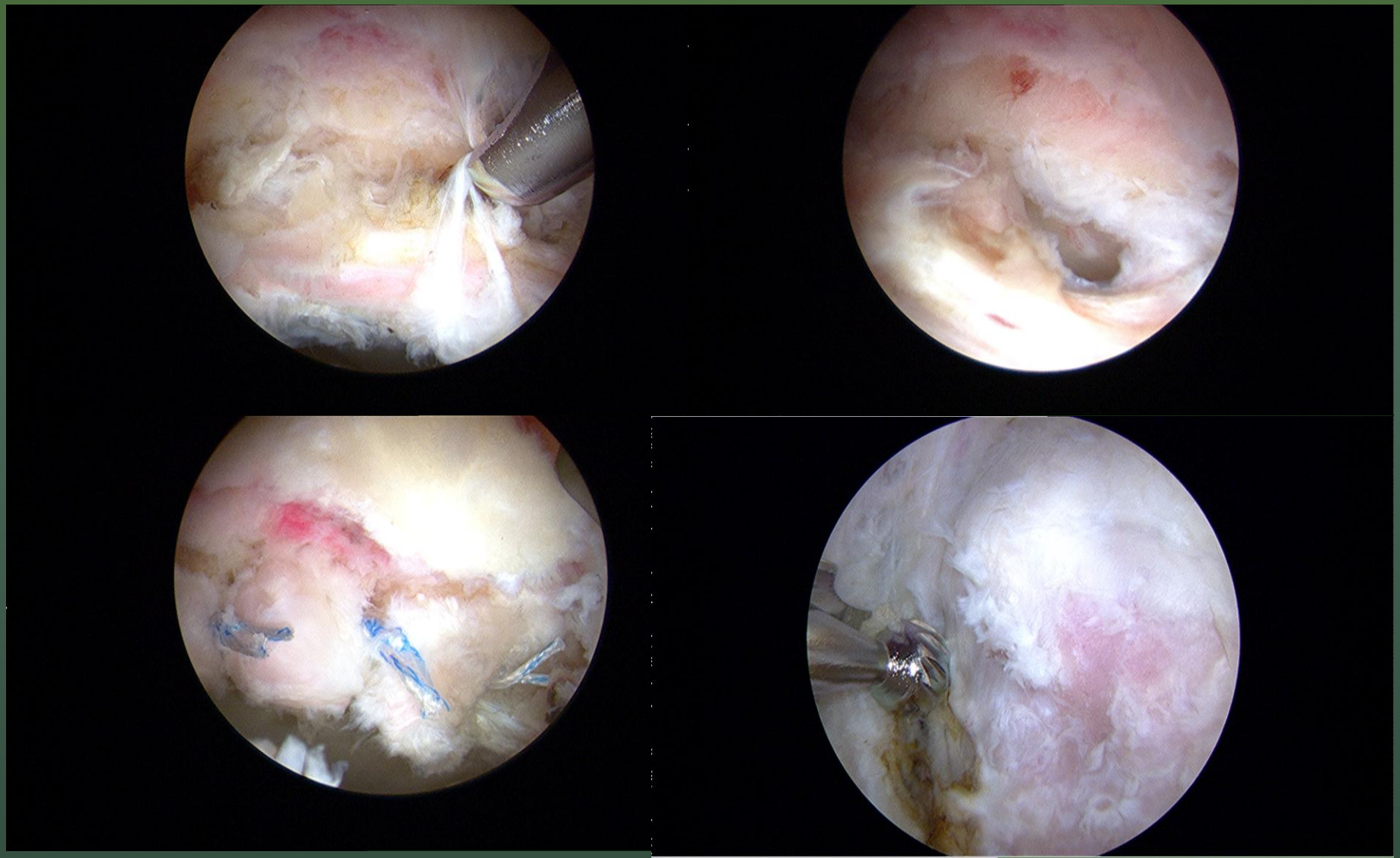
Case 2

- Division 3 power forward
- Senior year
- Increasing hip pain over last 6 months, localized to groin, exacerbated with going into defensive stance and pushing off
- Recent mechanical symptoms and locking
- Can no longer pivot or cut

Case 2

- Xrays show significant CAM deformity
- MRI demonstrates large flap type labral tear with chondral delamination
- IA injection provides 1 week of relief
- Able to play in following game, but next game unable to go into stance

Case 2



Case 2

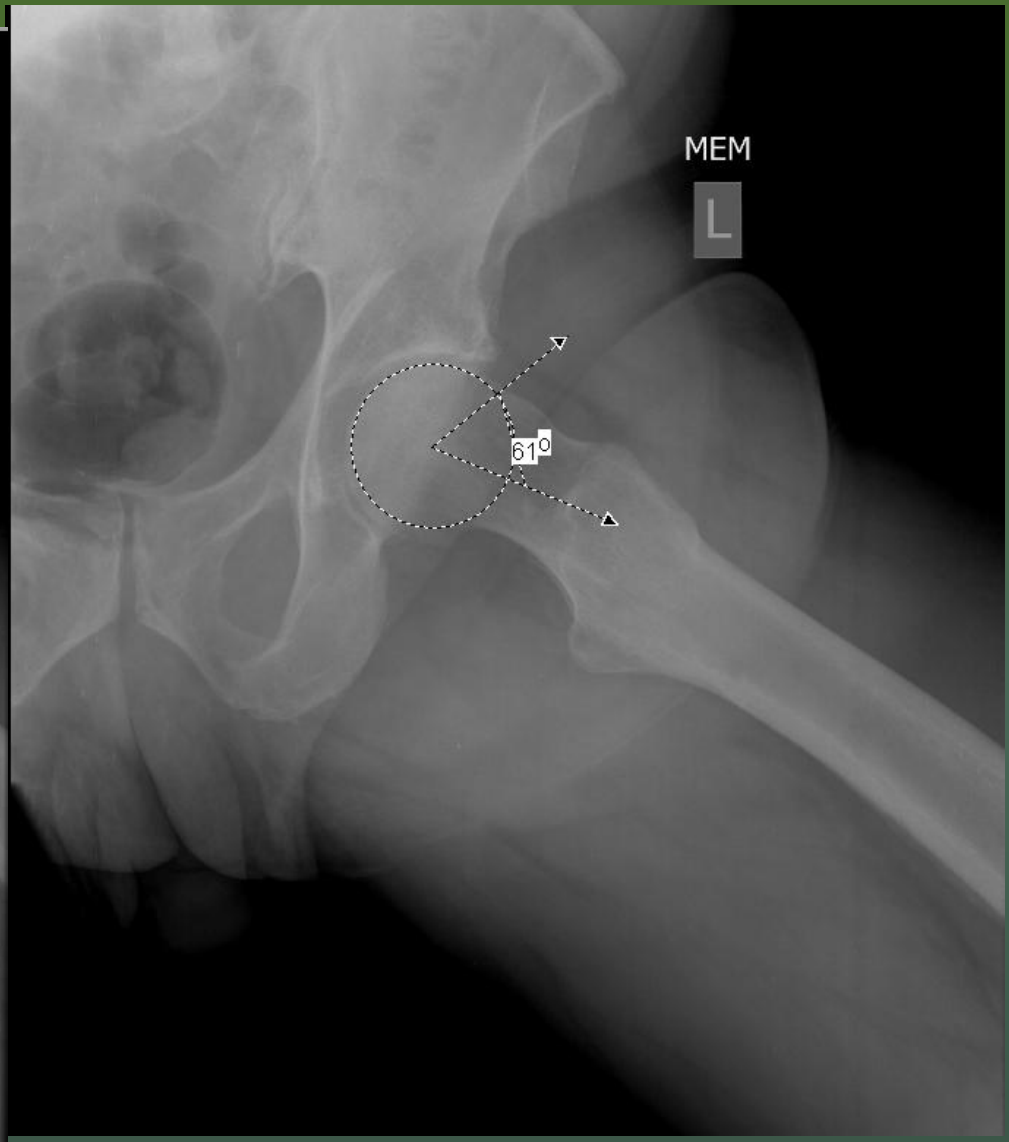
Case 2

- Returned to play the following season

Case 3

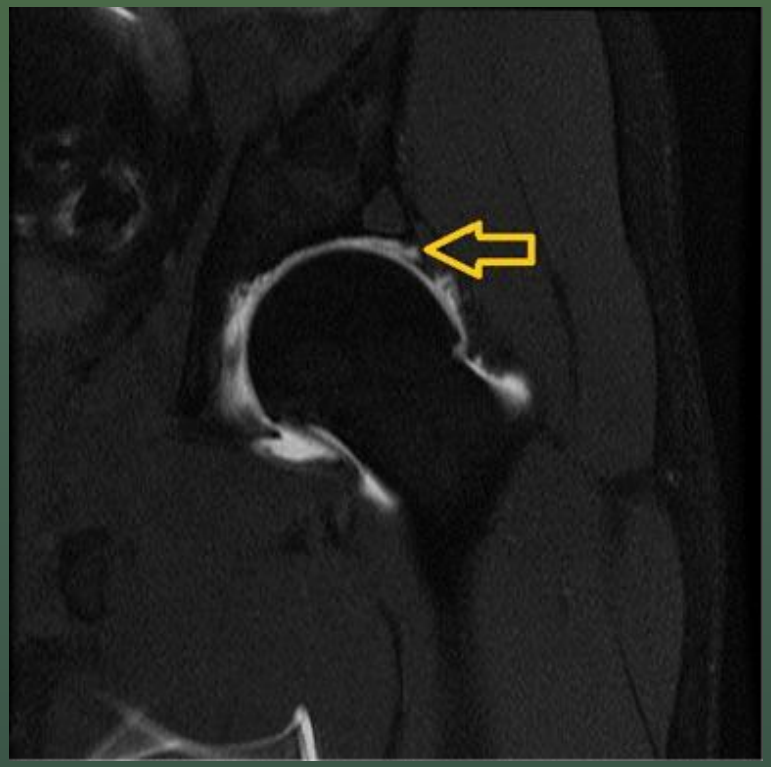
- 57 yo M, cycling enthusiast
- Anterior groin pain when sitting for long periods, getting up from seated position
- PT – provided minimal benefit
- Sent for IA injection, last 3 hours


MEM
L

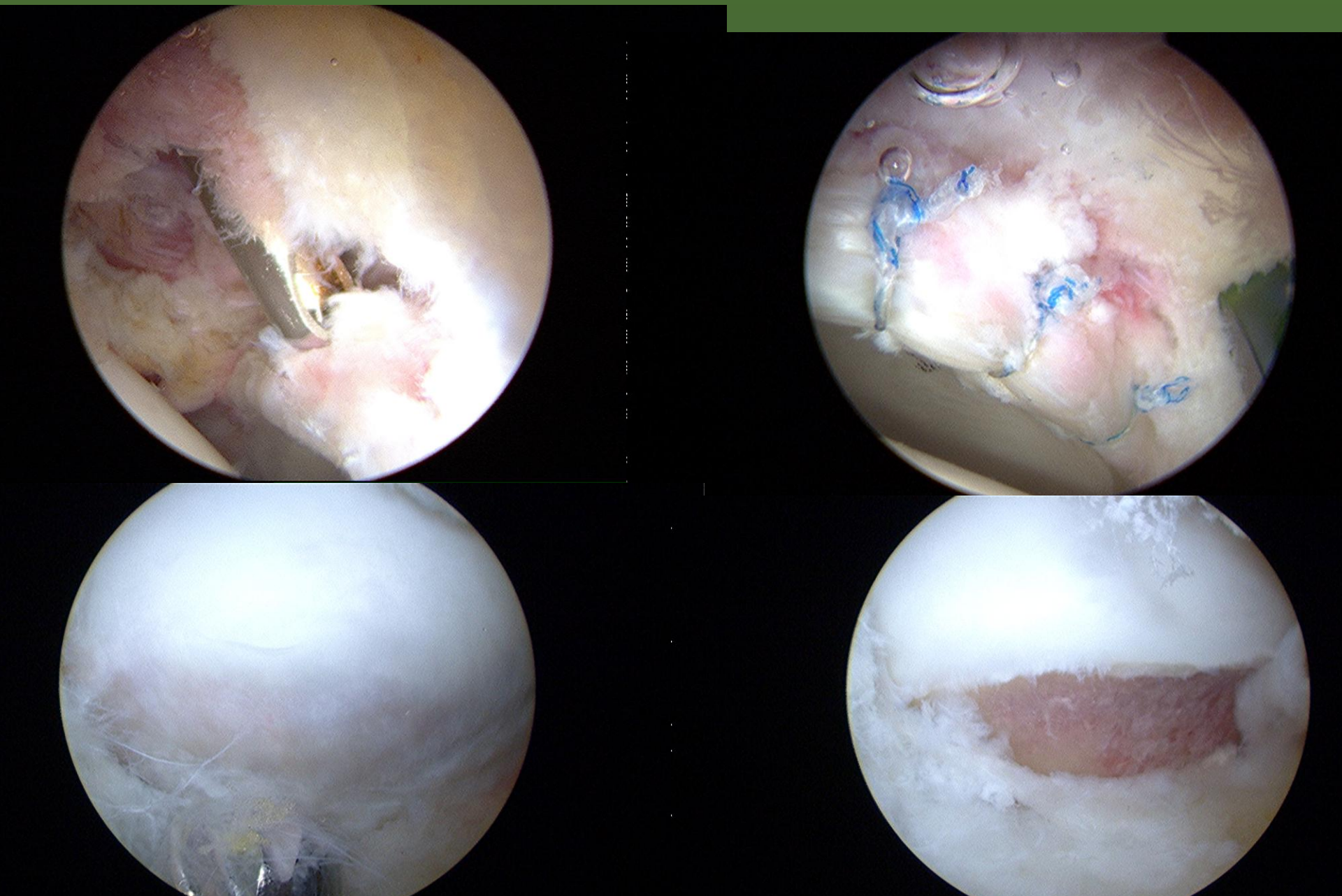

MEM
L
61°

Case 3

- MRI demonstrated a labral tear which was consistent with his symptoms
- Unable to ride for more than a few minutes without pain
- Underwent hip arthroscopy



Case 2



Conclusions

- Hip injuries in sports are common…with increasing frequency
- Evaluation of the hip & groin is not so hard
  - Requires an understanding of the anatomy & pathomechanics
- Different problems may have similar appearances and may coexist…such as concomitant FAI and athletic pubalgia
- Conservative treatment remains mainstay
  - Effective surgical techniques have been developed
- Arthroscopy has greatly enhanced our understanding of hip joint pathology
  - And forced our understanding of other associated disorders
- Specific sport and position may affect degree of symptoms and timing of treatment
- Biologics are playing an increasing role in treatment, but more research is needed

References

1. **Byrd JWT, Jones KS**: Hip arthroscopy in athletes. Clin Sports Med, 20(4): 749-762; 2001.
2. **Byrd JWT, Jones KS**: Prospective analysis of hip arthroscopy with two year follow up. Arthroscopy, 16(6): 578-587; 2000.
3. **O'Leary JA, Berend K, Vail TP**: The relationship between diagnosis and outcome in arthroscopy of the hip. Arthroscopy, 17(2): 181-188; 2001.
4. **Hilton J**: Rest and pain. London; Bell, 1863.
5. **Byrd JWT**: Physical Examination. In Byrd JWT (ed) Operative Hip Arthroscopy, New York, Springer-Verlag, 2005, 36-50.
6. **Byrd JWT, Jones KS**: Osteoarthritis caused by an inverted acetabular labrum: radiographic diagnosis and arthroscopic treatment. Arthroscopy, 18(7); 741-747, 2002.
7. **Byrd JWT, Jones KS**: Diagnostic accuracy of clinical assessment, MRI, gadolinium MRI, and intraarticular injection in hip arthroscopy patients, Am J Sports, 2004: 32(7); 1669-1674.
8. **Byrd JWT**: Labral lesions: an elusive source of hip pain: case reports and review of the literature, Arthroscopy, 12(5); 603-612, 1996.
9. **Byrd JWT**: Hip arthroscopy in athletes. Instr Course Lect 52: 701-709; 2003.
10. **Byrd JWT, Jones KS**: Prospective analysis of hip arthroscopy with ten year follow up. Presented as AAOS 74th Annual Meeting, San Diego, CA February 16, 2007.
11. **Ganz R, Parvizi J, Beck M, Leunig M, Notzli H, Siebenrock KA**: Femoracetabular impingement: a cause for osteoarthritis of the hip. Clin Orthop 2003: 417; 112-120.
12. **Byrd JWT**: Hip arthroscopy: Evolving Frontiers. Op Tech in Orthop, 14(2): 58.
13. **Gray AJR, Villar RN**: The ligamentum teres of the hip: an arthrscopic classification of its pathology. Arthroscopy 1997; 12(5): 575-578.
14. **Byrd JWT, Jones KS**: Traumatic rupture of the ligamentum teresas a source of hip pain. Arthroscopy 2004: 20(4): 385-391.
15. **Byrd JWT**: Hip arthroscopy for post-traumatic loose fragments in the young active adult: three case reports, Clin Sport Med, 6(2); 1129-134, 1996.
16. **From the Centers for Disease Control and Prevention**. Prevalence of self-reported arthritis or chronic joint symptoms among adults – United States, 2001. JAMA 2002; 288(24): 3103-3104.
17. **Byrd JWT, Jones KS**: Microfracture for grade IV chondral lesions of the hip. Arthroscopy, 20(5): SS-89, 41; 2004.
18. **Meyers WC, Foley DP, Garrett WE et al**. Management of severe lower abdominal or inguinal pain in high-performance athletes. PAIN, AJSM 2000; 28: 2-8.
19. **Fricker P, Taunton J, Ammann W**. Osteitis Pubis in Athletes. Sports Med 1991; 12: 266-79.

Thank You!