Hip Impingement Syndromes

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EOY Presentation

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Inspiration

Introduction

- Epidemiology:
  - 5-24% of athletic injuries
    - Pediatric >> adults
  - 5-9% of high school athlete injuries
  - 12% of football/soccer/hockey players
  - 70% yearly incidence in runners

The New York Times

Sports

Hips Are Bringing More Athletes to Their Knees

By MICHAEL S. SCHMIDT
Published: May 31, 2009

The quest to build ever more proficient athletes keeps hitting unexpected snags, and perhaps nowhere is this more vivid than in Major League Baseball. Several top players have been hampered by a hip ailment that was unheard of in the sport a decade ago.

Which Athletes?

- Repetitive twisting, kicking, turning
  - Ballet
  - Football, soccer, hockey
  - Basketball, tennis
  - Martial arts
  - Breaststroke swimmers
- Repetitive Impact
  - Runners
  - Track & field
- Supermarket Shoppers*

Arthroscopy. 2008 Apr;24(4):490-3. doi: 10.1016/j.arthro.2008.01.004. Epub 2008 Feb 20.

Supermarket hip: an unusual cause of injury to the hip joint.

Yamamoto Y[1], Villar RN, Papavasileiou A.

⊕ Author information

Abstract

Sporting activity can be a significant cause of injury to the hip joint, in particular tears of the acetabular labrum and, less commonly, tears of the ligamentum teres. Femoroacetabular impingement and acetabular dysplasia are also commonly associated with labral tears. However, shopping in a supermarket would not normally be regarded as an at-risk activity for the hip joint. Despite this, we report 3 separate cases of hip injury (2 labral tears, 1 partial avulsion of the ligamentum teres), each of which was sustained while shopping in a supermarket. None of the 3 patients involved had radiographic evidence of acetabular dysplasia or arthroscopic evidence of femoroacetabular impingement. All patients were successfully treated by arthroscopic surgery of the hip. We therefore suggest that shopping in a supermarket may need to be reclassified as an at-risk activity for the hip joint.

Under-recognized/diagnosed

- After workup, 30% of hip pain remains with no firm diagnosis pre-op

- Hip not recognized as the source of pain in upto 60% of pts presenting w hip pathology

Orthopaedic Etiologies	Nonorthopaedic Etiologies
Muscle	**Hernia**
Adductor strain/tendonitis	Inguinal hernia
Rectus femoris strain/tear	Femoral hernia
Iliopsoas strain/tear	Preperitoneal lipoma
Rectus abdominis strain/tear	**Urologic**
Muscle contusion	Prostatitis
Gracilis syndrome	Epididymitis
Athletic hernia	Urethritis/UTI
Bone/Joint	Testicular neoplasm
Osteitis pubis	Ureteral colic
Degenerative joint disease: hip	Testicular torsion
Avascular necrosis: hip	Hydrocele/varicocele
Labral tear: hip	**Gynecologic**
Femoral neck fracture/stress fracture	Endometriosis
Pubic ramus stress fracture	Pelvic inflammatory disease
Myositis ossificans, adductors	Ovarian cyst
Slipped capital femoral epiphysis	**Surgical/GI**
Avulsion fracture: ASIS/AIIS/ischium	Rectal/colon neoplasm
Nerve	Inflammatory bowel disease
Lumbar radiculopathy	Diverticulitis
Ilioinguinal neuropathy	
Obturator neuropathy	
Other Orthopaedic	
Bone/soft tissue neoplasm of hip/pelvis	
Seronegative spondyloarthropathy	

Now, lets go through each one…

Focus on Impingement Syndromes

MAJOR IMPINGEMENT SYNDROMES*

LOWER EXTREMITY

SITE	SYNDROME	JOINT POSITION	STRUCTURES	TYPE
HIP	CAM – TYPE FEMORO-ACETABULAR	FLEXION, VARIABLE (IR / ER / ABD / ADD)	LABRUM, ARTICULAR CARTILAGE	BONE, SOFT TISSUE
	PINCER – TYPE FEMORO-ACETABULAR	FLEXION, VARIABLE (IR / ER / ABD / ADD)	LABRUM, ARTICULAR CARTILAGE	BONE, SOFT TIS
	ISCHIOFEMORAL	ADDUCTION	QUADRATUS FEMORIS	BONE, SOFT TISSUE
	SNAPPING HIP	VARIABLE	ILIOPSOAS, GLUTEAL, ILIOTIBIAL TRACT	BONE, SOFT TISSUE

Resnick, D. Mechanisms of impingement: concepts and controversies. ISS. 2011;Combined Session.

FEMOROACETABULAR IMPINGEMENT

FAI Is An Important Risk Factor for Hip OA

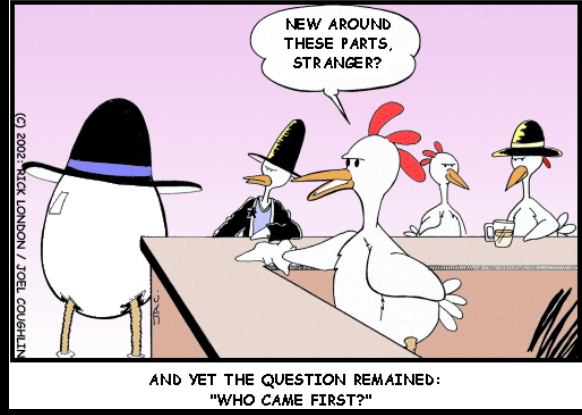
I come to bury Caesar, not to praise him.

-Mark Antony

(also, David Rubin)

Rubin D. Femoroacetabular impingement: fact, fiction or fantasy. AJR. Sept 2013;201:526-34

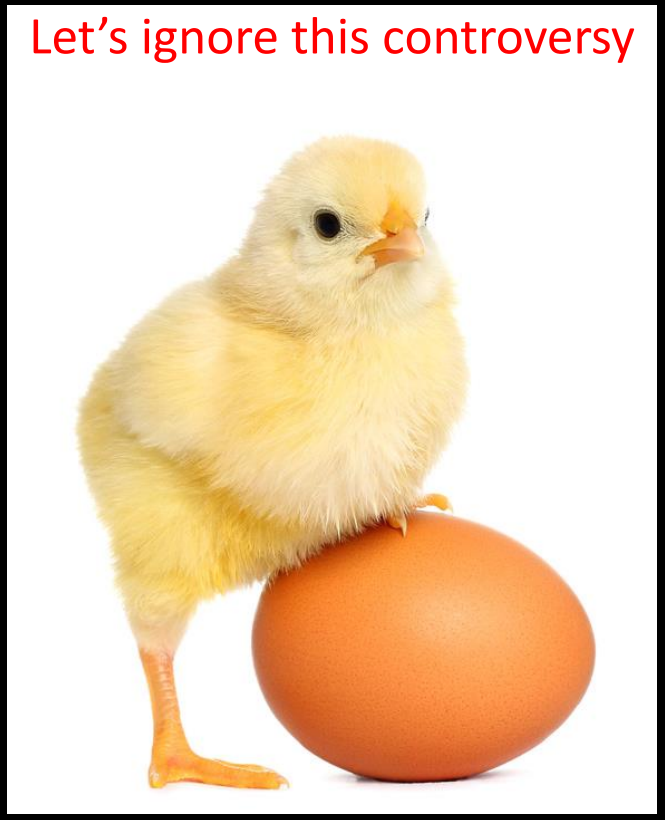
Chicken Vs. Egg



"The controversies regarding the concept of femoroacetabular impingement are analogous to the "chick and egg" scenario- that is, which comes first? Do structural alterations of the femoral head or acetabuli, or both, relate to developmental modifications or are they related to an underlying disorder, such as osteoarthrosis…"

– Words of Wisdom

Let's ignore this controversy



Resnick, D. Mechanisms of impingement: concepts and controversies. ISS. 2011;Combined Session.

FAI

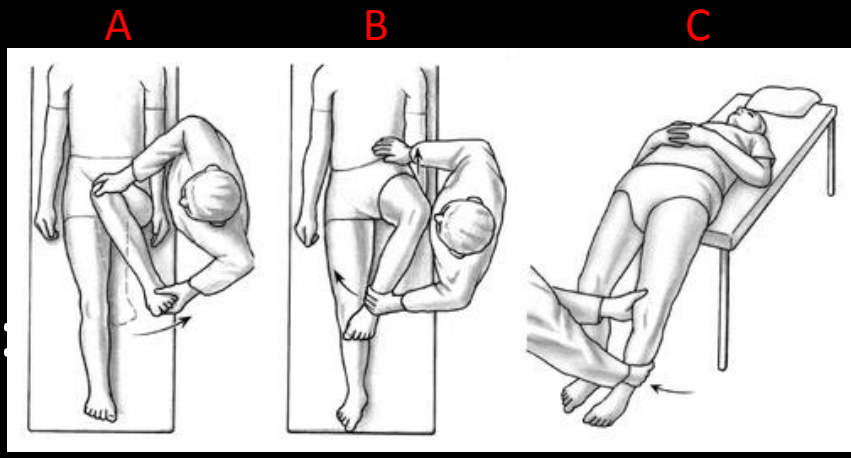
- Epidemiology
  - 10-15% of general population
    - Possibly as high as 25% in young adult males
  - Young, athletic patients
  - Symptomatic 2nd-4th decade
  - Major cause of early osteoarthrosis
- Cause:
  - Early pathologic contact of acetabulum & femur
  - Limiting physiologic hip motion
  - Repetitive microtrauma
  - Labral degeneration/chondral damage

FAI

- Initially, limited range of motion

- Then, pain:
  - Groin pain with hip rotation
    - Sitting position or after sports activities
  - Trochanteric pain radiating to lateral thigh

FAI



- Physical Exam:
  - Restricted flexion & IR
  - Positive Impingement sign:
    - A. Anterior:
      - Pain w forced IR/Adduction w hip in 90 deg flexion
    - C. Posterior:
      - Pain w forced ER w hip in extension
  - B. Drehmann's sign:
    - Unavoidable passive ER rotation of hip while flexing hip

Tannast M, Siebenrock KA, Anderson SE. Femoroacetabular Impingement: radiographic diagnosis- what the radiologist should know. AJR. 2007;188:1540-52.

FAI: Types

- Cam: Young active men (14:1 M:F)
  - Aspherical femoral head
  - Lateral (pistol-grip) vs Anterosuperior osseous bump
  - Chondral damage to anterosuperior acetabular cartilage
    - Large area of cartilage involved
  - Separation bet labrum & cartilage

- Pincer: Middle aged women (3:1 F:M)
  - Acetabular overcoverage of the hip
    - General vs focal
  - Circumferential peripheral chondral loss near labrum
  - Labrum crushed bet acetabular rim & femoral neck

- Majority (86%) have mixed cam/pincer type

Importance of early diagnoses

- Imaging plays key role

- Early phase without findings of OA
- Important to detect in this phase
- Institute surgical intervention early

Role of Imaging

- XR:
  - Evaluate for pincer/cam FAI
  - Exclude arthritis
  - Exclude AVN
- CT:
  - Evaluate acetabular/femoral version
- MR/MR Arthrography
  - Labral damage
  - Cartilage loss
  - α-angle measurement

Imaging: XR

- AP Pelvis:
  - Evaluate acetabulum
  - Evaluate femoral head-neck junction
  - Evaluate for coxa vara
- Axial/Cross-table Lateral:
  - Evaluate anterior femoral head-neck junction
- Faux Profile:
  - Evaluate anterior coverage of acetabulum
  - Evaluate posteroinferior joint space (contrecoup lesion)

Importance of True AP View of Pelvis

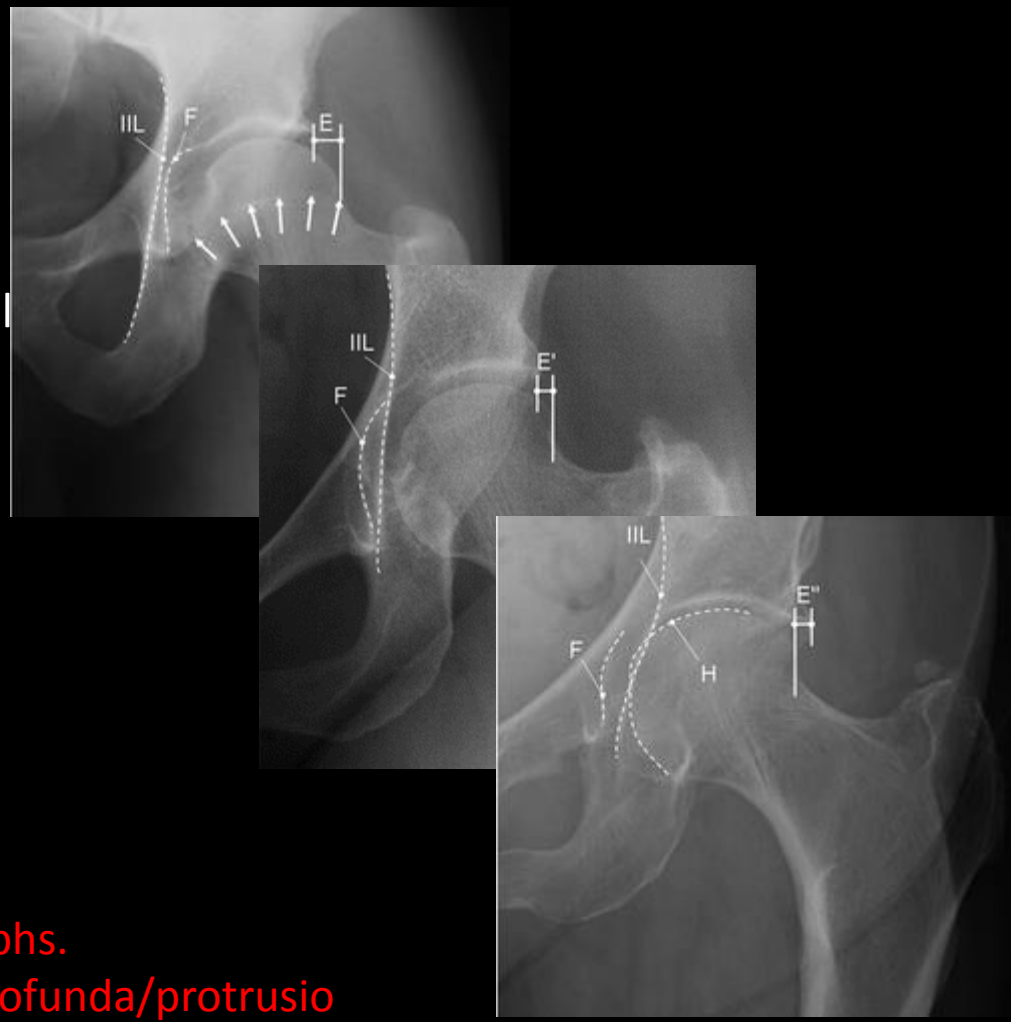
- Normal Pelvis Tilt/Rotation
  - Tip of coccyx in line w symphysis pubis
  - Distance bet sup aspect of symphysis pubis & mid portion of sacrococcygeal joint
    - 3.2 cm in men; 4.7 cm in women

Femoroacetabular Impingement

- **Pincer**
- Cam

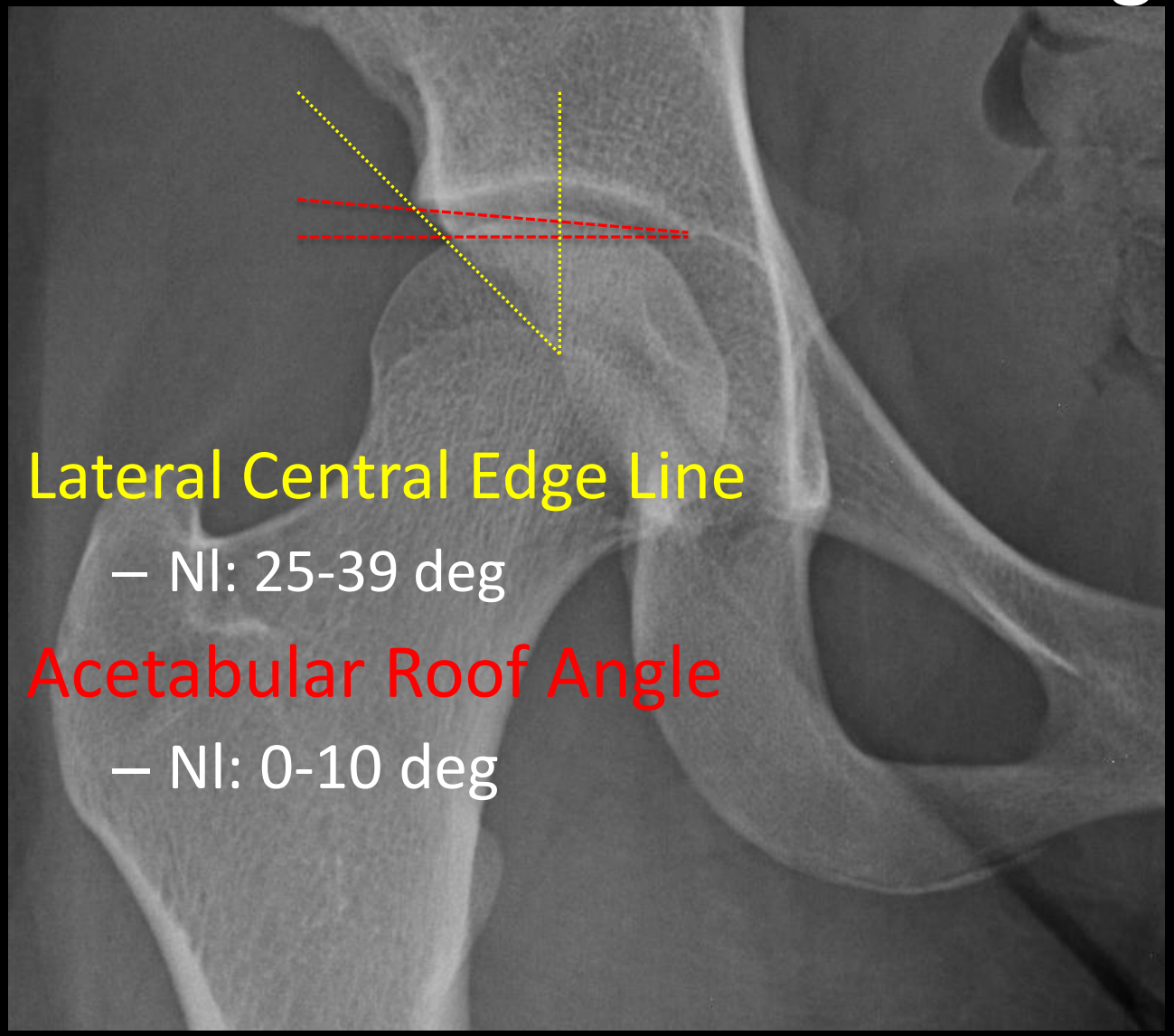
Pincer:
General Acetabular Overcoverage

- Correlated w radiologic depth of acetabular fossa
  - NL:
    - Acetabular fossa line lateral to ilioischial line
  - Coxa Profunda:
    - Acetabular fossa touches/overlaps ilioischial line
  - Protrusio Acetabuli:
    - Femoral head overlaps ilioischial line



Can only evaluate on pelvis radiographs.
Hip radiographs can overdiagnose profunda/protrusio

Pincer:
General Acetabular Overcoverage



Lateral Central Edge Line

– Nl: 25-39 deg

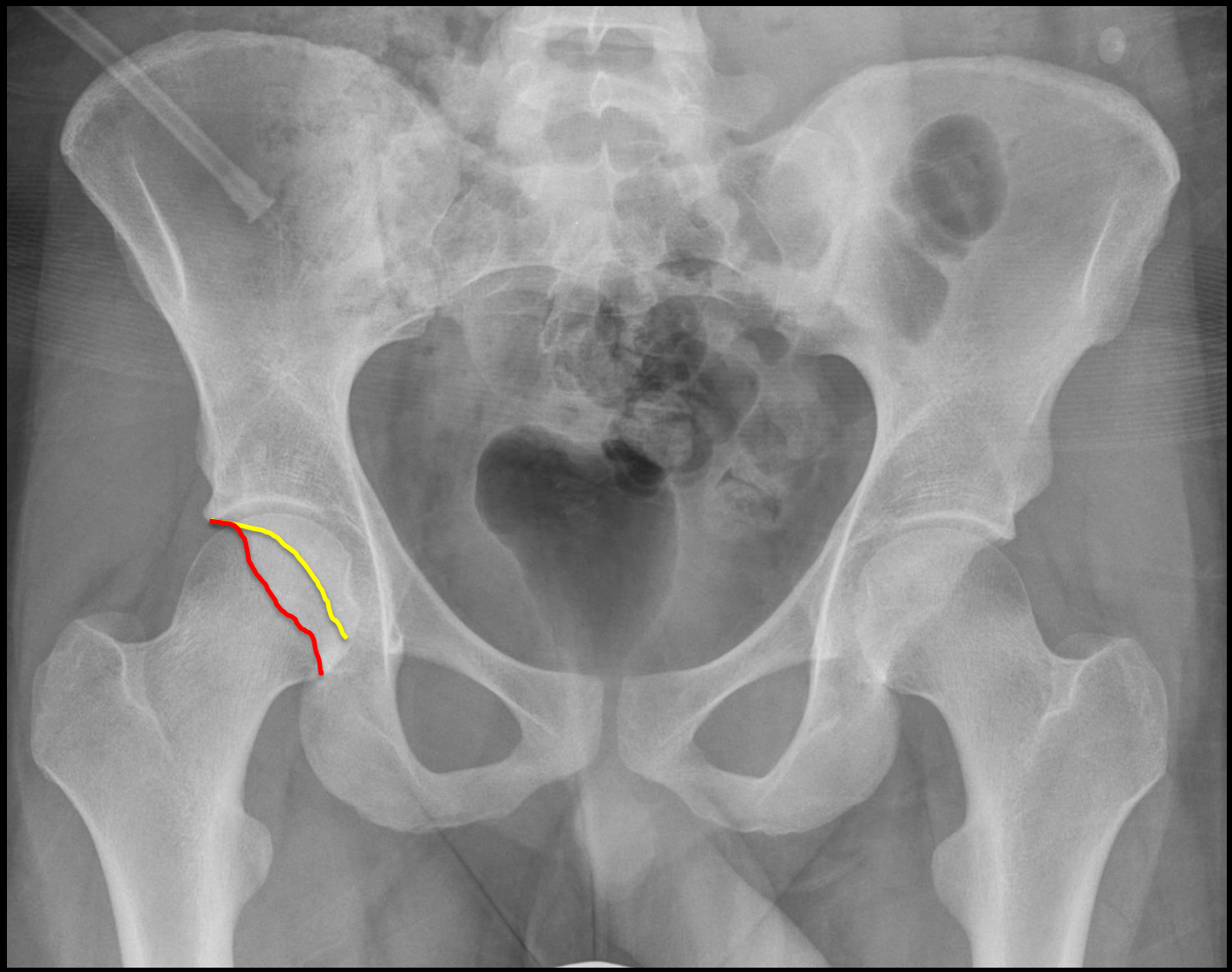
Acetabular Roof Angle

– Nl: 0-10 deg

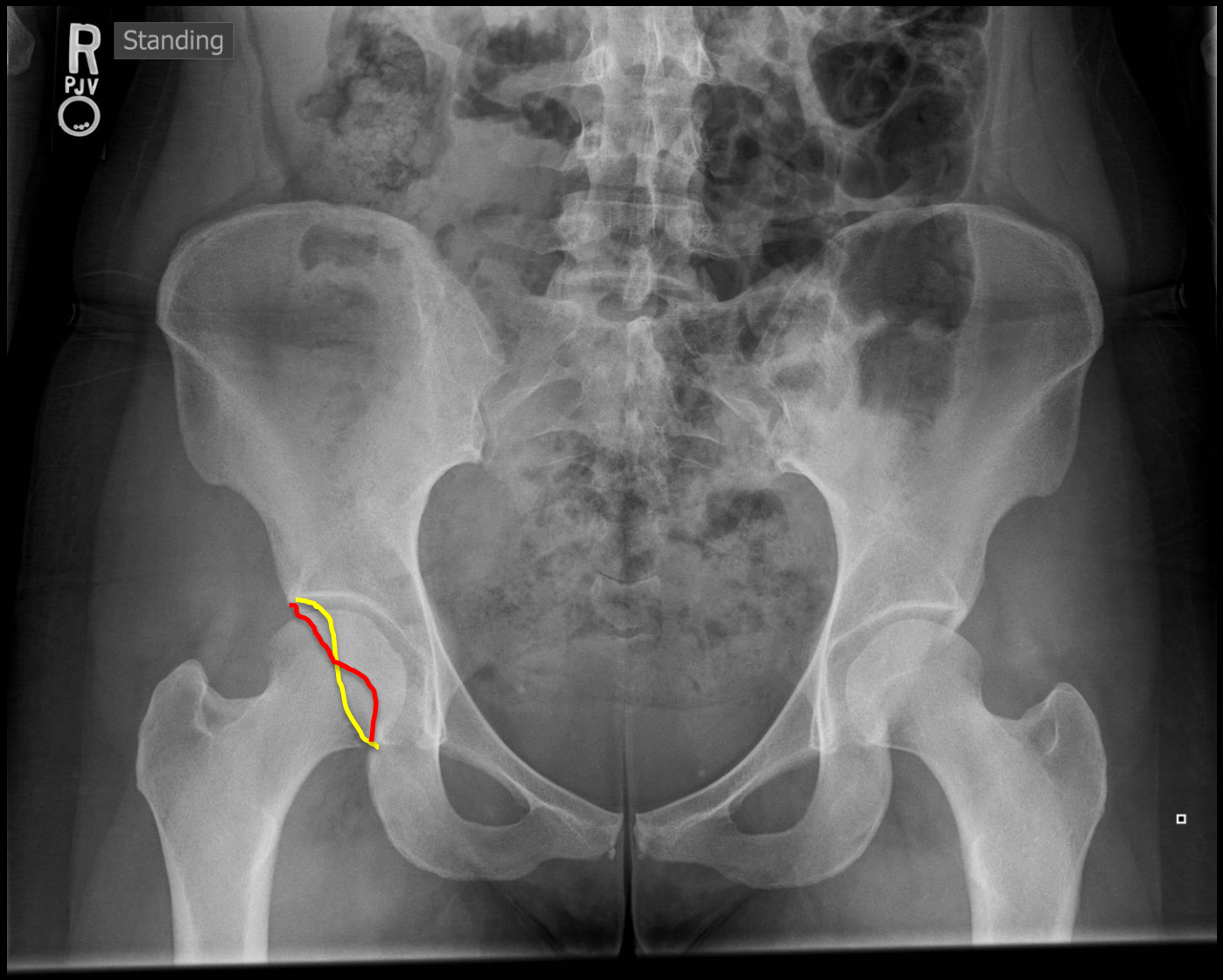
Pincer:
Focal Acetabular Overcoverage

- Anterior Focal Acetabular Retroversion
  - Vs. Deficient Posterior Wall
- Prominent Posterior wall

Normal

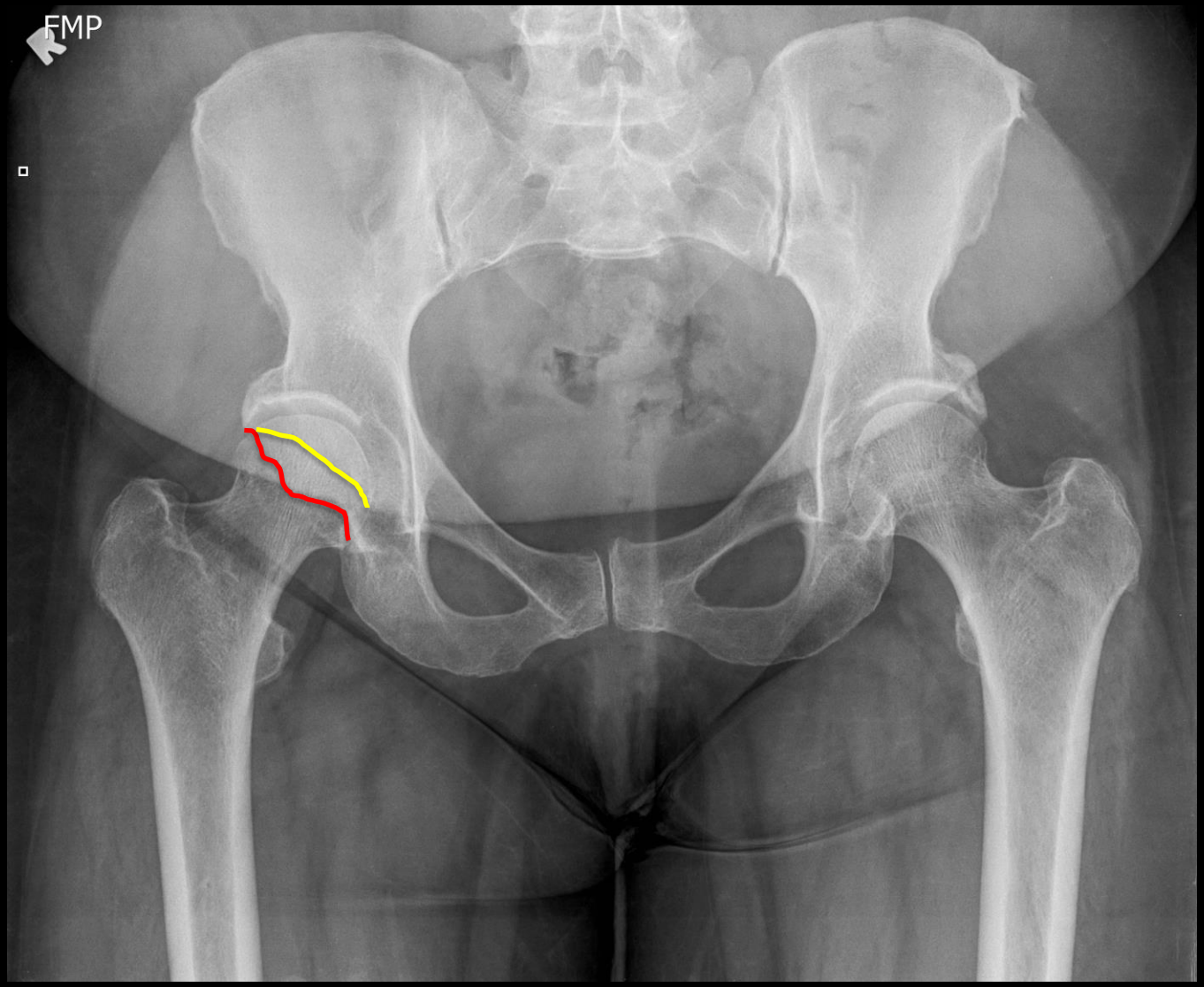


Cross-Over Sign



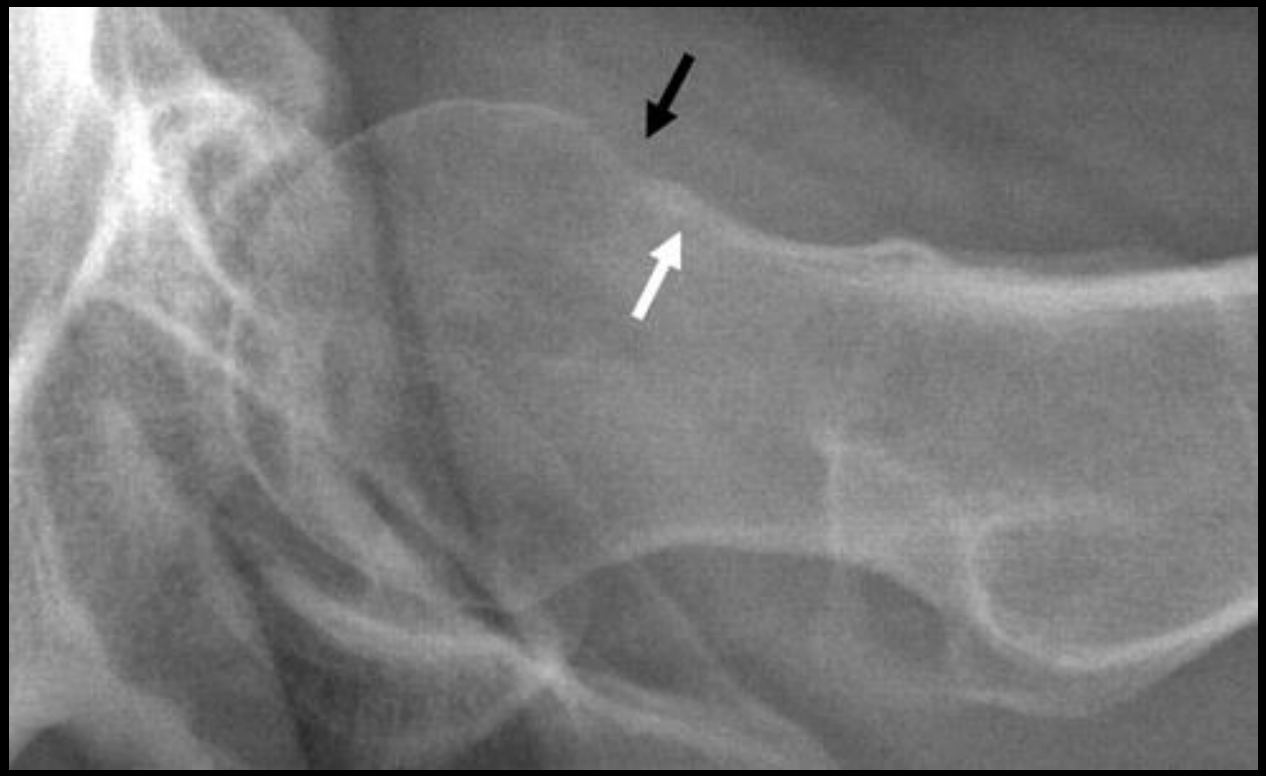
Courtesy: Dr. Brady Huang

Posterior Wall Sign



Courtesy: Dr. Brady Huang

Pincer:
Occasional Finding

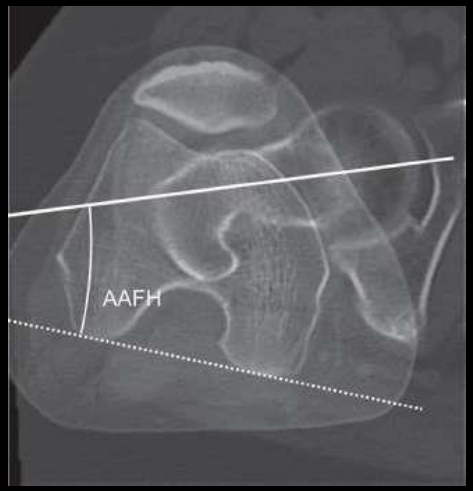


Femoroacetabular Impingement

- Pincer
- **Cam**

CAM:
Primary vs Secondary

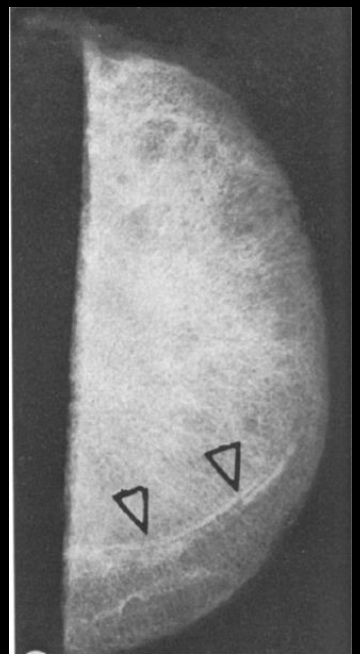
- Primary:
  - Growth abnormality of capital femoral epiphysis



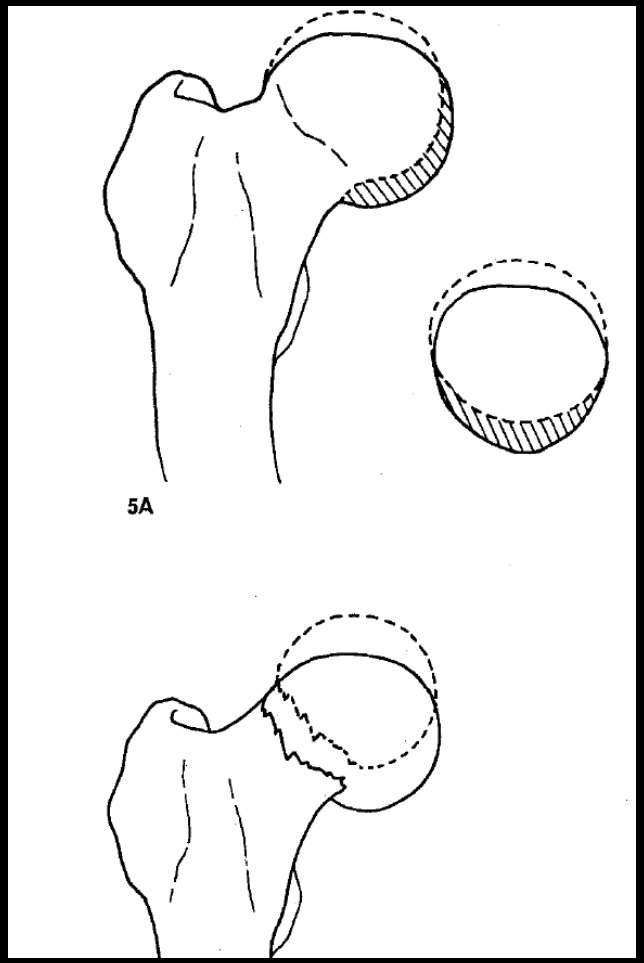
- Secondary:
  - Subclinical SCFE
  - Legg-Calve-Perthes disease
  - Coxa Vara
  - Retrotorsion/version of femoral head
    - S/P femoral neck fracture
    - Need CT for evaluation

“The last useful thing I published”

- Tilt deformity
  - =Mild SCFE
    - Murray, 1965
  - =Remodelling from OA
    - Resnick, 1976



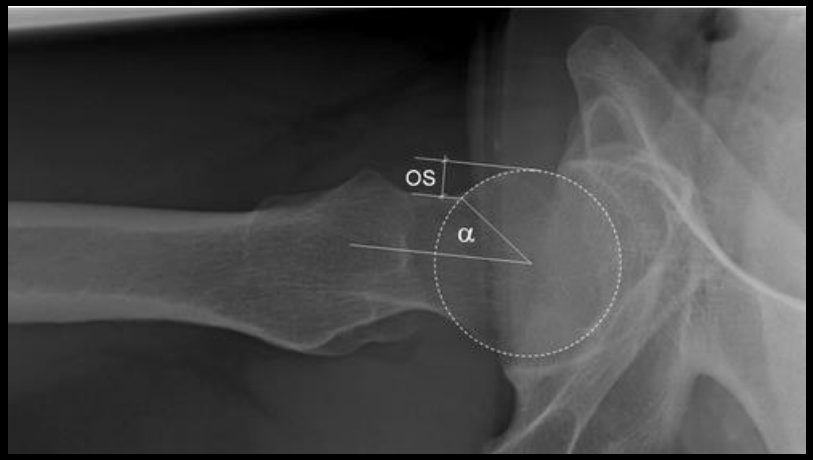
Original zone of calcified cartilage

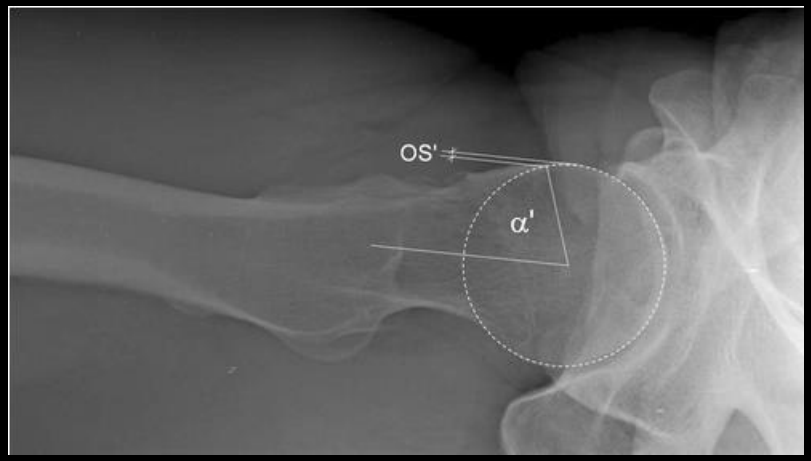


Resnick D. The ‘tilt deformity’ of the femoral head in osteoarthritis of the hip: a poor indicator of previous epiphysiolysis. Clin Radiol. 1976;27:355-63

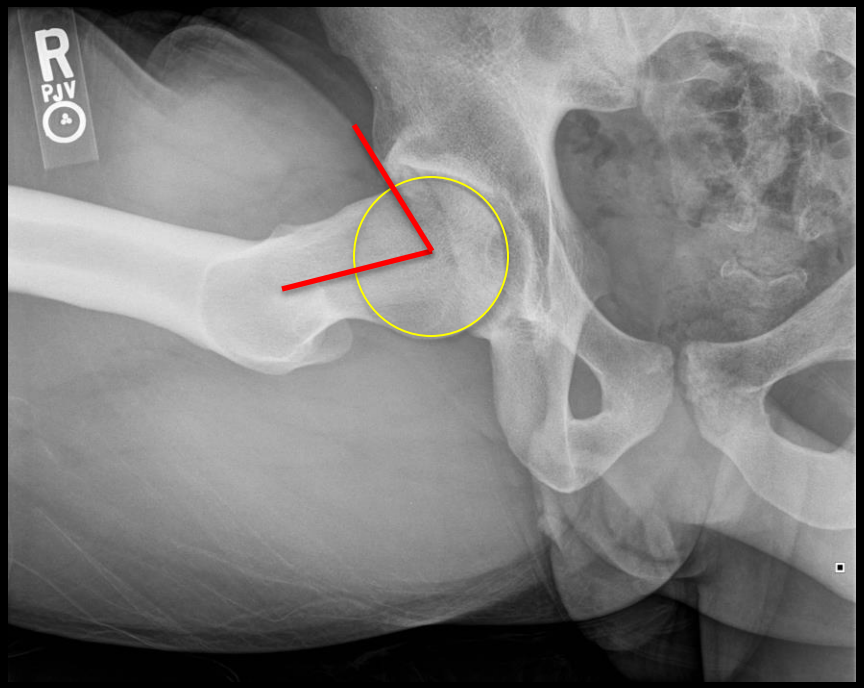
CAM: Measurements on Cross-table Lateral

- α-angle:
  - Angle between femoral neck axis & line connecting head center and head-neck junction asphericity
  - >50 ° is abnormal
- Anterior Offset:
  - Diff in radius bet ant fem head & ant fem neck
  - <10 mm is abnormal





Anterosuperior Osseous Bump



- Dunn View

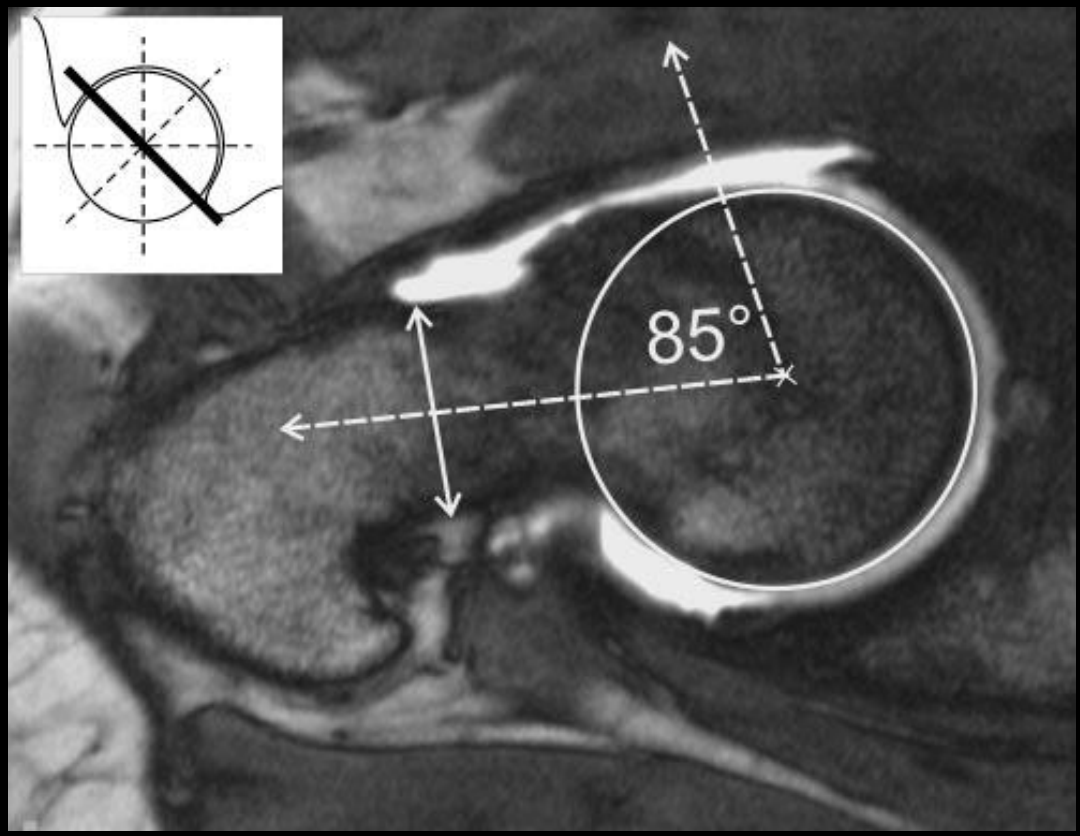
- Hips flexed 90 deg
- Hips abducted 20 deg
- Neutral rotation

Lateral bump/Pistol Grip

Courtesy: Dr. Brady Huang

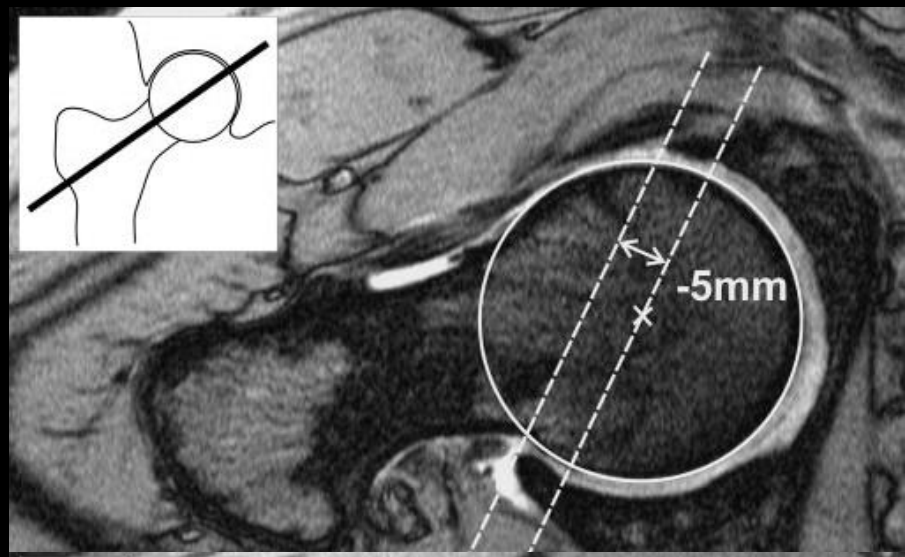
Alpha Angle (CAM type)

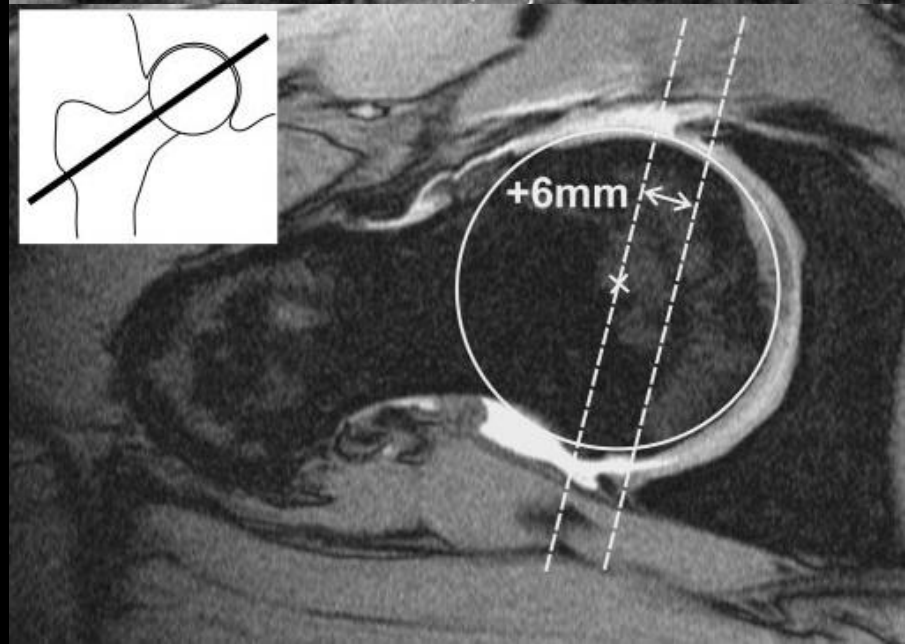
- Axial oblique MRI
- >50 degree is abnormal
  - ?55 degree



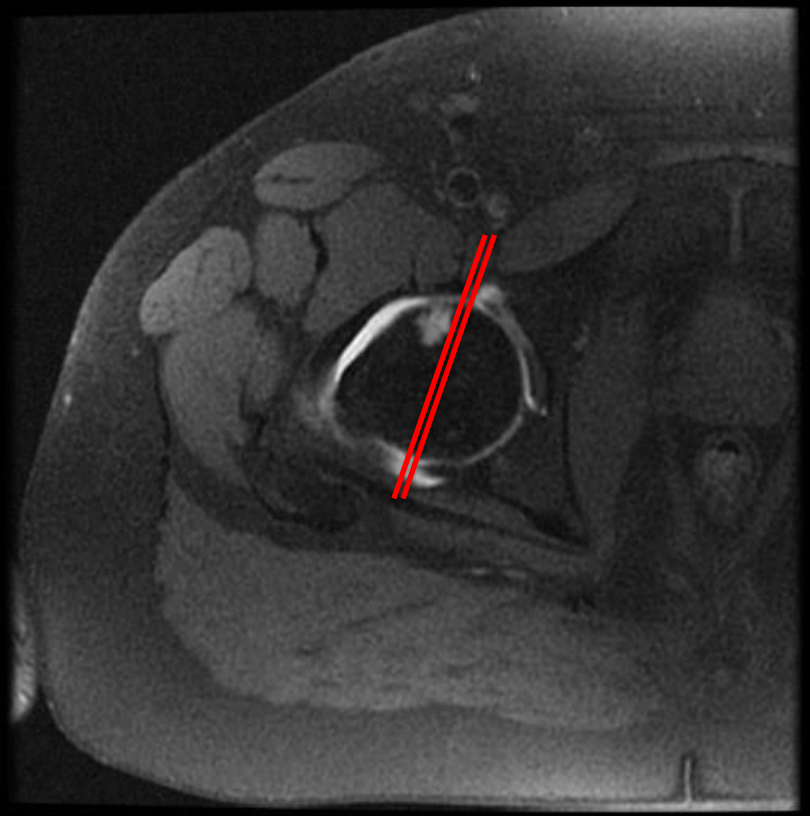
Acetabular Depth (Pincer Type)

- Normal: 0 to +5mm
- Pincer FAI: <-5mm

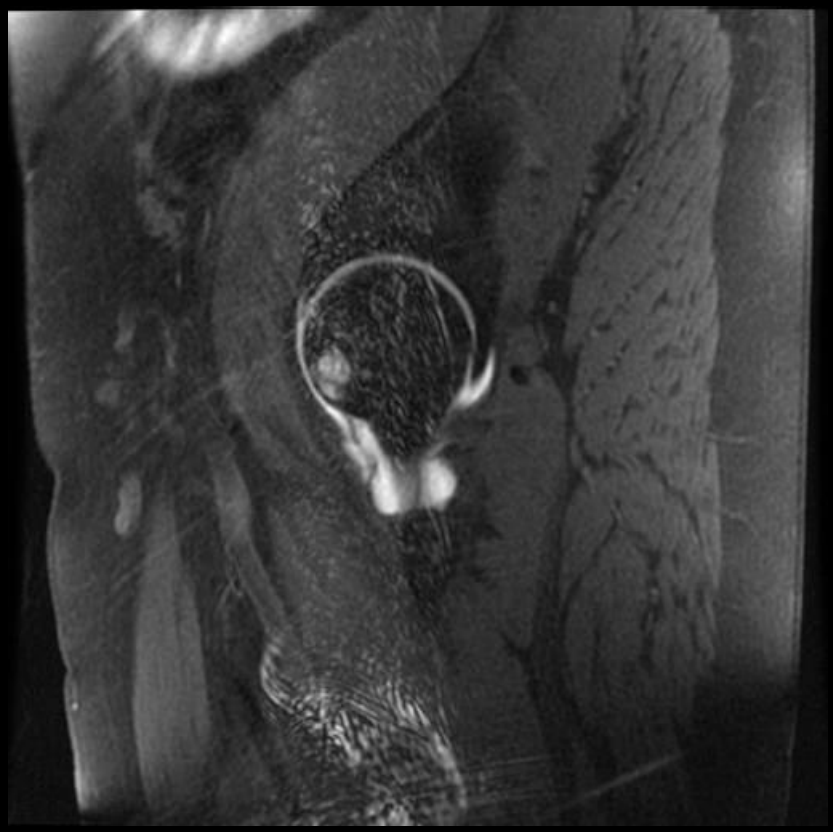




Axial Oblique MR Arthrogram

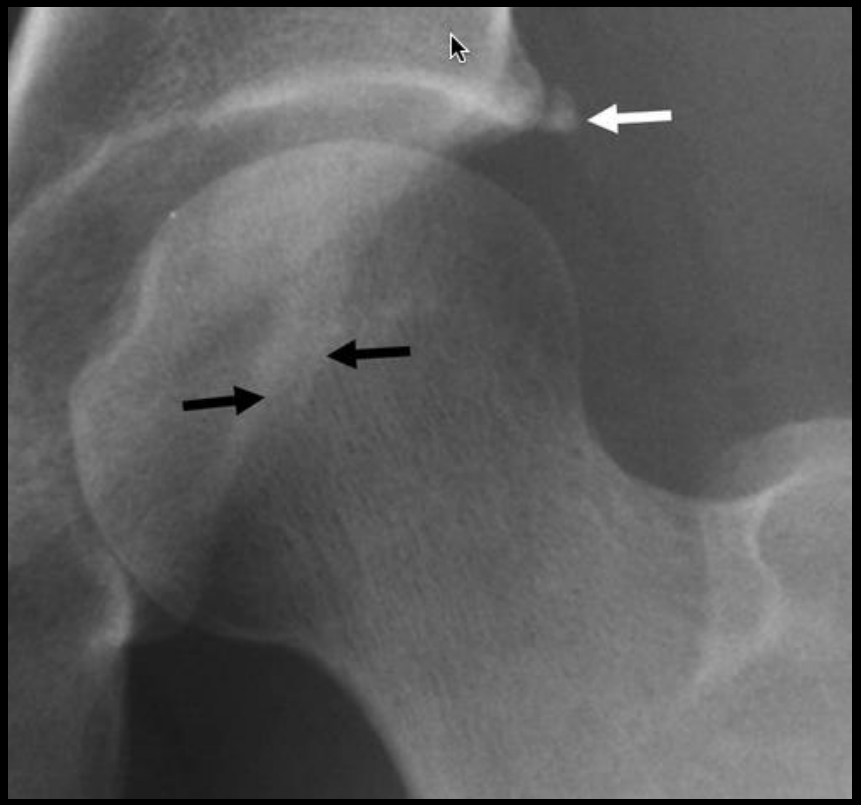


Courtesy: Dr. Brady Huang



Courtesy: Dr. Brady Huang

Secondary Findings



Counter Argument: 2 Longitudinal Studies

- Bardakos NV et al. (2009)
- 43 hips with cam morphology & mild OA
- 1/3rd had no progression of OA after 10 years

- Hartofilakidis G et al. (2011)
- 96 asymptomatic hips with FAI morphology
  - 17 cam, 34 pincer, 45 mixed
- 82% did not develop OA
  - 18-19 y mean followup
- α-angle of those that developed OA was no diff than those that did
- Only contralateral OA was predictive

Treatment

- Nonsurgical:
  - Relative rest & NSAIDs
  - Activity modification
    - Avoiding provocative positions
    - Muscle strengthening
  - Physical therapy

- Surgical:
  - Address labrochondral pathology
  - Address underlying bony deformity
  - Open surgical dislocation of hip
    - Ganz et al
  - Arthroscopic

SURGICAL

- Cam:
  - Arthroscopic:
    - Anterosuperior deformity
  - Open:
    - Posterolateral deformity
    - Complex proximal femoral deformities
      - Legg-Calve-Perthes disease
- Pincer:
  - Periacetabular osteotomy:
    - Severe retroversion w deficient posterior coverage
  - Acetabular rim trimming w labral refixation
    - Retroversion w nl posterior coverage
    - Risk for postoperative dislocation
  - Open surgical dislocation:
    - Global overcoverage

Nonsurgical

- Emara et al.
  - 37 pt w FAI & mild deformity (α-angle<60°)
  - Tx: Physical Therapy & activity modification
  - At 2 yr:
    - 11% had surgery
    - 89% had improvement in mean Harris hip score
      - 72 → 91
- Hunt et al.
  - 6/17 pts improved w/o surgery
  - Those who picked surgery had higher activity levels

Surgical

- Surgical Dislocation:
  - Ganz et al
  - Trochanteric osteotomy
  - Hip dislocated anteriorly
  - Allows circumferential access to acetabulum/proximal femur
- Complications:
  - Trochanteric pain
    - 46% of pts
  - Symptomatic intra-articular adhesions
    - 6%

Surgical

- Arthroscopy:
  - 10/12 studies: Good to excellent outcomes in >75% pts
- Complications:
  - Low:
    - 1-6%
  - Iatrogenic labral/cartilage damage

COXA SALTANS

Coxa Saltans

- "Snapping Hip"
- Audible snap of hip w/ flexion & extension or normal activities

- General population
  - 5-10% asymptomatic
- Certain professional athletes
  - Participate in extremes of hip motion
  - Higher incidence & more symptomatic

Elite Athletes

- Survey of Ballet Dancers:
  - 90% by report
  - Hip external rotation/abduction >90 degrees
- Wahl et al.
  - 2 footballers & 1 soccer player
  - Hip flexion >90 degrees
- Also seen in weight-lifters & runners

Coxa Saltans

- Mayer L. Snapping hip.
  - Surg Gynecol Obstet
  - 1919;29:425–4293

- Categories
  - Externa
  - Interna: Most common
  - Intraarticular

Imaging Evaluation

- XR:
  - Coxa vara
  - DDH
- MRI:
  - Soft tissue edema about involved structure
  - Bursitis
- MRA:
  - Investigate intra-articular causes
- Bursography:
  - Not commonly used anymore
  - Historical imaging test of choice
- Ultrasound:
  - Newer modality & imaging test of choice

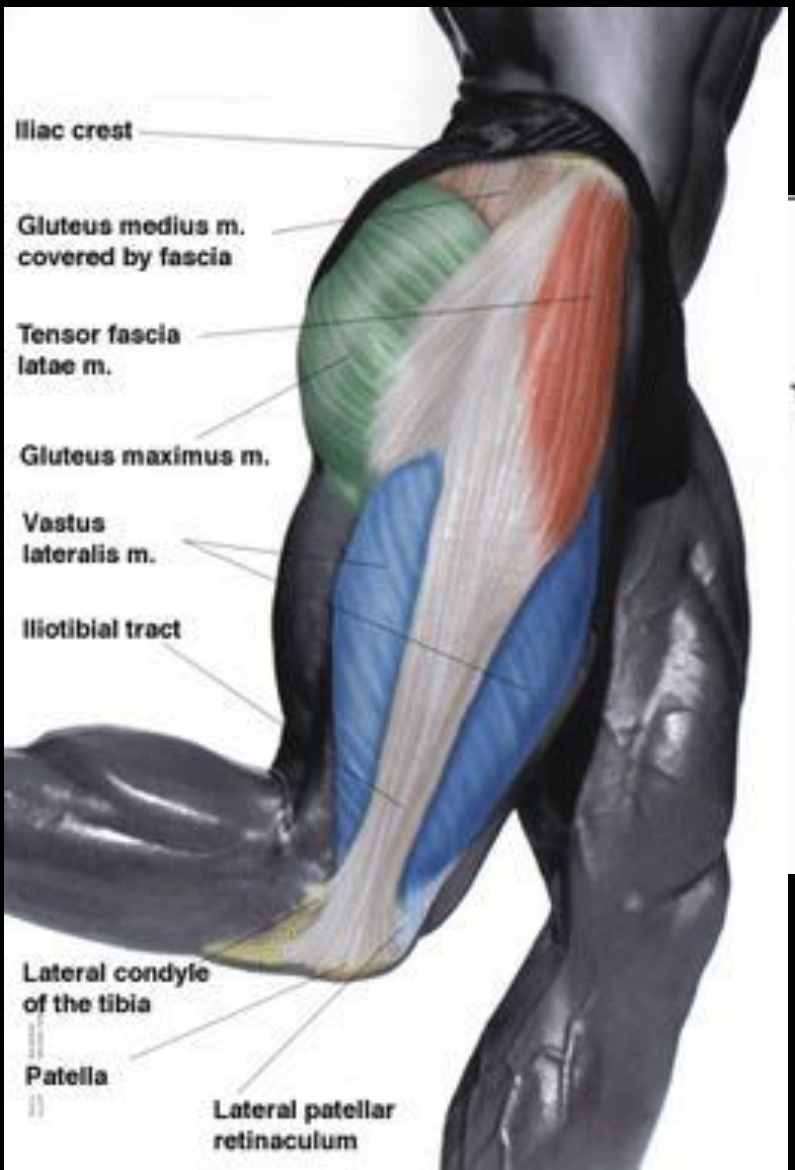
Coxa Saltans

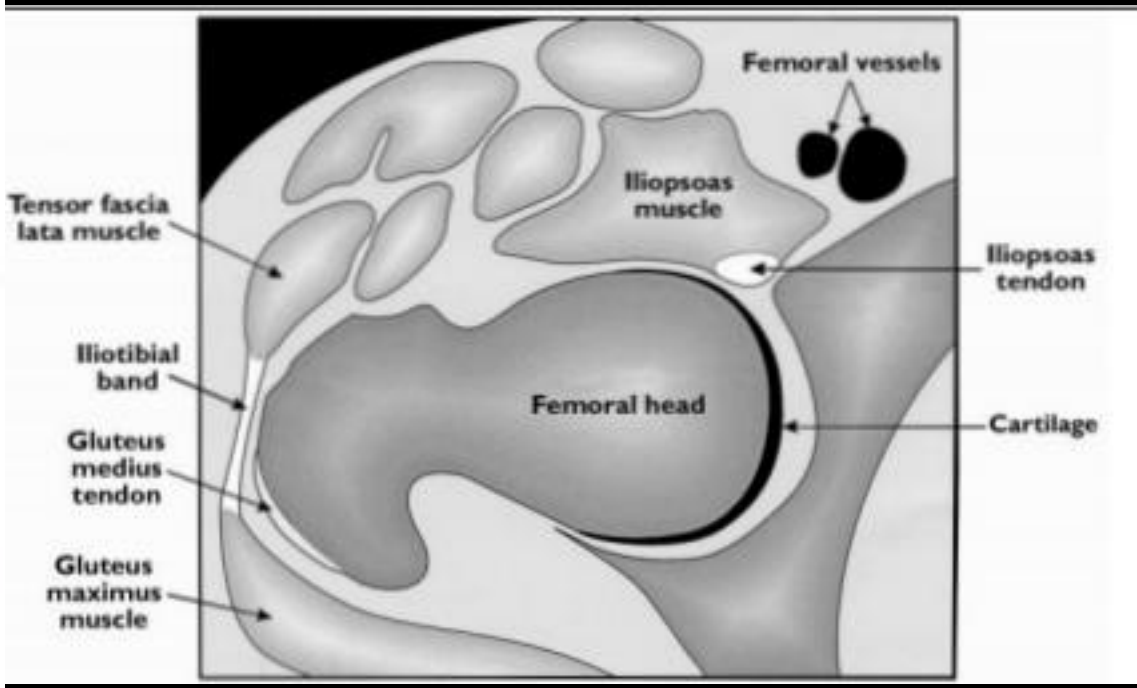
- **Externa**
- Interna
- Intraarticular

Coxa Saltans Externa

- Iliotibial tract slides over the greater trochanter with flexion/extension
- ITT is posterior with hip extension & moves anterior with hip flexion

Iliotibial Tract





Pelsser V, Cardinal E, et al. Extraarticular snapping hip: sonographic findings. AJR. Jan 2001;176(1):67-73

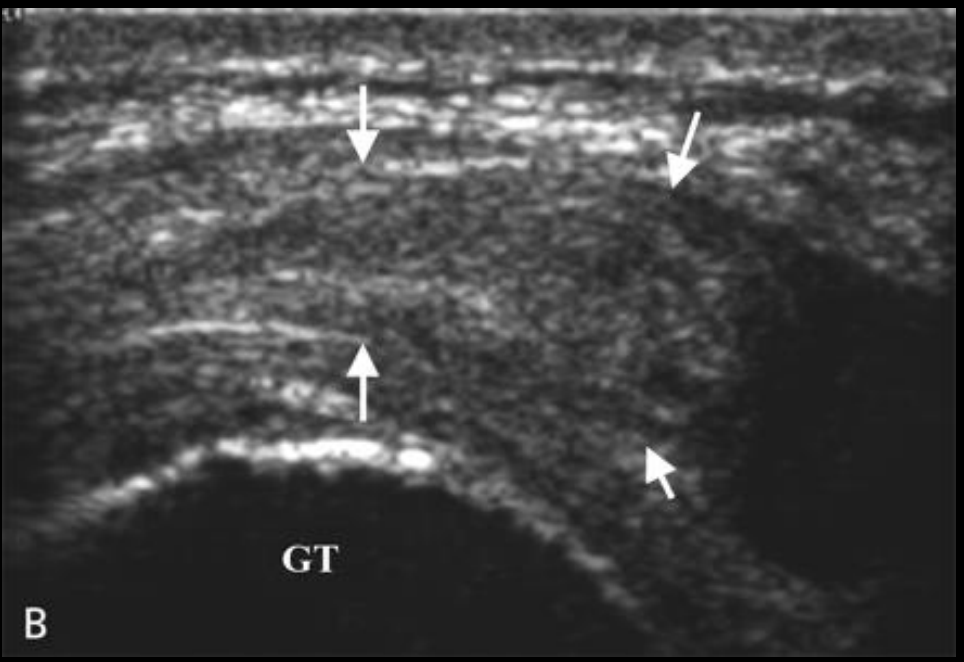
Iliotibial Tract

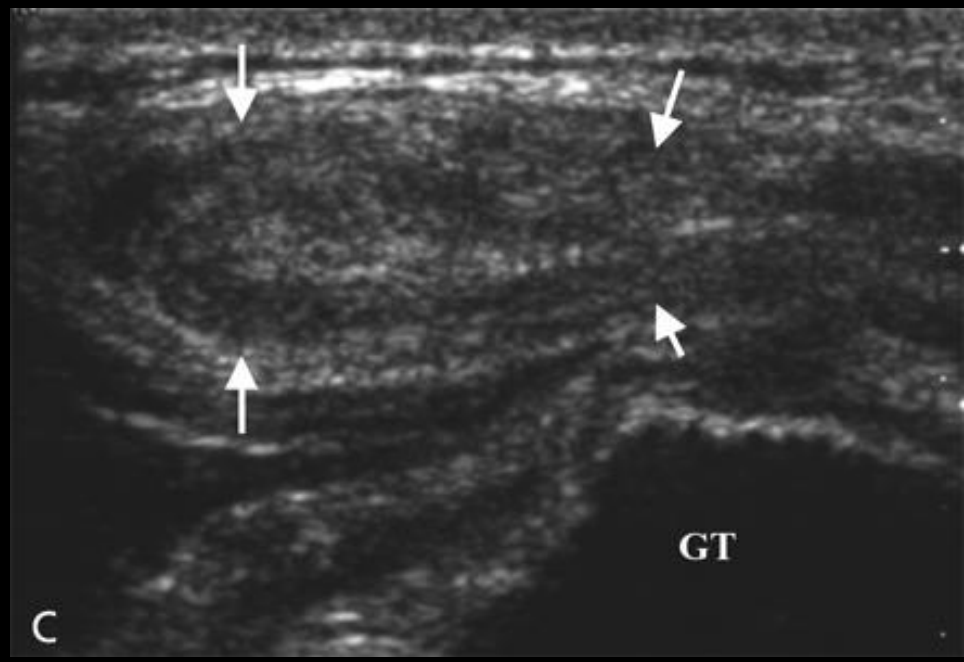
- TFL & Glut max keep ITT taut whether hip is flexed or extended
- As taut throughout, any small anatomic change would precipitate snapping over GT
- Greater trochanteric bursa lies between ITT & GT
  - Predisposed to bursitis

Coxa Saltans Externa: Physical Exam

Courtesy: Dr. Amy Sewick

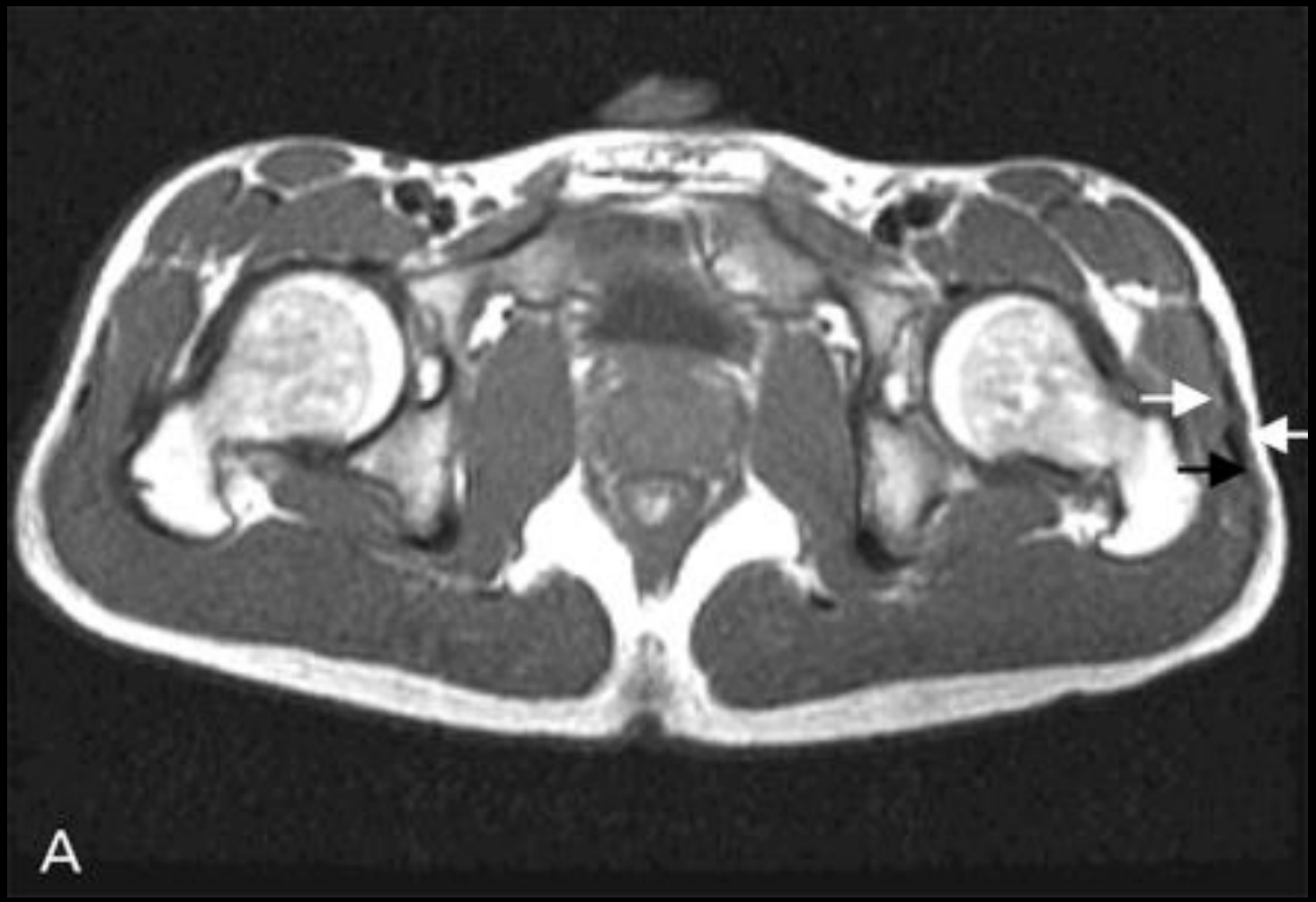
Coxa Saltans Externa: ITT





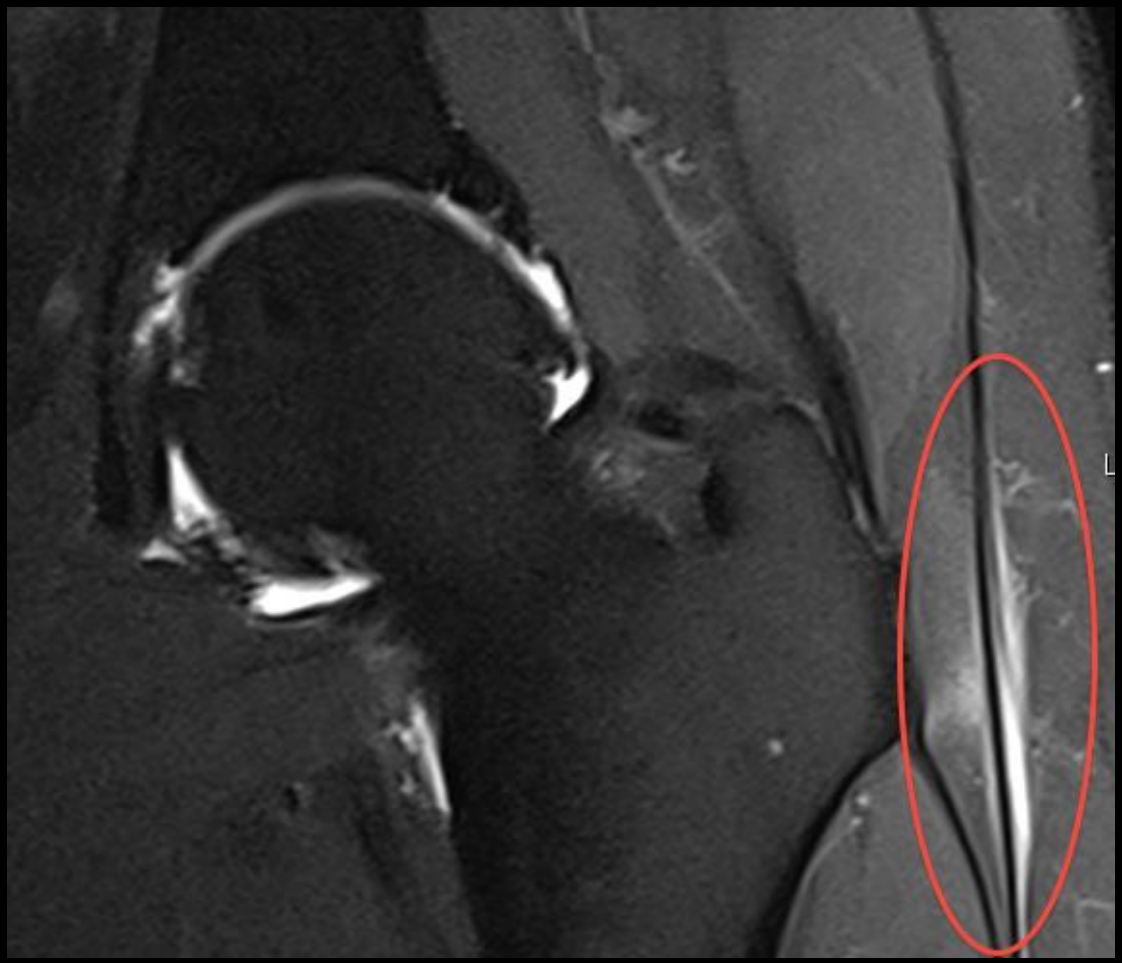
Choi YS, et al. Dynamic Sonography of External Snapping Hip Syndrome. JUM. July 2002;21(7):753-8

Coxa Saltans Externa: ITT



Choi YS, et al. Dynamic Sonography of External Snapping Hip Syndrome. JUM. July 2002;21(7):753-8

Coxa Saltans Externa: ITT



Coxa Saltans

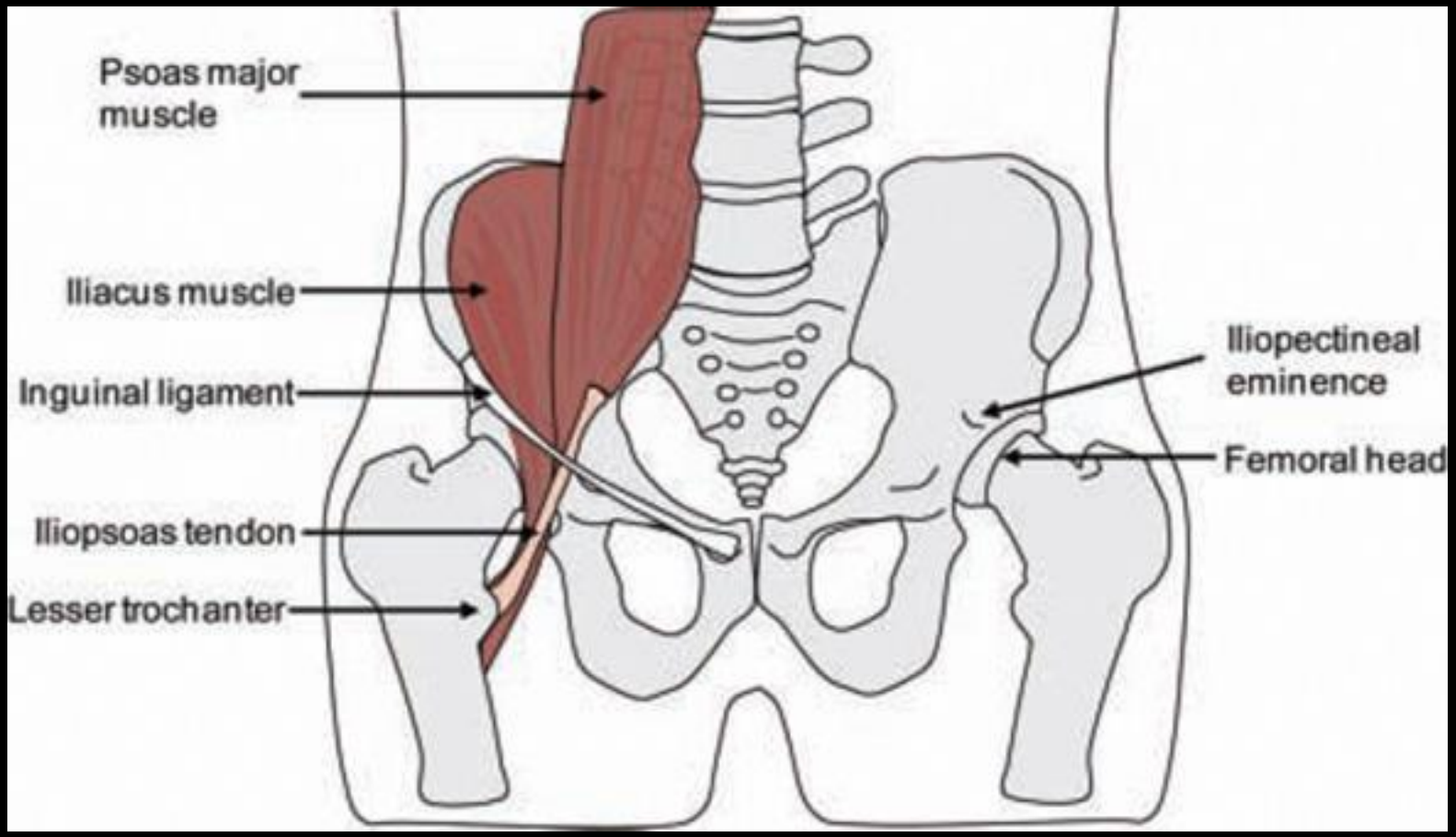
- Externa
- **Interna**
- Intraarticular

Coxa Saltans Interna

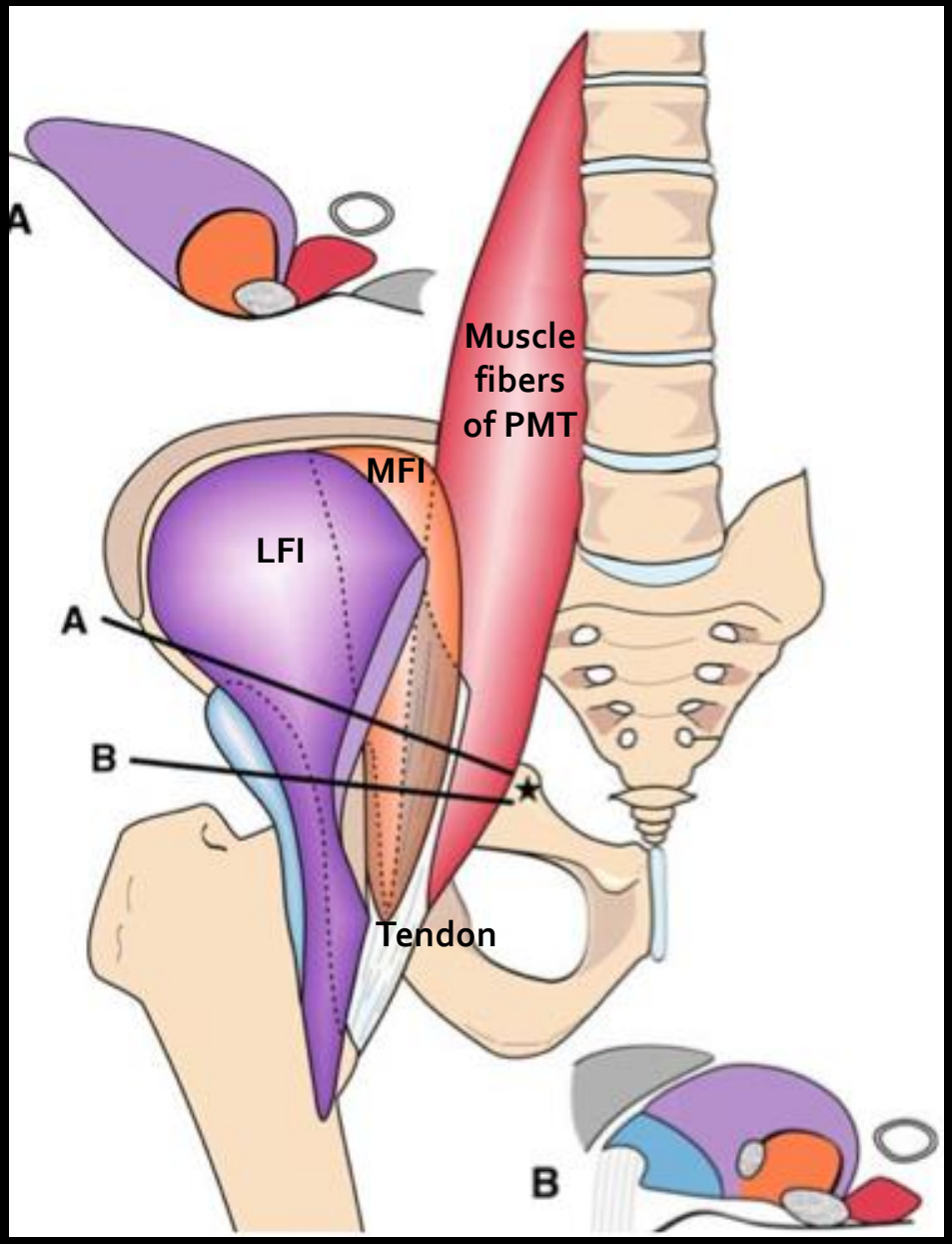
- Iliopsoas tendon moving over the:
  - Classically:
    - Femoral head/anterior hip capsule
    - Prominent iliopectineal ridge
    - Exostoses of lesser trochanter
    - Iliopsoas bursa
  - Newer:
    - Medial fibers of iliacus

CSI: Physical Exam

- Supine patient
- Reproduce snapping by flexing/extending hip
- Block snapping by finger pressure over iliopsoas tendon at femoral head


Psoas major muscle
Iliacus muscle
Inguinal ligament
Iliopsoas tendon
Lesser trochanter
Iliopectineal eminence
Femoral head

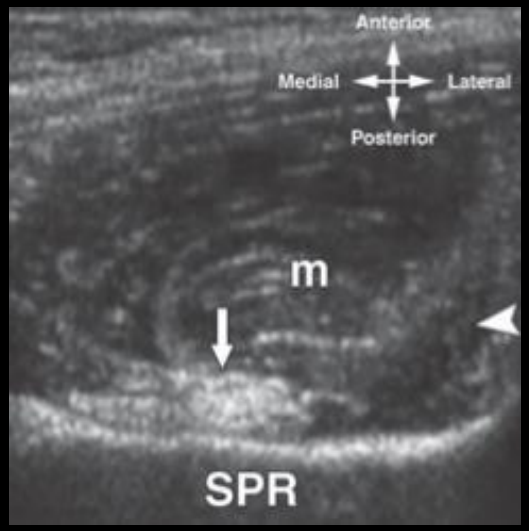
Anatomical View of the Iliopsoas Muscle



- PMT = psoas major tendon
- MFI = medial fibers of iliacus
- LFI = lateral fibers of iliacus
- IIT = ilioinfratrochanteric bundle
- * = iliopectineal eminence

Guillin R, Cardinal E, Bureau N Sonographic anatomy and dynamic study of the normal iliopsoas musculotendinous junction Eur Radiol (2009) 19: 995–1001

Snapping Iliopsoas Tendon

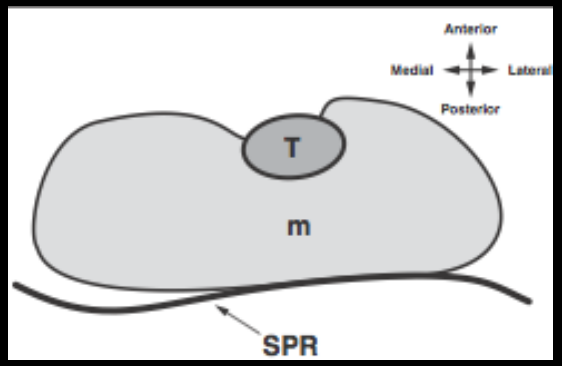


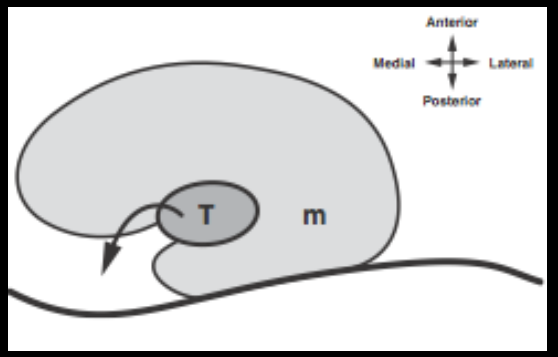
Neutral position

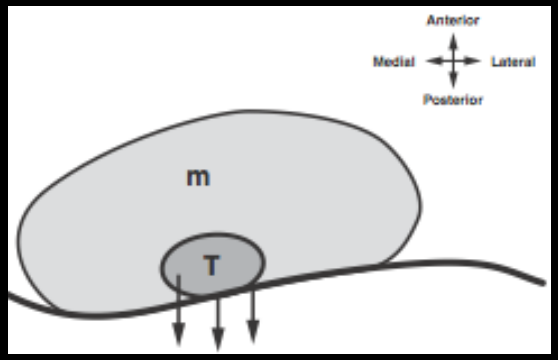
Frogleg position

Returning to neutral position

Back to neutral position





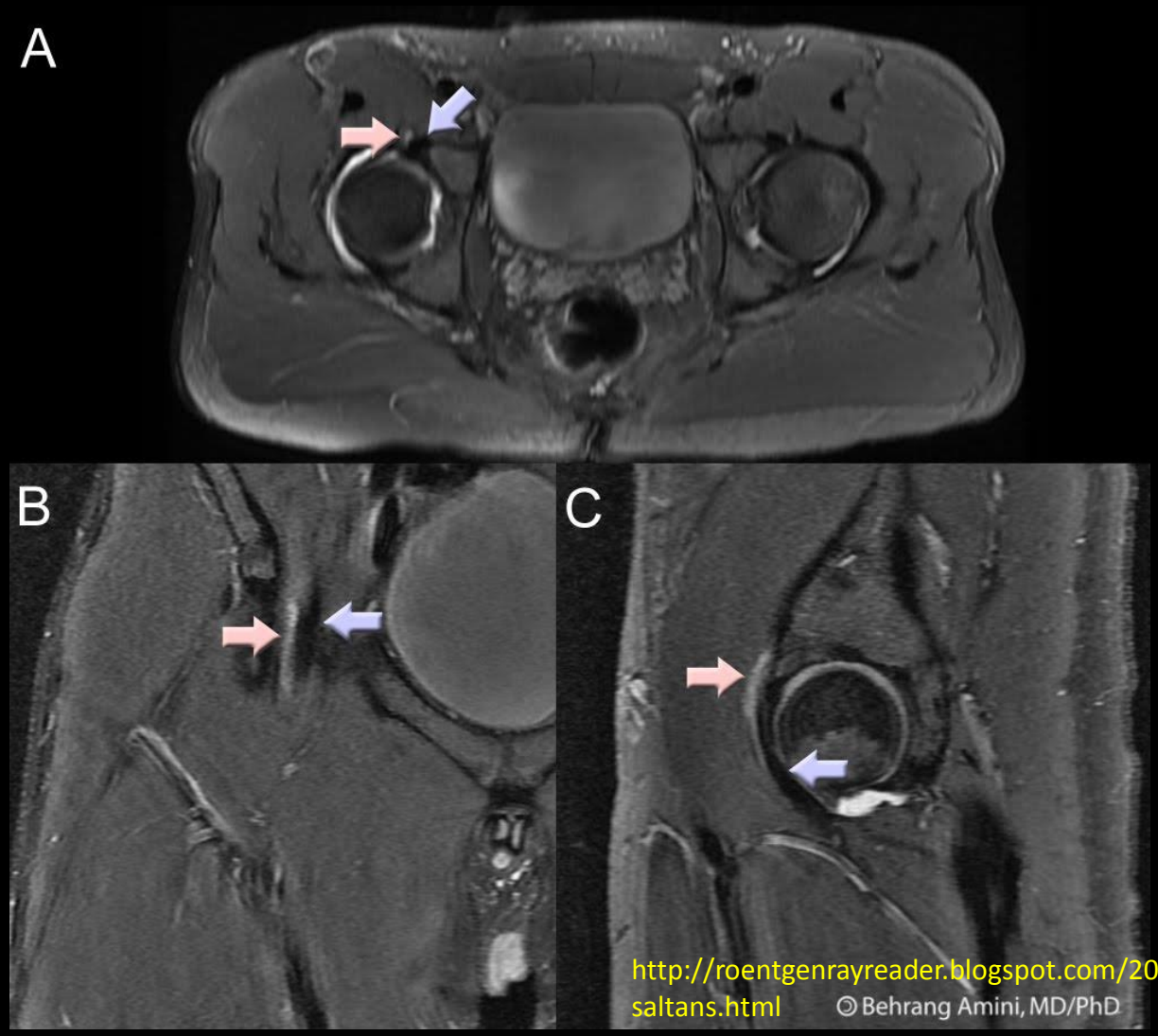


Deslandes M, Guillin R, Cardinal E, The Snapping Iliopsoas Tendon: New Mechanisms Using Dynamic Sonography *AJR* 2008; 190:576–581

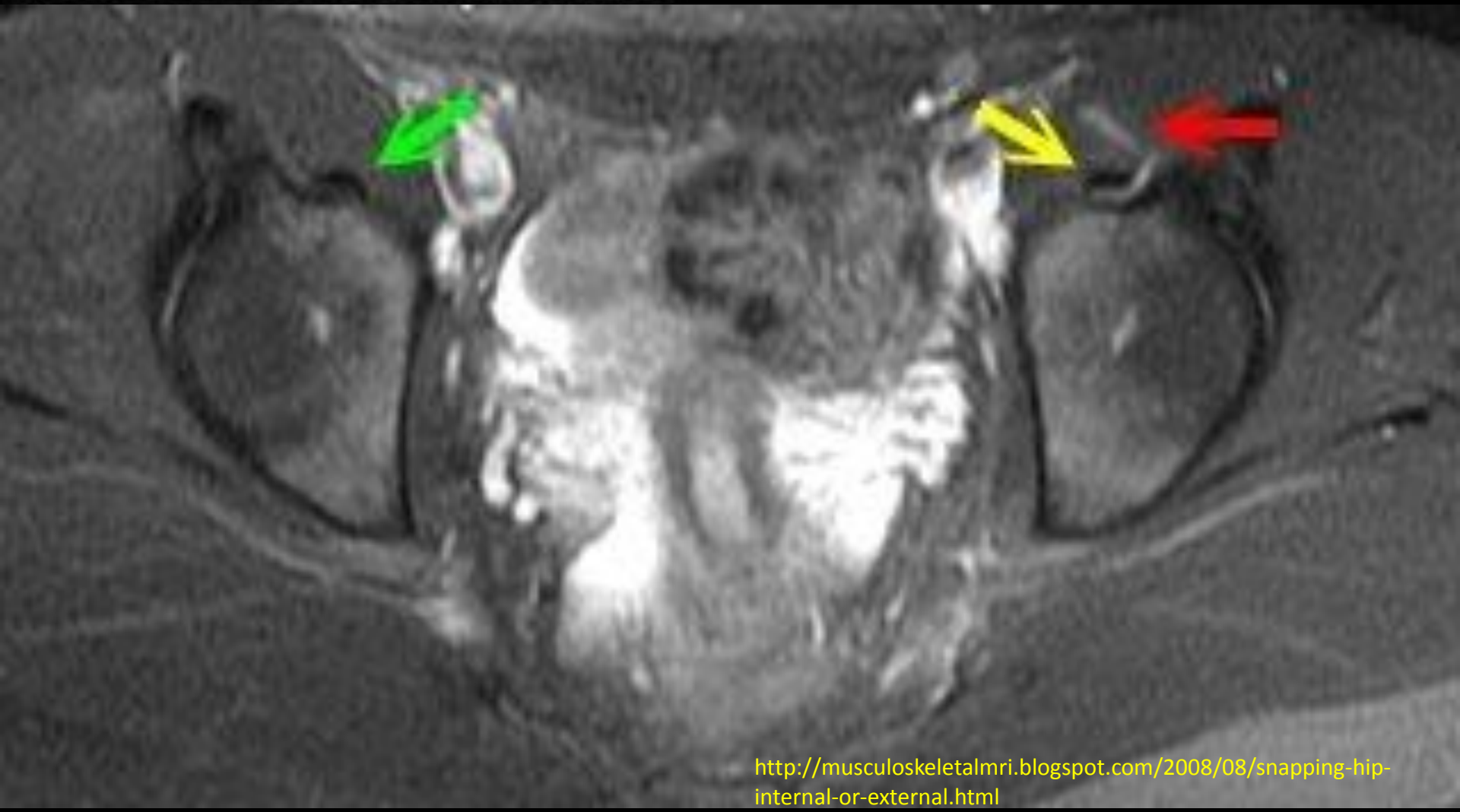
Dynamic Ultrasound

Courtesy: Dr. Tudor Hughes

Coxa Saltans Interna



Coxa Saltans Interna



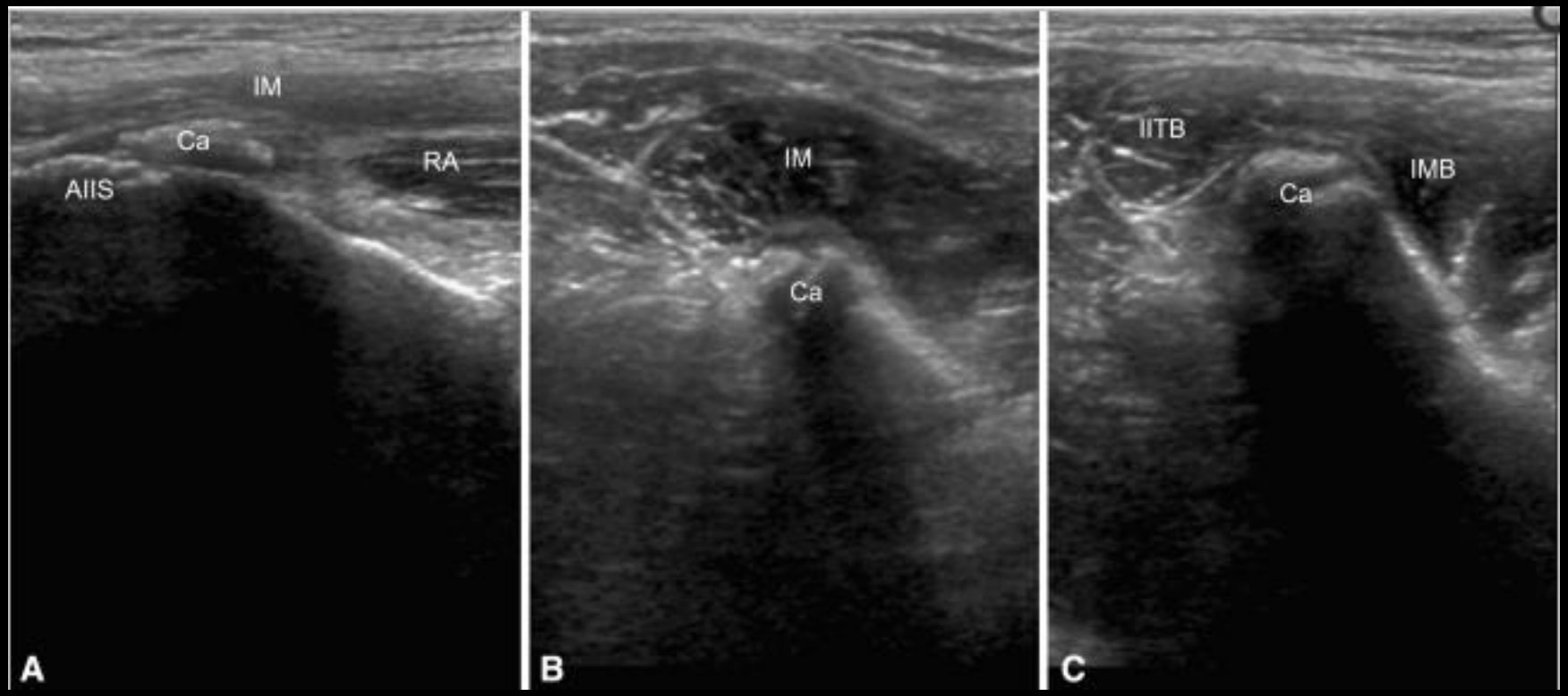
http://musculoskeletalmri.blogspot.com/2008/08/snapping-hip-internal-or-external.html

Sounds Painful

- Pelsser V, et al. AJR. 2001.
- 26 cases of extra-articular coxa saltans
  - 24: Underlying cause identified
  - 22: Coxa Saltans Interna
  - 14: Painful

Rare Cause: XR

Rare Cause: US



Rare Cause: CT

Coxa Saltans

- Externa
- Interna
- **Intraarticular**

Coxa Saltans Intra-articular

- Clicking sensation

- Labral tear
  - Cause pain >>> snapping hip
  - Usu posterosuperior
- Loose body
- Synovial chondromatosis
- Femoral head subluxation
- Synovial fold(Atilihan et al. 2003)

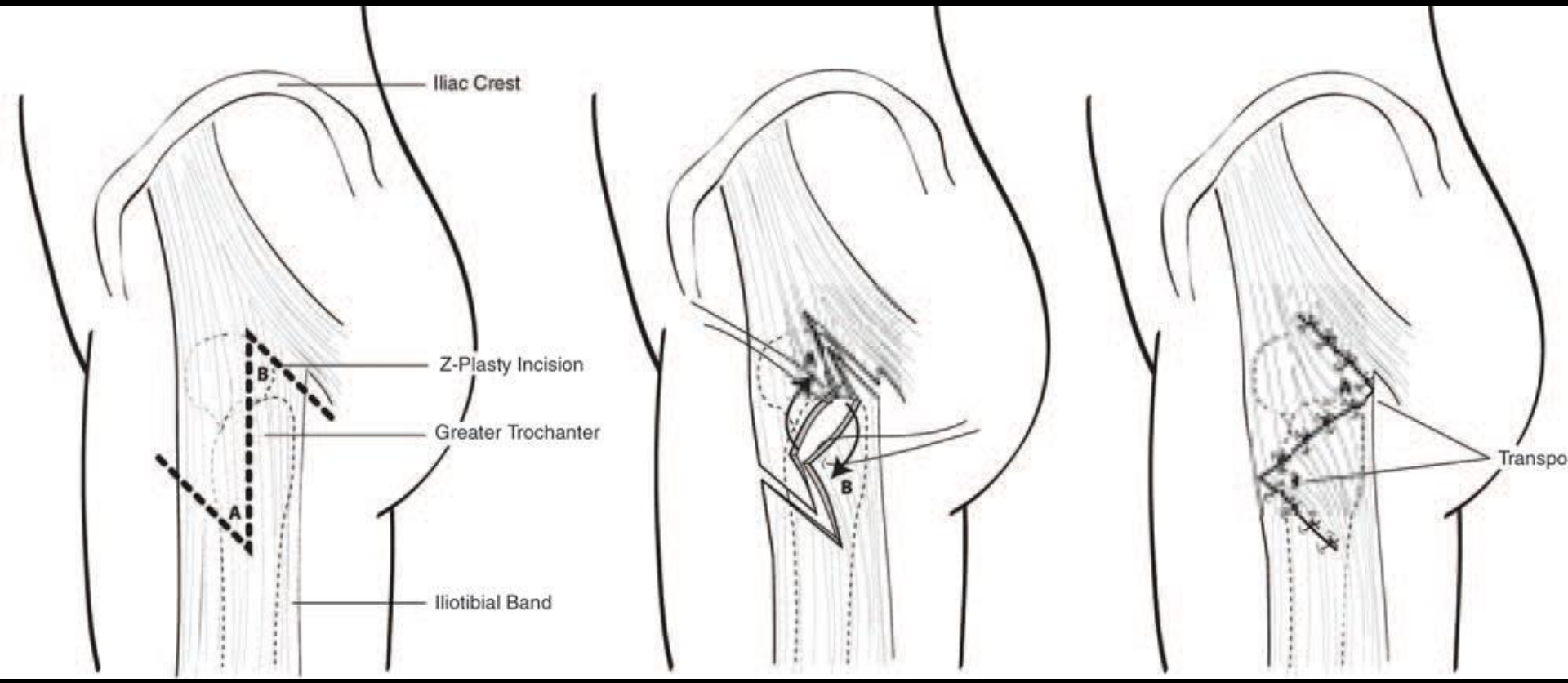
Yamamoto et al. 2005.

Treatment of Coxa Saltans

- Conservative
  - Avoid inciting activities
  - Rest
  - Corticosteroid injection
  - Therapy emphasizing stretching
- Surgical
  - External – excision of greater trochanteric bursa w/ IT band lengthening
  - Internal – iliopsoas release &/or lengthening

Treatment

- External:
  - Provencher et al. (2004)
    - 9 hips treated by ITT Z-lengthening
    - All had resolution of snapping
    - 1 had persistent groin pain
  - Ilizaliturri et al (2006)
    - 11 hips treated by diamond excision of ITT over GT
    - 10 had full resolution of symptoms
    - 1 had mild snapping but no pain at 2 year followup
- Most common complication:
  - Mild to moderate Trendelenburg gait
    - Caused by abductor weakness


Iliac Crest
Z-Plasty Incision
Greater Trochanter
Iliotibial Band
B
A
B
A
Transpo

Courtesy: Dr. Amy Sewick

Treatment

- Internal:
  - Hoskins JS, et al (2004)
    - 85 patients fractional lengthening of iliopsoas
    - 20 patients had return of snapping by 1 year
  - Anderson SA, et al (2008)
    - Arthroscopic repair in 15 athletes
    - Incidental note of 12 athletes having labral tear
    - 0 had return of snapping
    - Theory: Iliopsoas dysfunction leads to labral tear
- Most common complication:
  - Hip flexor weakness

ISCHIOFEMORAL IMPINGEMENT

Ischiofemoral Impingement

- First reported in 1977 in 2 pts after total hip arthroplasy and 1 pt after proximal femoral osteotomy
- Radiographs: Narrowing bet ischium & lesser trochanter
- Relief with resection of the lesser trochanter

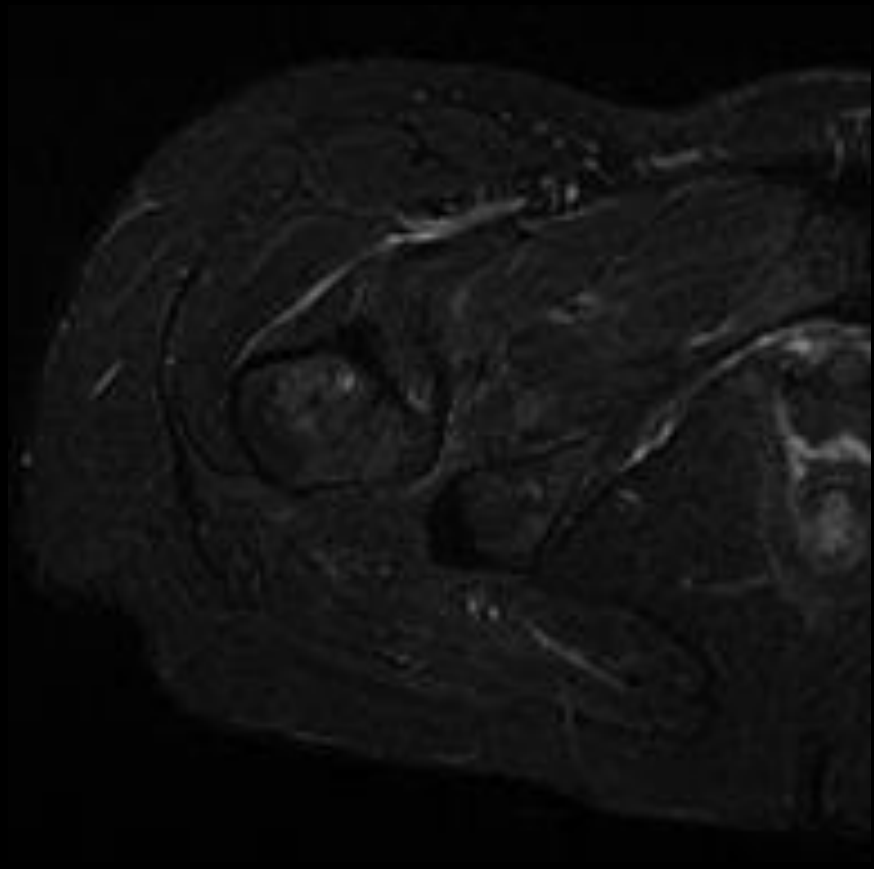
Epidemiology

- Hip/Groin pain
  - Usu posterior
  - Pain radiates distally
  - Snapping/locking
- F >>> M
  - 84-100% female
  - Middle aged-elderly
- Bilateral: 25-40%

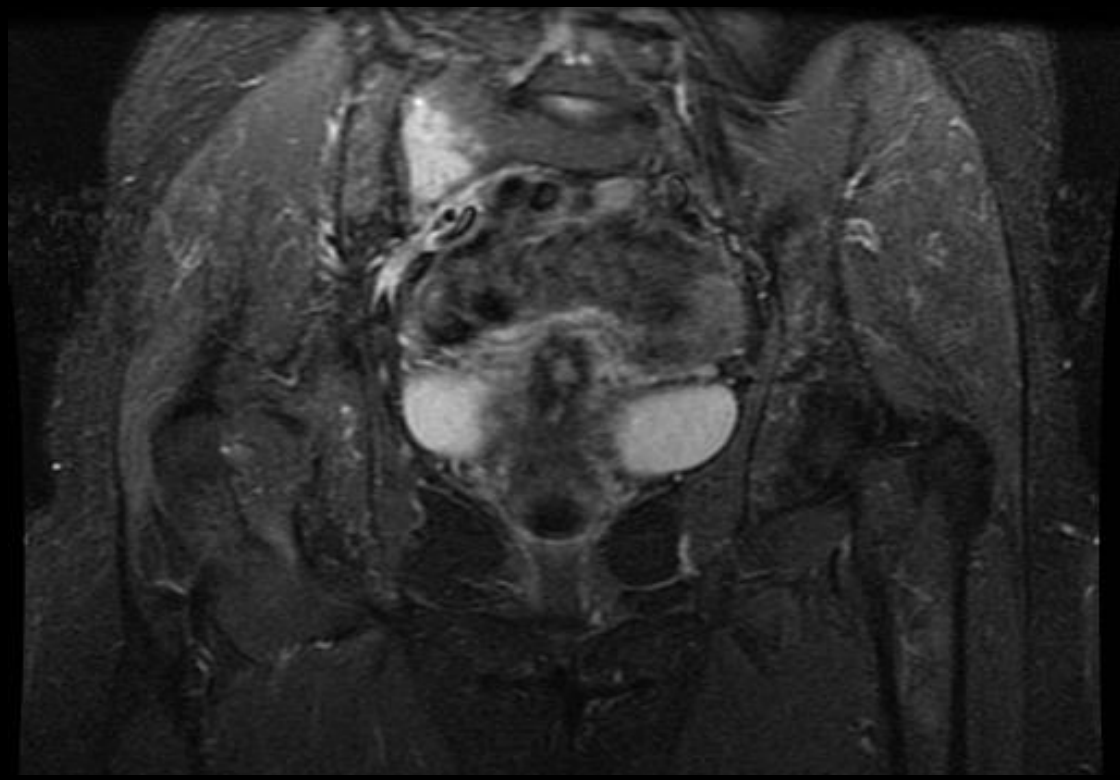
Risk Factors

- Superomedial migration of femur 2/2 OA
- Osteochondroma
- Prominent lesser trochanter
- Enlarged ischium from prior fracture

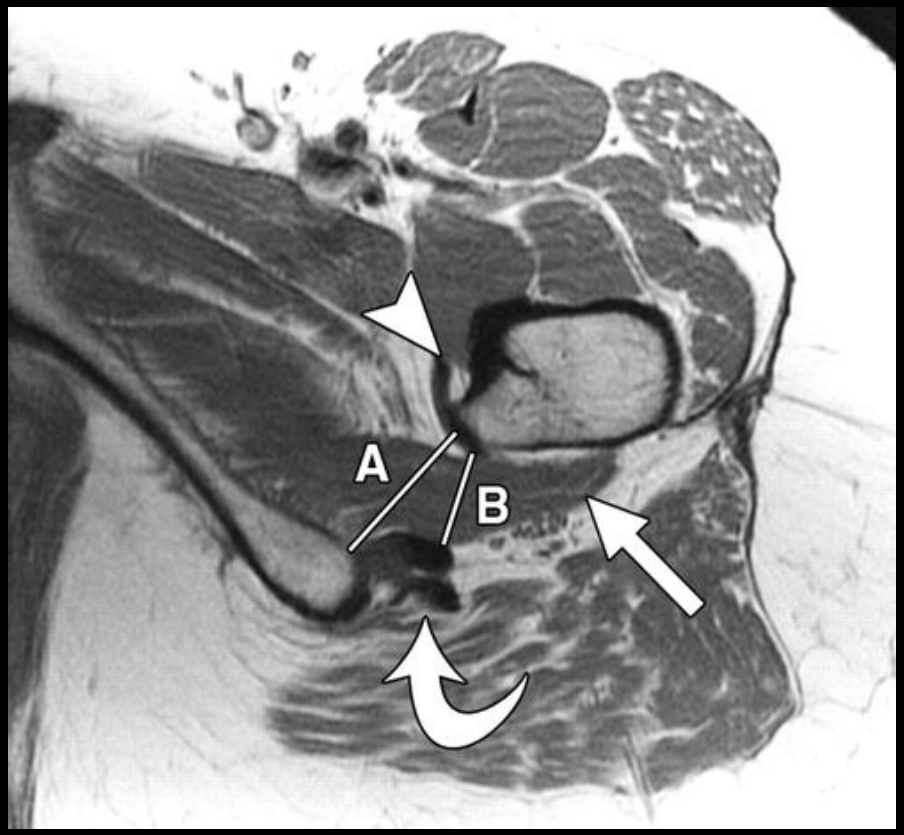
Ischiofemoral Impingement



Ischiofemoral Impingement



Measuring for IFI

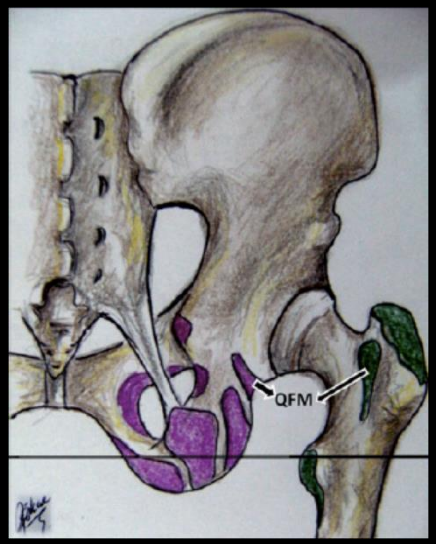


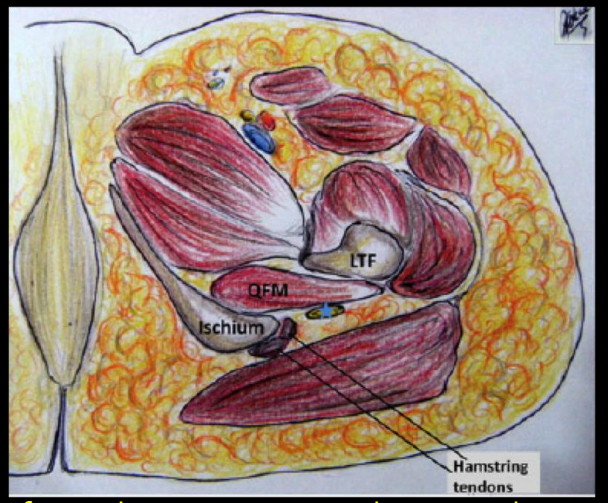
- A: Ischiofemoral Space (IFS)
  - 12.9 (±5) vs 22 (±8) mm
- B: Quadratus Femoris Space (QFS)
  - 6.7 (±3) vs 13.5 (±4) mm

Torriani M, Souto SCL, et al. Ischiofemoral impingement syndrome: an entity with hip pain and abnormalities of the quadratus femoris muscle. AJR. July 2009;193(1):186-90.

Quadratus Femoris

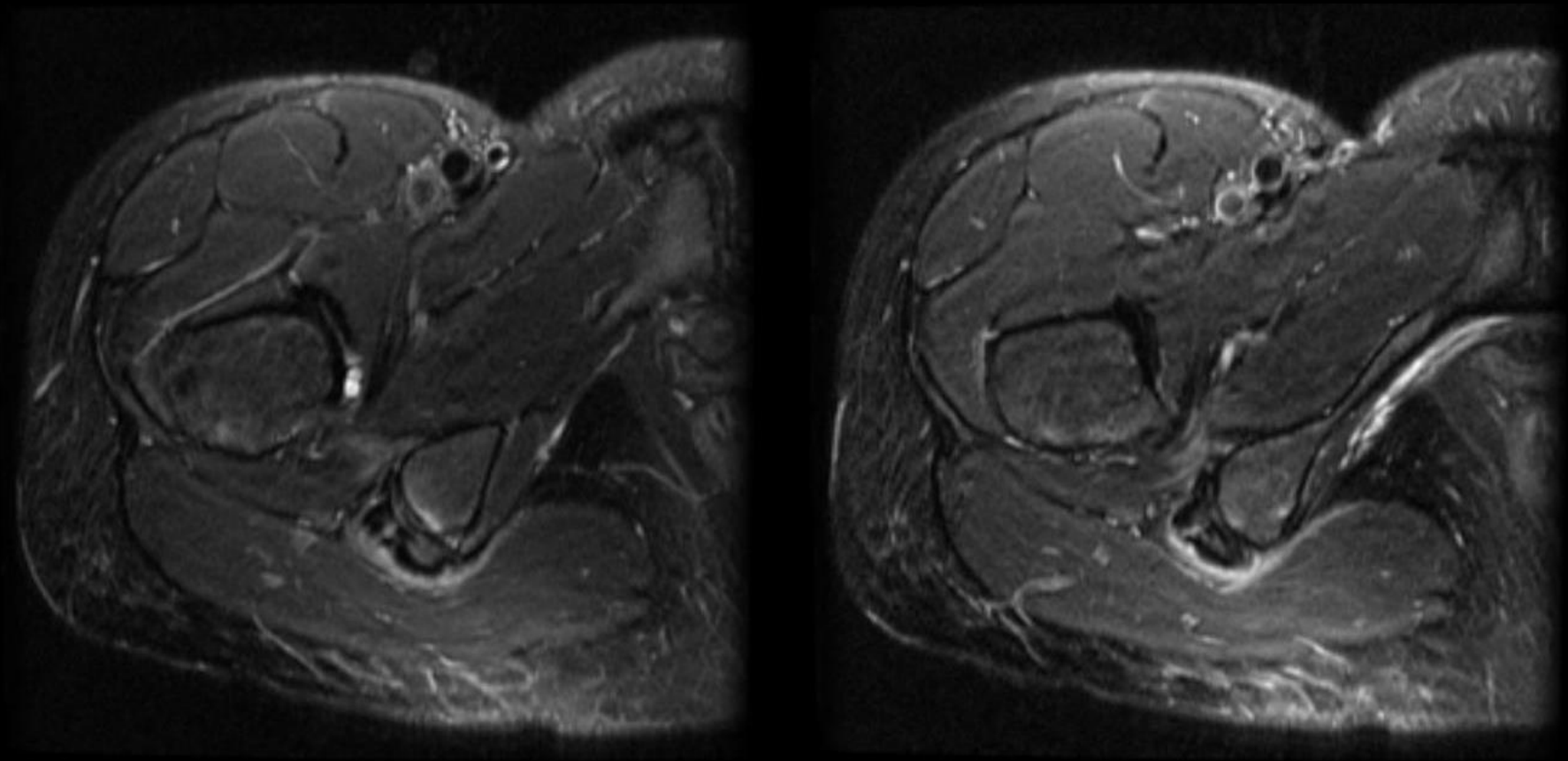
- Square muscle of the thigh
- Origin: Superior aspect of lateral surface of ischial tuberosity, just anterior to origin of semimembranosus tendon
- Insertion: Posteromedial aspect of proximal femur
- Nl width bet ischium & proximal femur: 2 cm





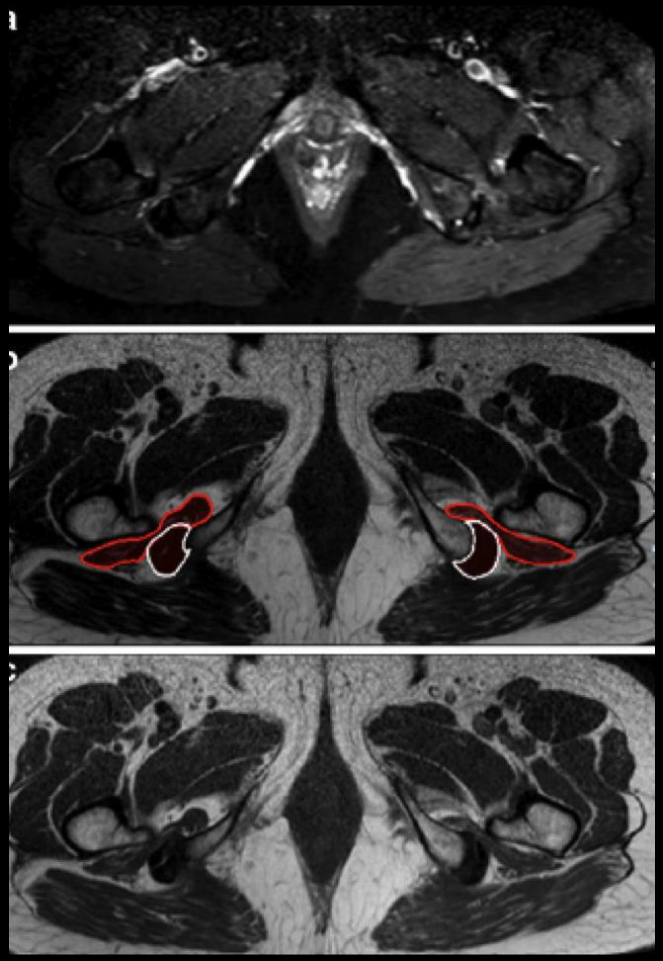
Tosun O, Algin O. Ischiofemoral impingement: Evaluation with new MRI parameters and assessment of their reliability. Skeletal Radiology 2012

Ischiofemoral Impingement



Courtesy: Dr. Erica Chu

Hamstring Tendons



- Associated with hamstring tendon edema (50%) or partial tears (25%)
- Seagull Wing Sign of QFM
  - Hamstring tendinopathy/area contributes to IFI

Tosun O, Algin O. Ischiofemoral impingement: Evaluation with new MRI parameters and assessment of their reliability. Skeletal Radiology 2012

Grading QFM Edema

- Tosun et al. 2012

- 0: Nl muscle signal
- I: Focal edema where IFS/QFS are narrowest
- II: Diffuse edema confined to muscle
- III: Edema extending to surrounding soft tissues
  - Can cause irritation of adjacent sciatic nerve→ sciatica

Grading QFM Fatty Replacement

- Tosun et al. 2012

- 0: Nl muscle signal
- I: Tiny linear fat signal bet muscle fibers
- II: Linear & globular fat signal <50% of QFM
- III: Globular fat signal >50% of QFM

SUMMARY

Hip Impingement

- FAI
  - Pincer vs Cam
- Ischiofemoral Impingement
- Coxa Saltans
  - Externa, Interna, Intra-articular

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