Capsulolabroligamentous Structures of the Hip: Anatomy and Pathology

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MSK Fellow Lecture

May 7, 2009

Lecture Outline

I. Normal Articular Anatomy of the Hip
II. Pathology of Joint Capsule and Ligaments
III. Labrum:
    I. Normal Anatomy
    II. Pathology
    III. Pitfalls
IV. Miscellaneous
    I. Supraacetabular fossa/Stellate lesion

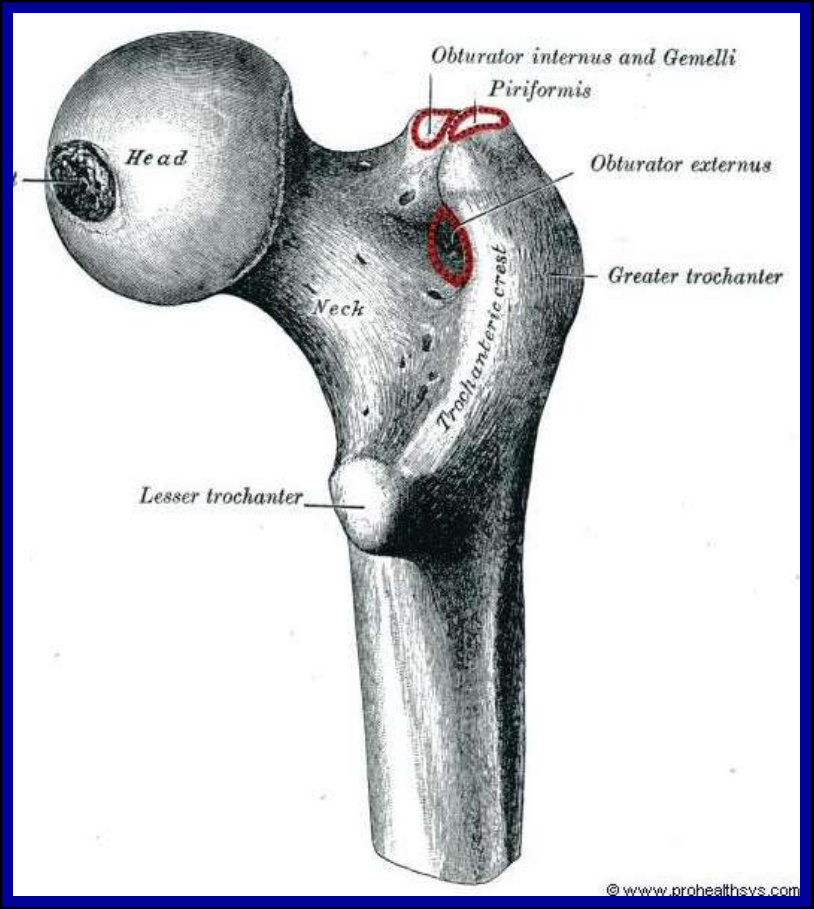
Hip Joint: Articular Anatomy

Hip Joint

- Synovial ball-and-socket joint
- Rotate around 3 planes
  - Transverse axis: flexion and extension
  - Longitudinal axis: medial and lateral rotation
  - Sagittal axis: abduction and adduction

Hip Joint: Osseous Anatomy

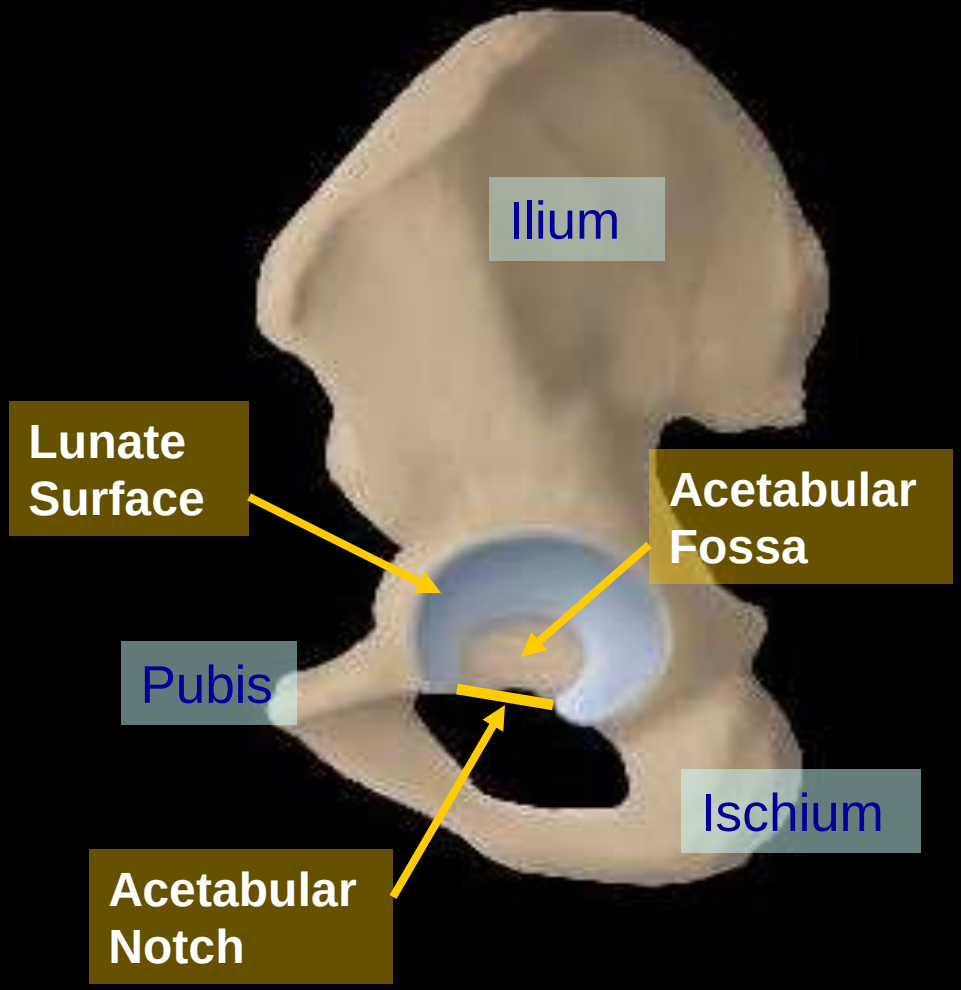
- **Femoral Head**
  - Half a sphere
  - Directed upward, medially and slightly anteriorly
  - Smooth surface xc for roughened pit, the fovea
- **Femoral Neck**
  - Entire anterior surface intracapsular
  - Medial third of posterior surface intracapsular



Hip Joint: Osseous Anatomy

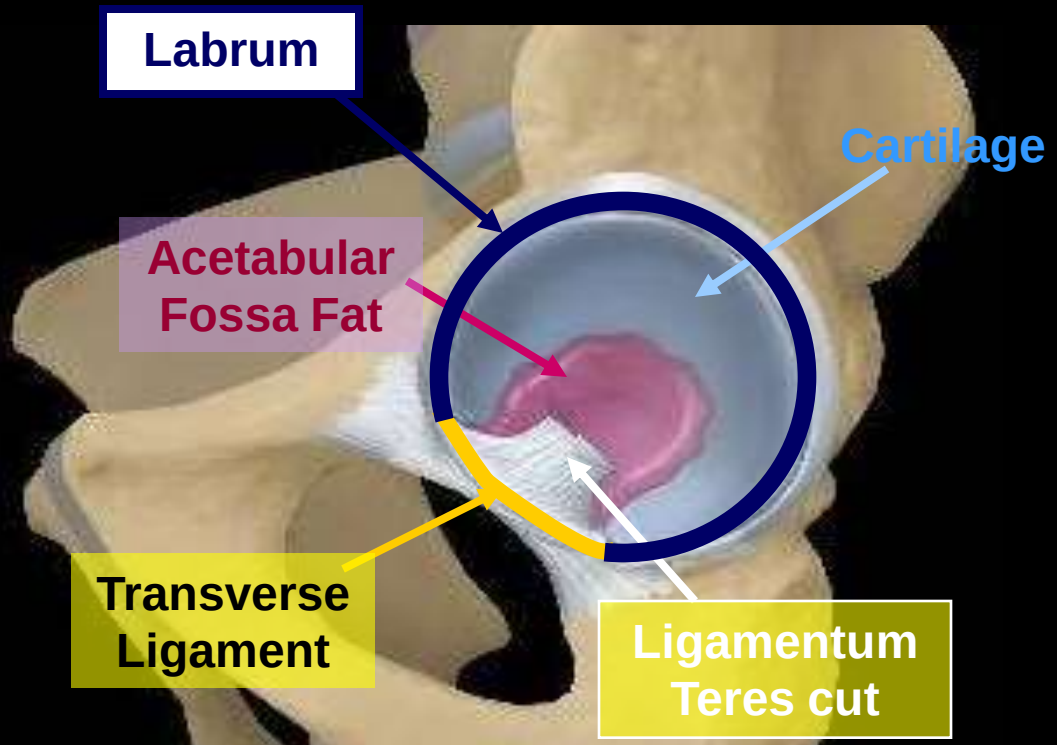
Acetabulum

- Cup-shaped socket
- Elevated bony rim with lunate cartilaginous surface
- Bony rim/cartilage absent inferiorly at the acetabular notch
- Acetabular fossa
  - Devoid of cartilage
  - Filled with fat
  - Covered by synovium



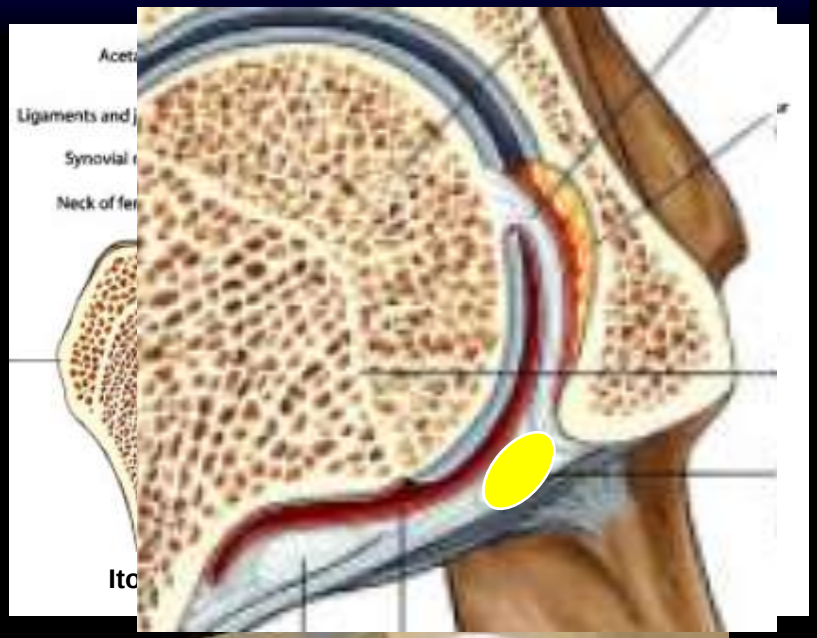
Hip Joint: Articular Anatomy

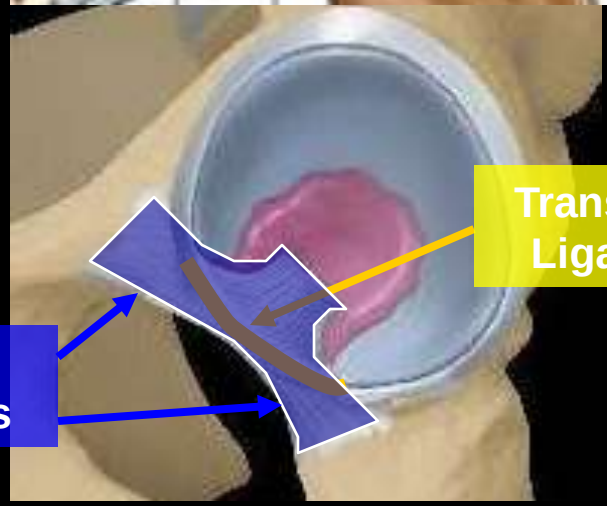
- **Labrum**
  - Fibrocartilaginous rim attached to edge of the acetabulum
  - Deepens the acetabular side of the joint
  - Ends and merges inferiorly with the transverse ligament
- **Transverse Ligament**
  - Spans the acetabular notch, coverting notch to foramen
  - A non-cartilaginous extension of the labrum



Ligamentum Teres Femoris

- Pyramidal ligament
- Covered by synovium
- Extends from femoral fovea as round band
- Inserts distally as 2 flattened bands on either side of acetabular notch, blending with fibers of transverse ligament
- Sometimes only synovial covering is present
- Contributes to stability in fetal and neonatal hips[9]
- Debated function in adult hips





Ligamentum Teres Femoris

Table I. Proposed functions of the ligamentum teres (LT)

Function	Arguments for	Arguments against
Mechanical		
Stability	Rich in collagen[9] stiffness comparable to other ligaments;[9] hip joint stability gradually decreases during gestation,[20] while the collagenous component of LT increases[10]	Presence of numerous static and dynamic stabilisers around the hip; minimal increase in range of movement after sectioning the LT[7]
Proprioception/co-ordination	Presence of FNE* in LT;[29,30] episodes of recurrent subluxation in athletes with injured LTs[26] may be caused by loss of fine coordination	FNE identified in 100% of normal[29] but only 66.6% of dysplastic[30] hips; cause-and-effect relationship between subluxation and injury to LT not proven
Biological		
Nociception	Presence of FNE;[29,30] pain reported in otherwise healthy hips with ruptured LTs;[3,5] pain in inflammatory/degenerative arthropathy	Multiple potential sources of pain in inflammatory/degenerative arthropathy
Vascularity to femoral head	Vessels present in LT[10,65-67]	Penetration of fovea by vascular canals limited and extremely variable[10]
Distribution of synovial fluid	None	Lack of experimental proof[13]

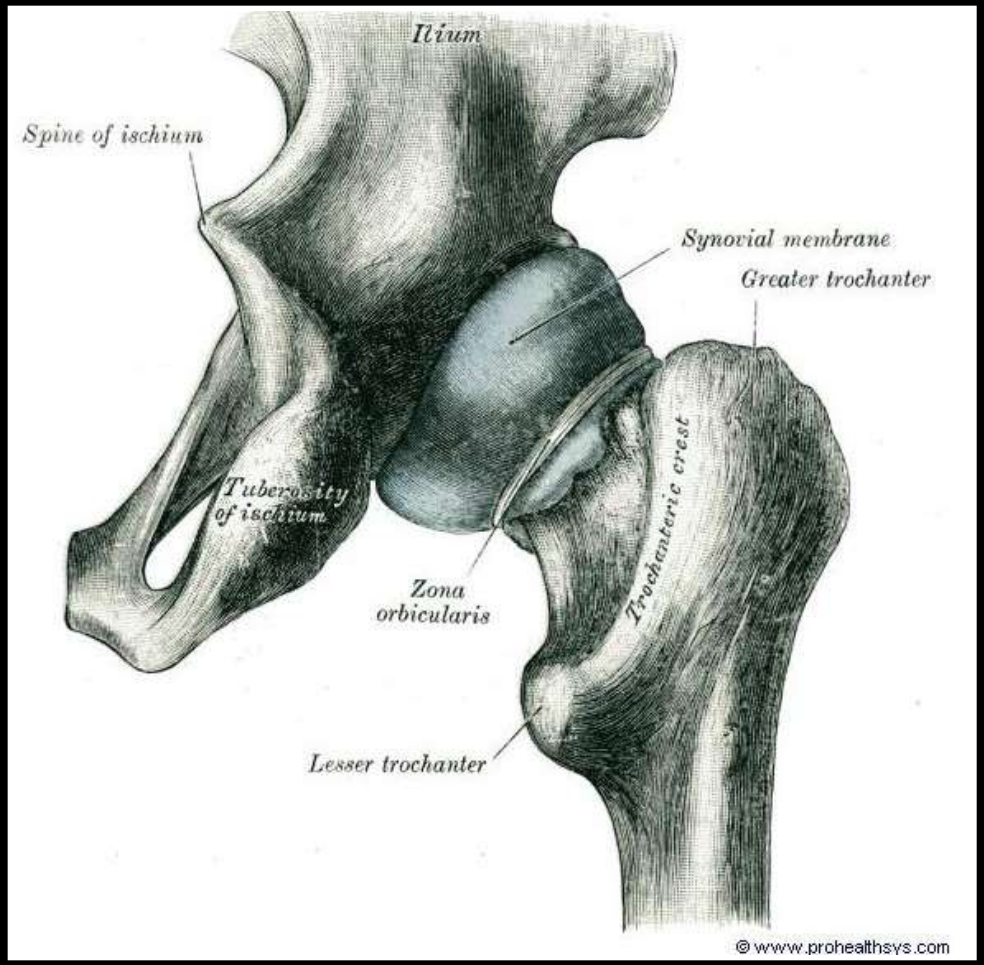
* FNE, free nerve endings

Bardakos N et al. The Ligamentum Teres of the Adult Hip. JBJS 2009;91- B:8-15.

Hip Joint: Synovial Cavity

Synovial Membrane

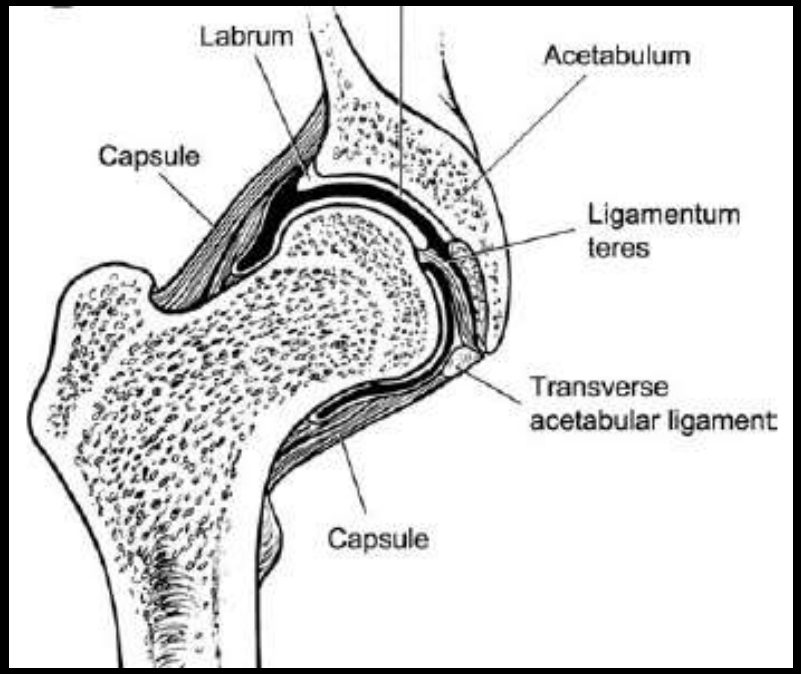
- Covers portion of femoral neck, femoral head articular surface, ligamentum teres
- Intimate with deep fibers of capsular ligaments
- Covers acetabular labrum and fossa



Hip Joint: Capsule

Fibrous capsule

- Circular and longitudinal fibers
- Strongest anteriorly and superiorly
- Attachments:
  - Proximal: acetabular margin (5-6mm above labrum), labrum, transverse ligament
  - Anterior/distal: surrounds femoral neck to trochanteric line
  - Posterior/distal: femoral neck to 1cm above trochanteric crest

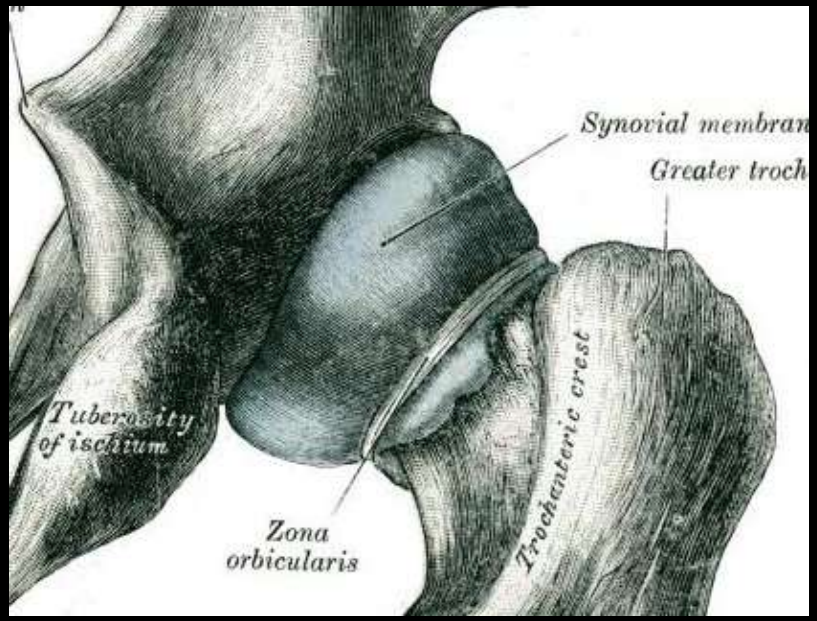


Chatha DS et al. Mag Res Imag Clin N Am 2005;13: 605-15.

Hip Joint: Capsule

Zona orbicularis

- Deep circular fibers of capsule
- Collar about femoral neck
- No connection to bone
- Blends with the more superficial capsular ligaments
- Abundant at inferior and posterior capsule
- Tension at extreme flexion or extension
- Hip stability in distraction[7]
- "femoral arcuate ligament[8,10]"



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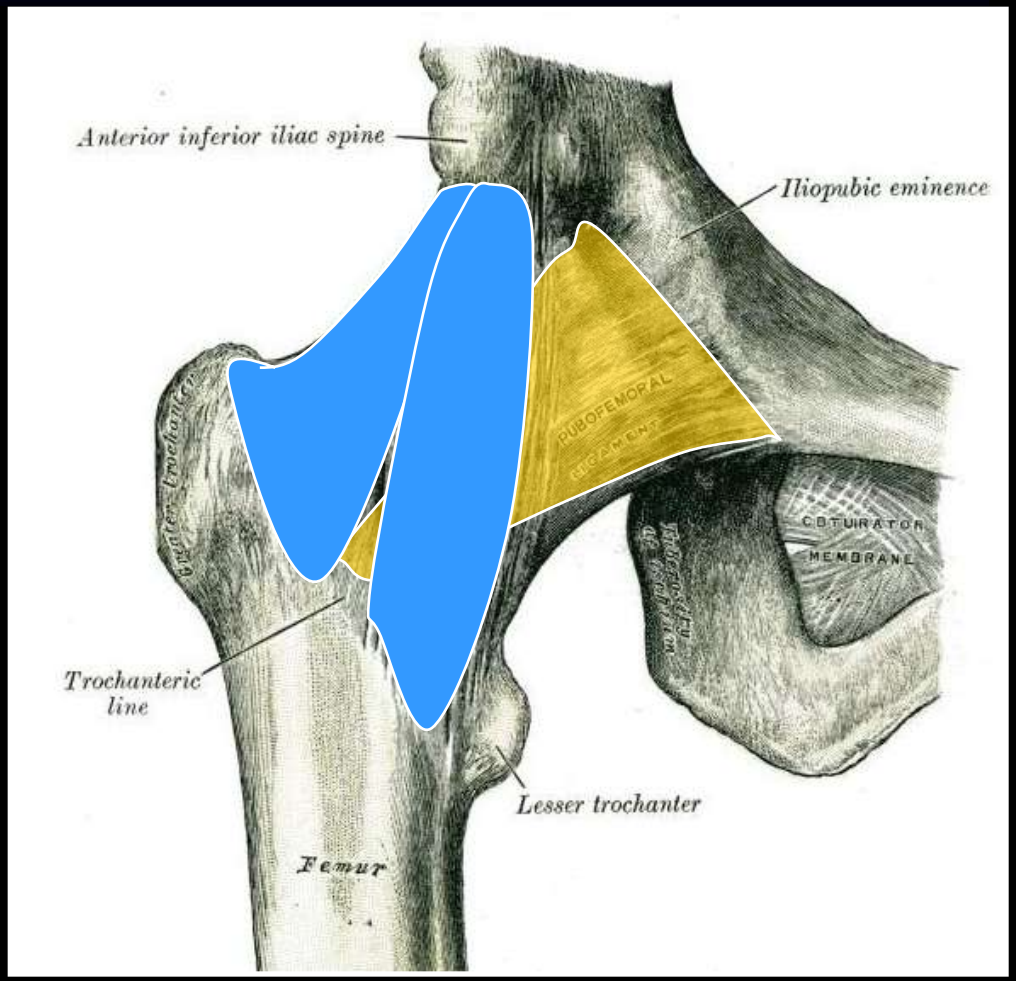
Capsular Ligaments

- Hip joint capsule is intimate with and reinforced by caspular ligaments
- Strongest anteriorly
- **<u>Anterior Ligaments</u>:**
  - **Pubofemoral Ligament**
  - **Iliofemoral Ligament**



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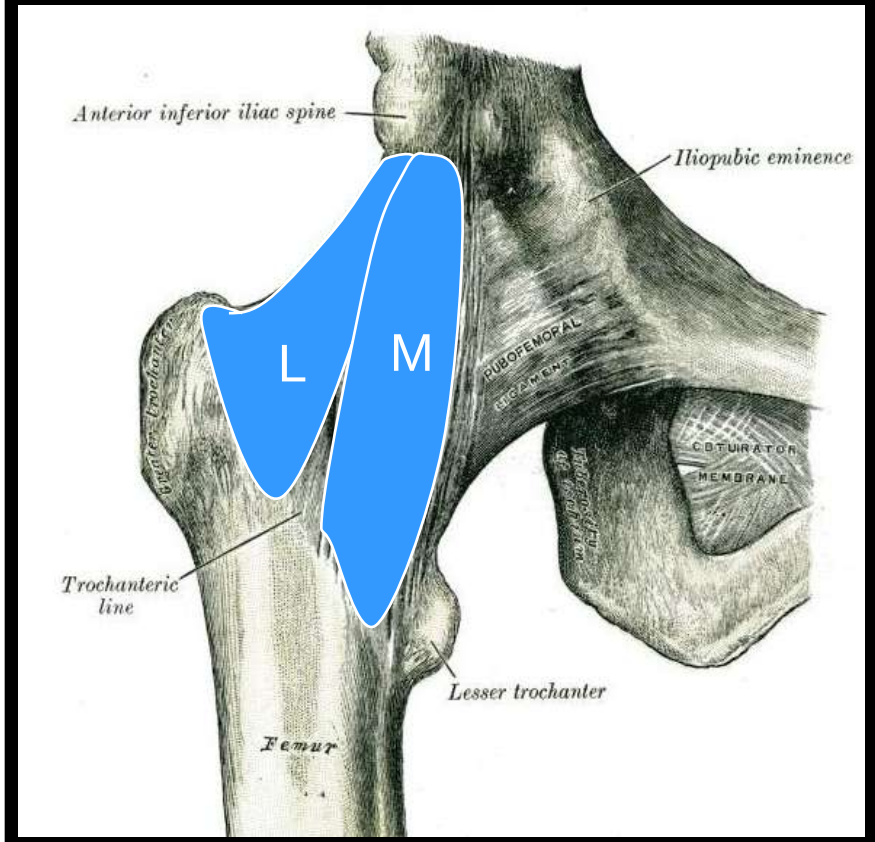
Anterior Capsular Ligaments

- **Iliofemoral Ligament**
  - Ligament of Bigelow
  - Strongest capsular ligament
  - "Y" shaped
    - Apex attached to or near lower portion of anterior inferior iliac spine (AIIS)
    - Base attached along trochanteric line
  - Two bands (majority)
    - Lateral band (L)
    - Medial band (M)
  - Possible 3 bands[8]



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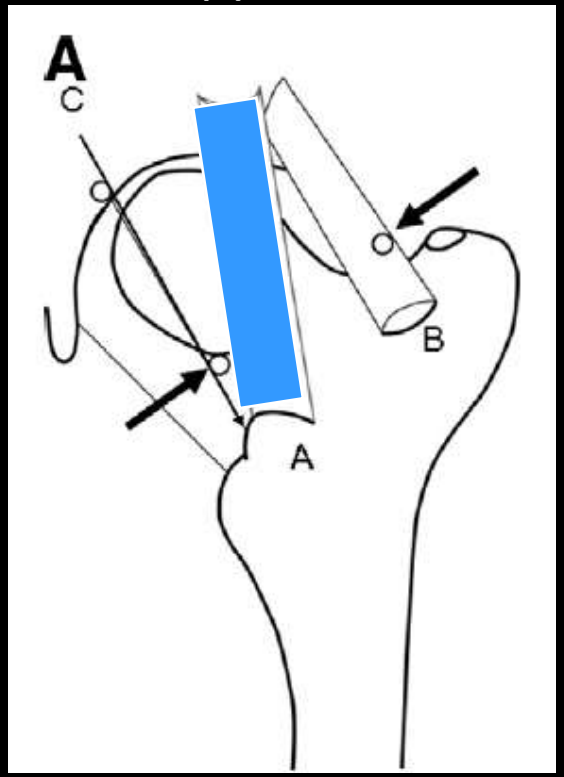
Iliofemoral Ligament

- Main restrictor of external rotation and extension
- **Medial Band (A)**
  - Anatomy
    - Origin: btwn AIIS and acetabular rim
    - Insertion: more distal trochanteric line of femoral neck
    - Almost vertical orientation
  - Function
    - Inhibitor of external rotation, especially in extension

Martin H et al. Arthroscopy 2008; 24(2): 188-195



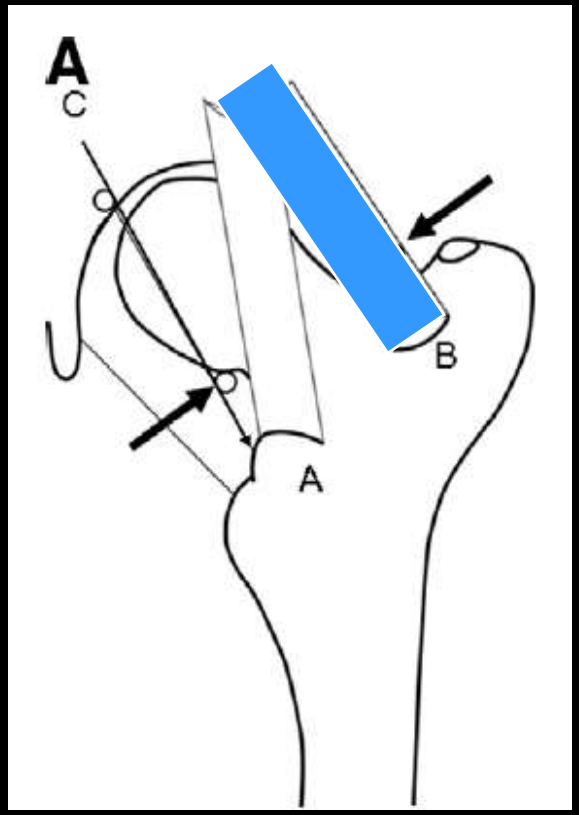
Cadaveric analysis of anatomy and function: Internal and external rotation thru ROM fr 30˚ flexion to 10˚ extension along neutral swing path

Iliofemoral Ligament

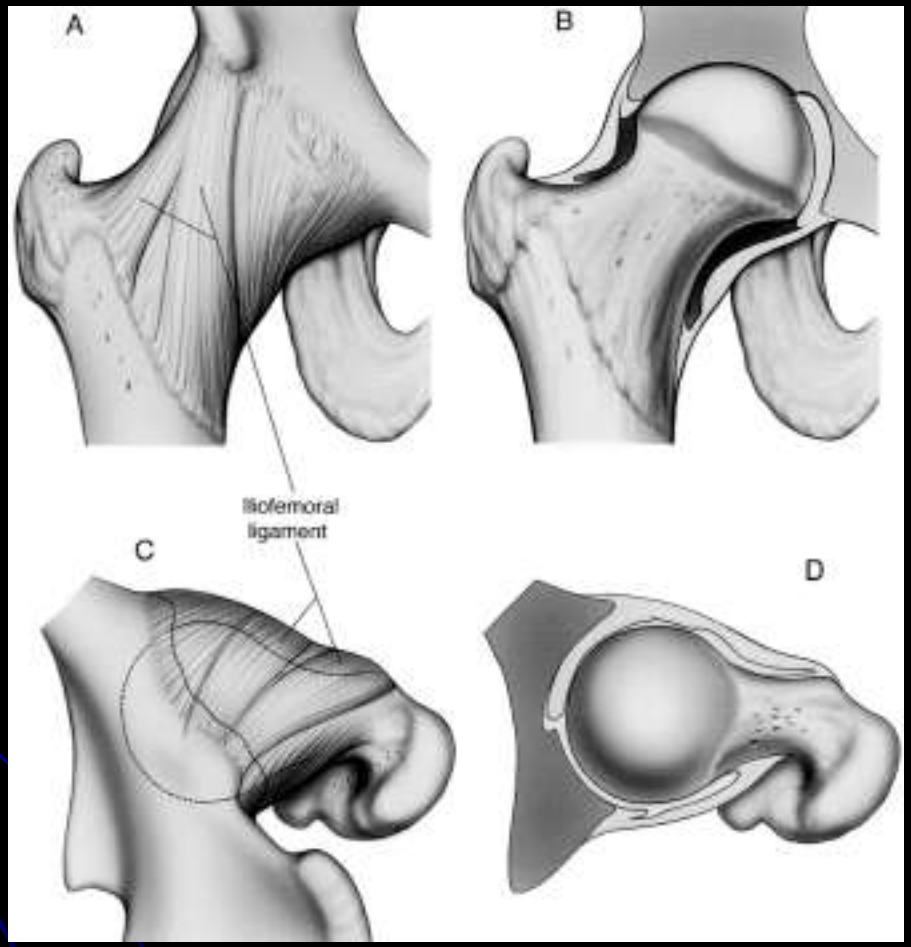
Lateral Band (B)

- Anatomy
  - Origin: AIIS
  - Insertion: superior portion of trochanteric line
  - More horizontal oblique orientation along femoral neck
- Function
  - Main inhibitor of external rotation, along neutral swing
  - Also inhibitor of internal rotation, esp in extension

Martin H et al. Arthroscopy 2008; 24(2): 188-195



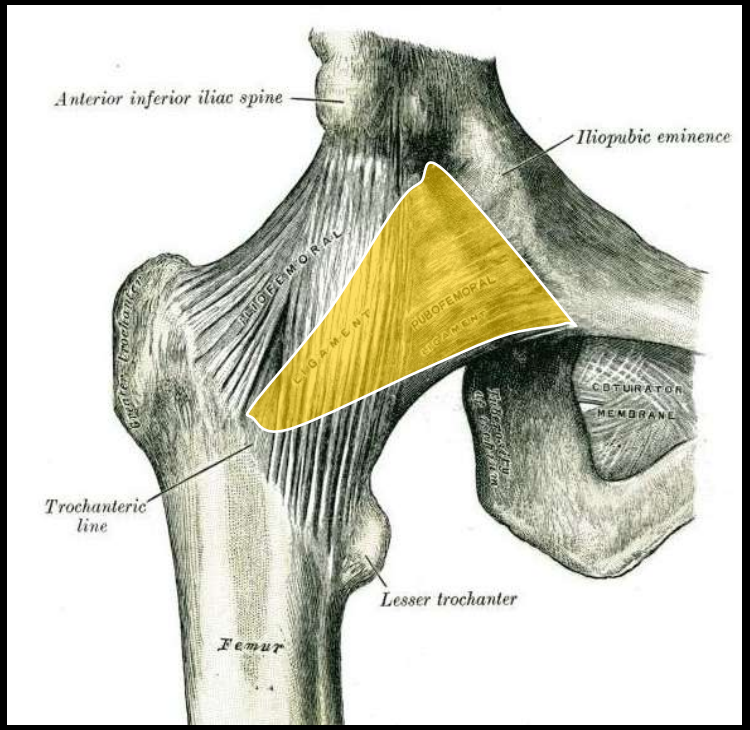
Iliofemoral Ligament



Moorman CT et al. *J Bone Joint Surg Am.* 2003;85:1190-1196.

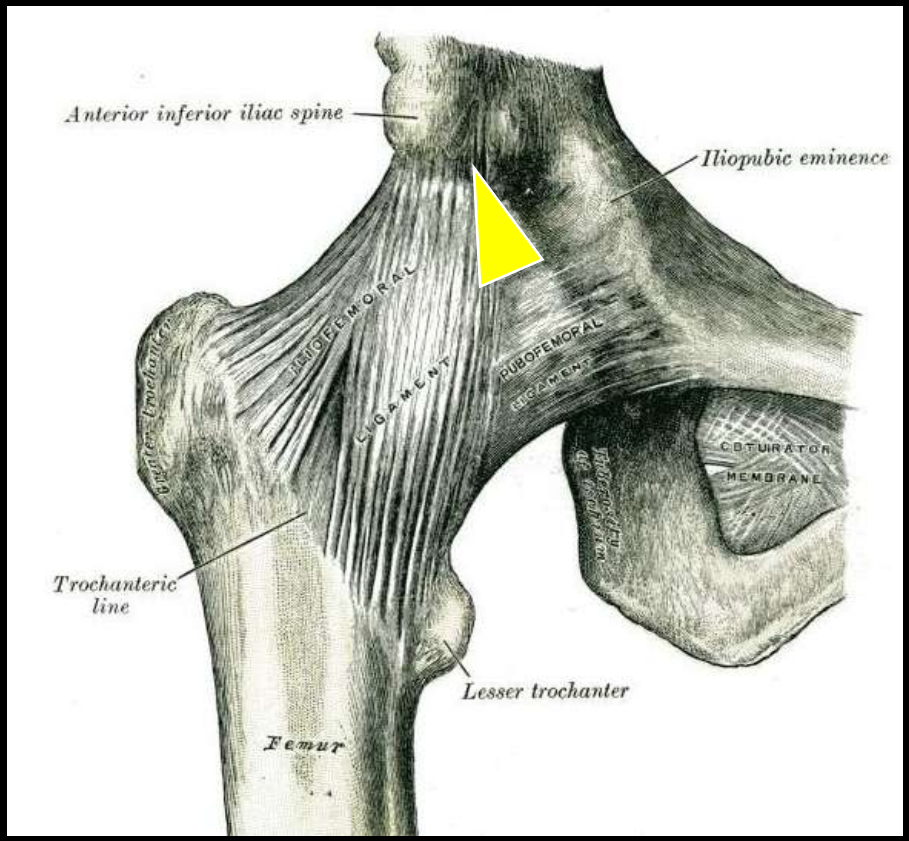
Anterior Capsular Ligaments: Pubofemoral Ligament

- Resembles a sling
- Anatomy[12]
  - Origin: Wide attachment to iliopectineal eminence, superior ramus and obturator crest
  - Insertion: Blends with capsule and deep surface of medial band of iliofemoral ligament. Attaches to femoral neck
- Function[12]
  - Inhibitor of external rotation in extension and abduction



Anterior Capsule: Inherent Weak Area

- Inherent weak area of anterior capsule between the medial band of the iliofemoral ligament and the pubofemoral ligament
- Potential communication between hip joint and iliopsoas bursa



Posterior Capsular Ischiofemoral Ligament

Anatomy[12]

- Origin: Ischial portion of acetabular rim and extends superolaterally as 2 bands
- Superior Band
  - Spirals across posterior femoral neck, blends with zona orbicularis
  - Inserts medial to anterosuperior base of greater trochanter
- Inferior Band
  - Crosses posterior femoral neck
  - Inserts medial to base of greater trochanter along posterior trochanteric crest

Function[12]: Inhibitor of external rotation in extension

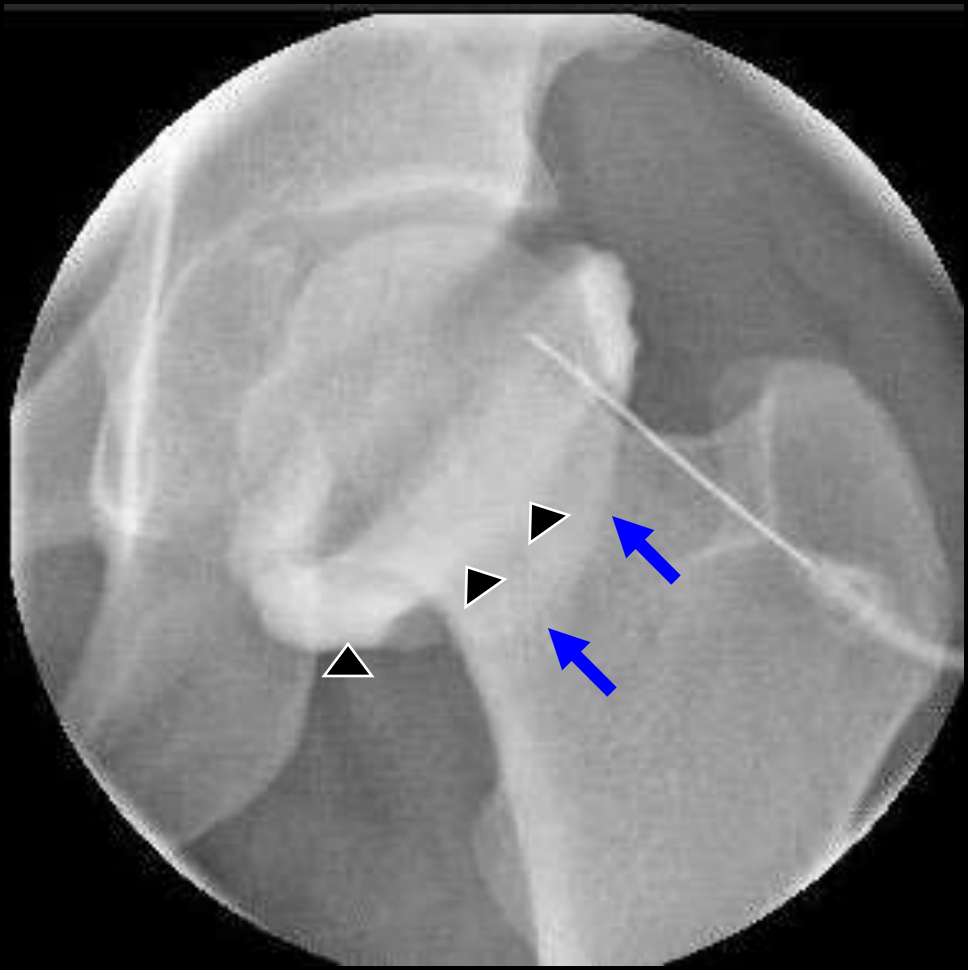
Capsule: Normal Arthrogram

Anterior Joint Capsule

- Blue arrows
- Extends to trochanteric line

Posterior Joint Capsule

- Black arrowheads
- More medial and proximal than anterior joint capsule

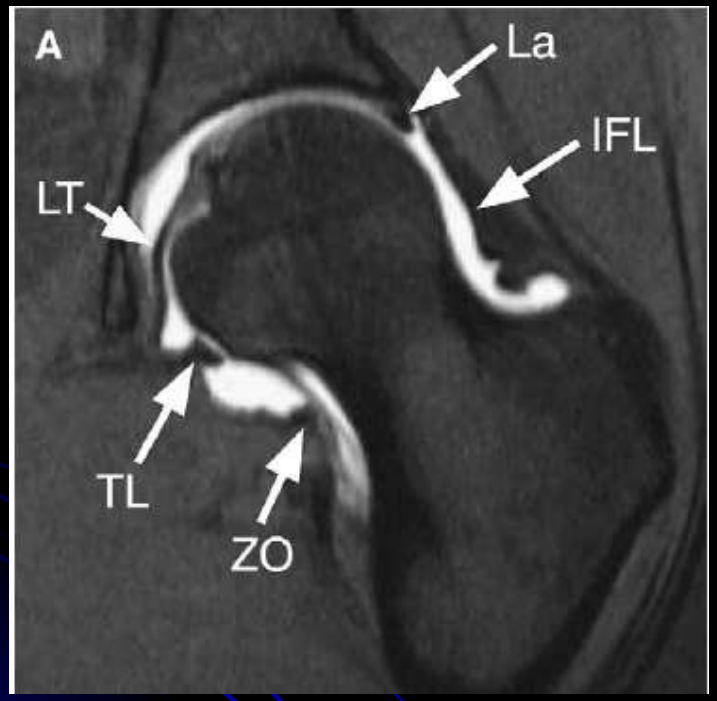


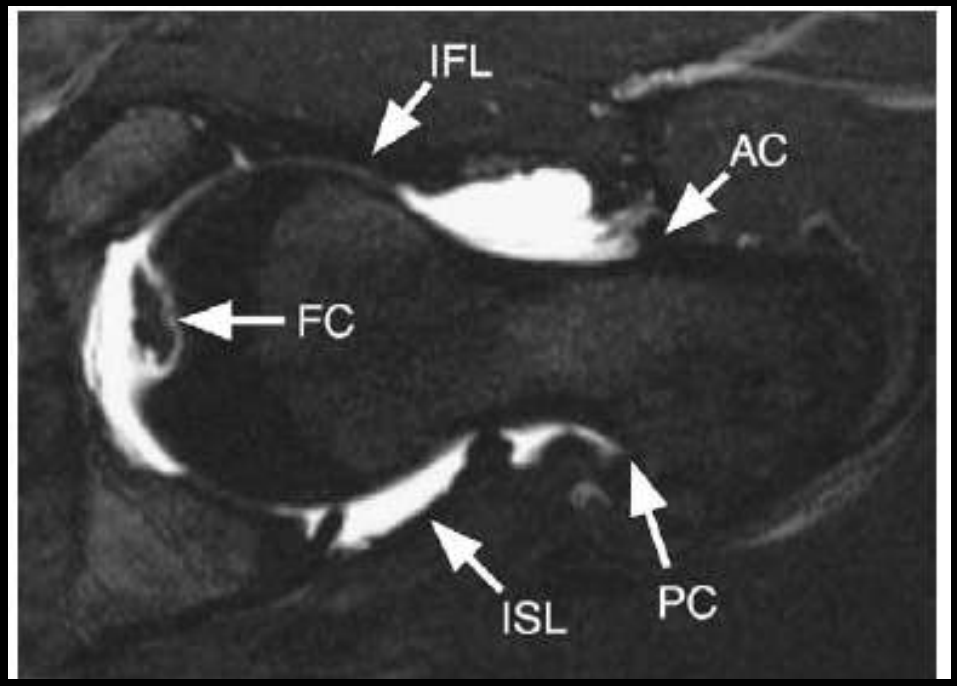
UCSD/VASD MRA Protocol

- Surface coil to maximize signal-to-noise ratio
- MR arthrogram is indicated to evaluate hip articular anatomy and pathology
- Fluoro-guided intraarticular injection of 1:200 dilution of Magnevist, about 10ml
- Unilateral hip with small FOV=18 cm, slice thickness=5mm
- Image matrix size=320x224 xc sag plane 256x224
- T1W-fat sat (TR 600 msec/TE 14 msec): all 3 planes
- T2W-fat sat (TR 3000 msec/TE 90 msec): coronal plane
- PD (TR 3000 msec/TE 30 msec): axial oblique plane

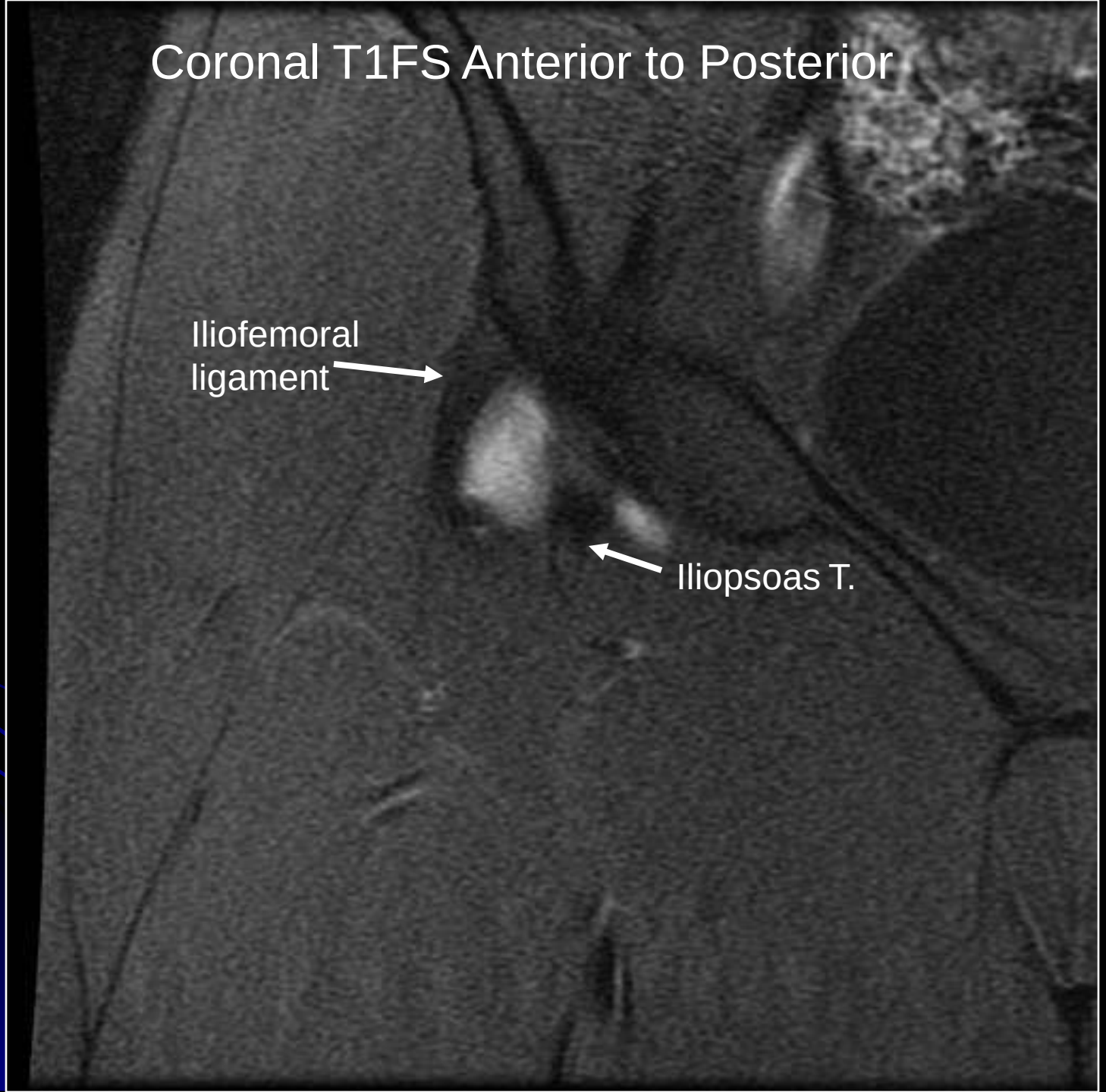
Hong R, Hughes T, Gentili A, Chung C. J of Mag Res Imag 2008;27:435

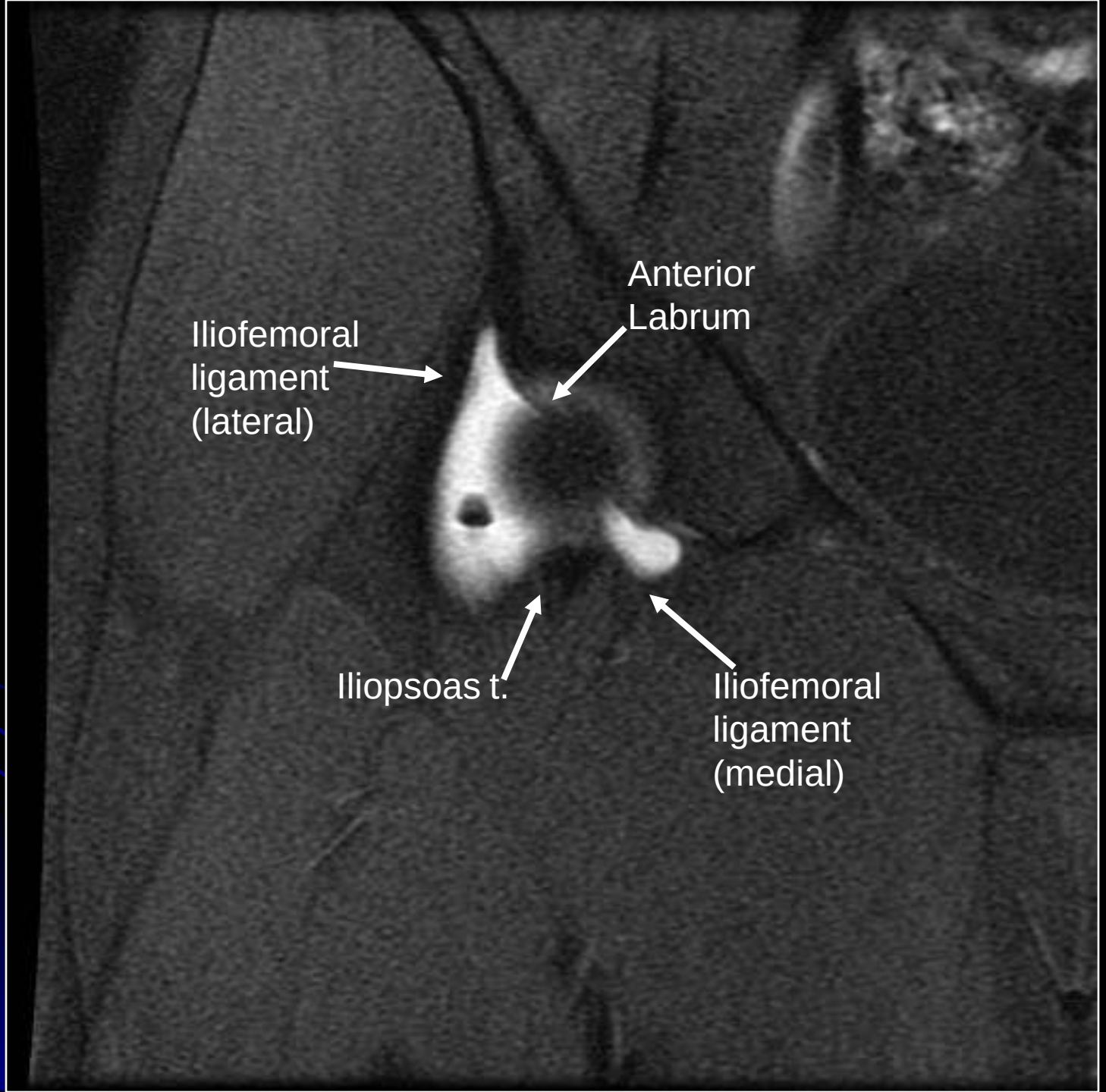
Hip Joint: Normal MR Anatomy

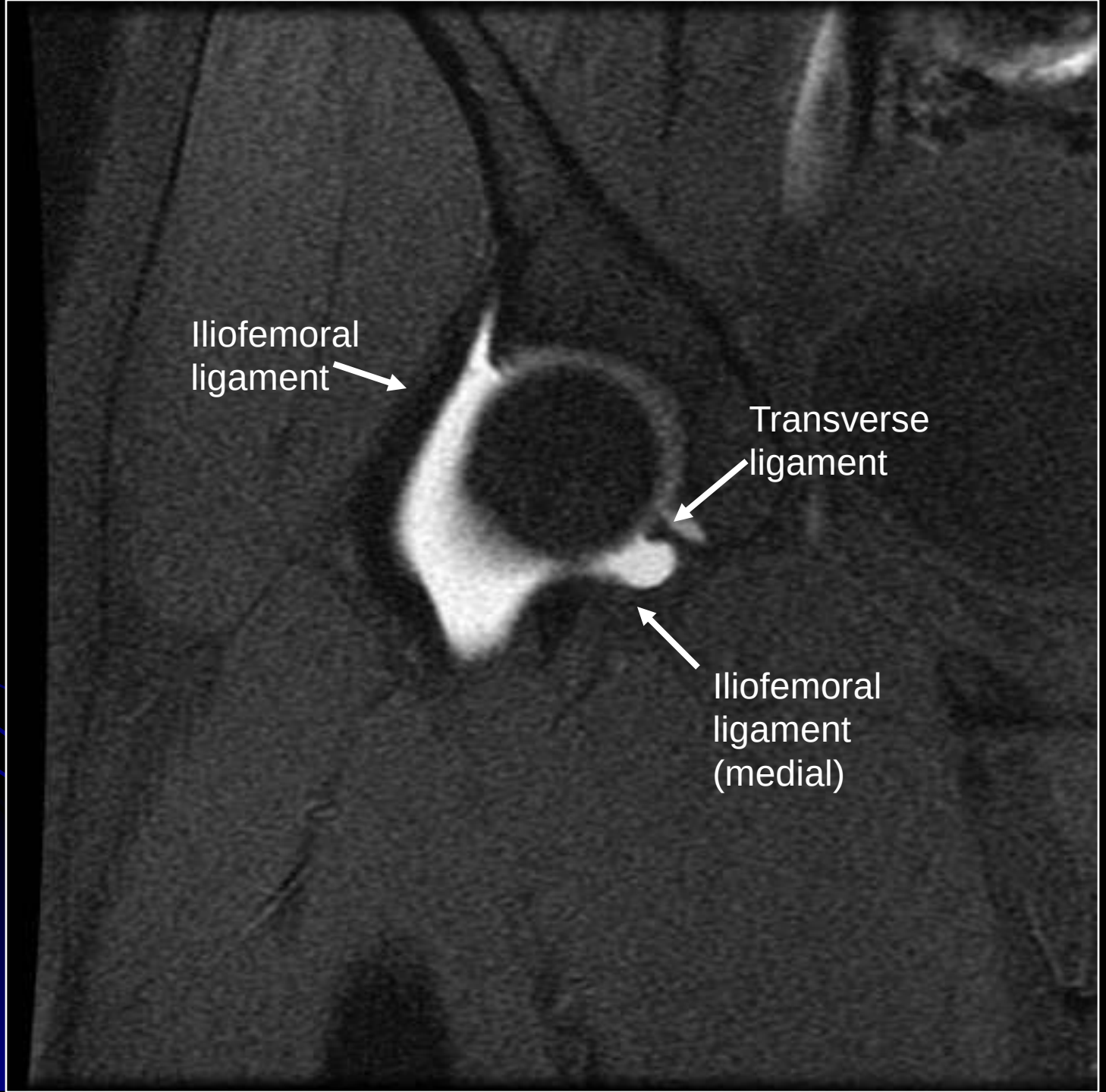


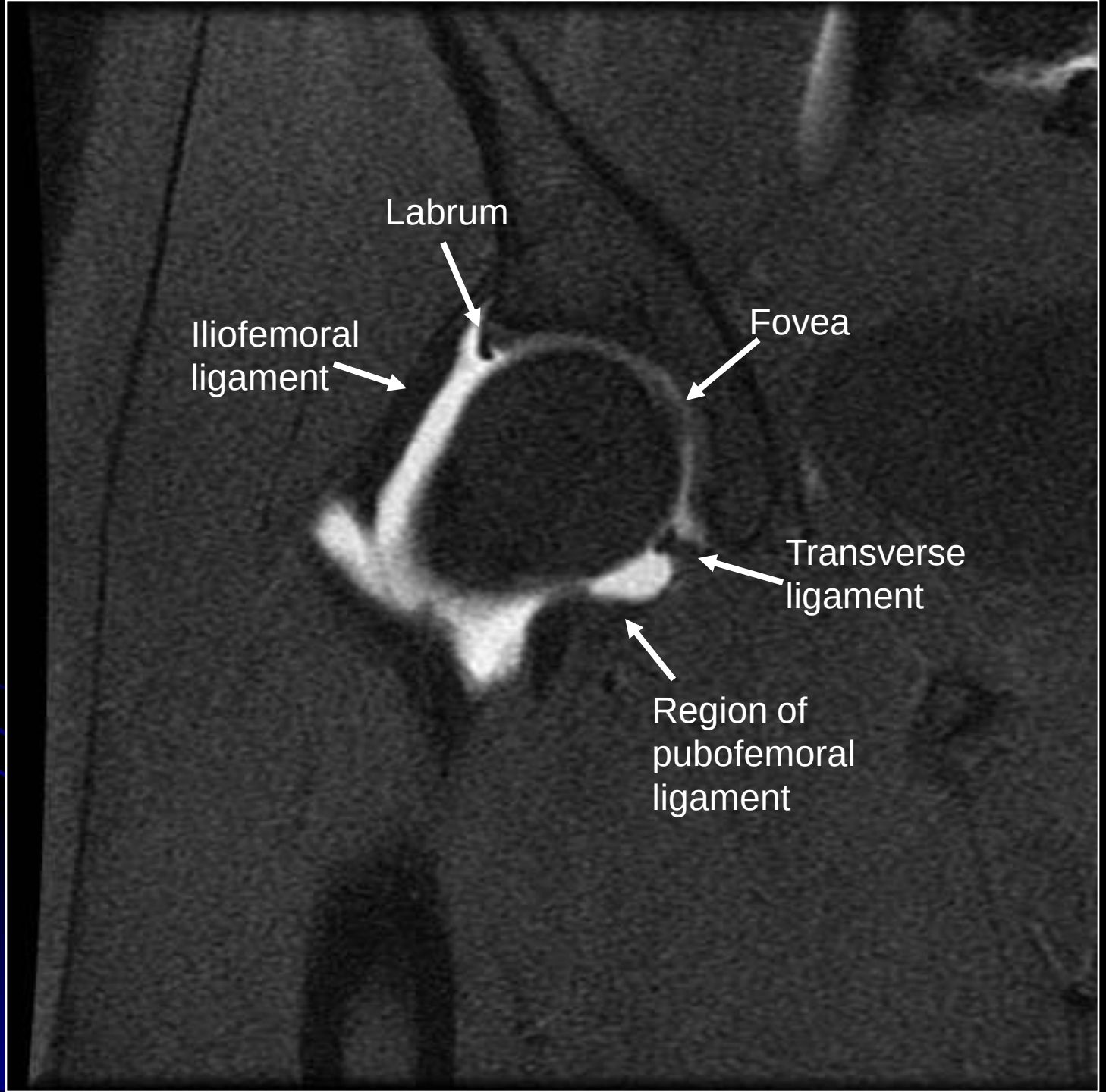


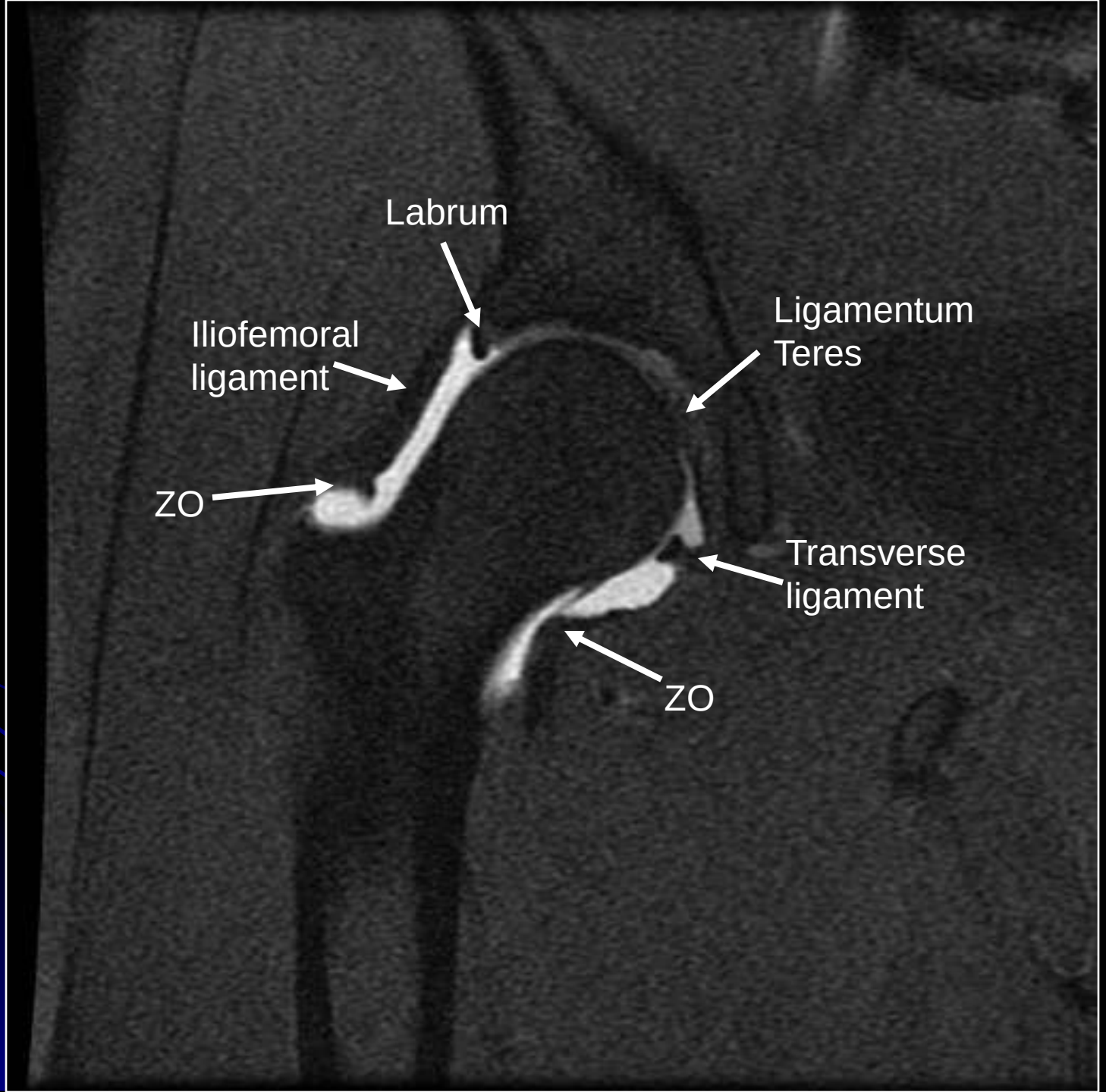
Chatha DS et al. MR Imaging of Normal Hip. MRI Clin N Am 2005;13: 605-15.

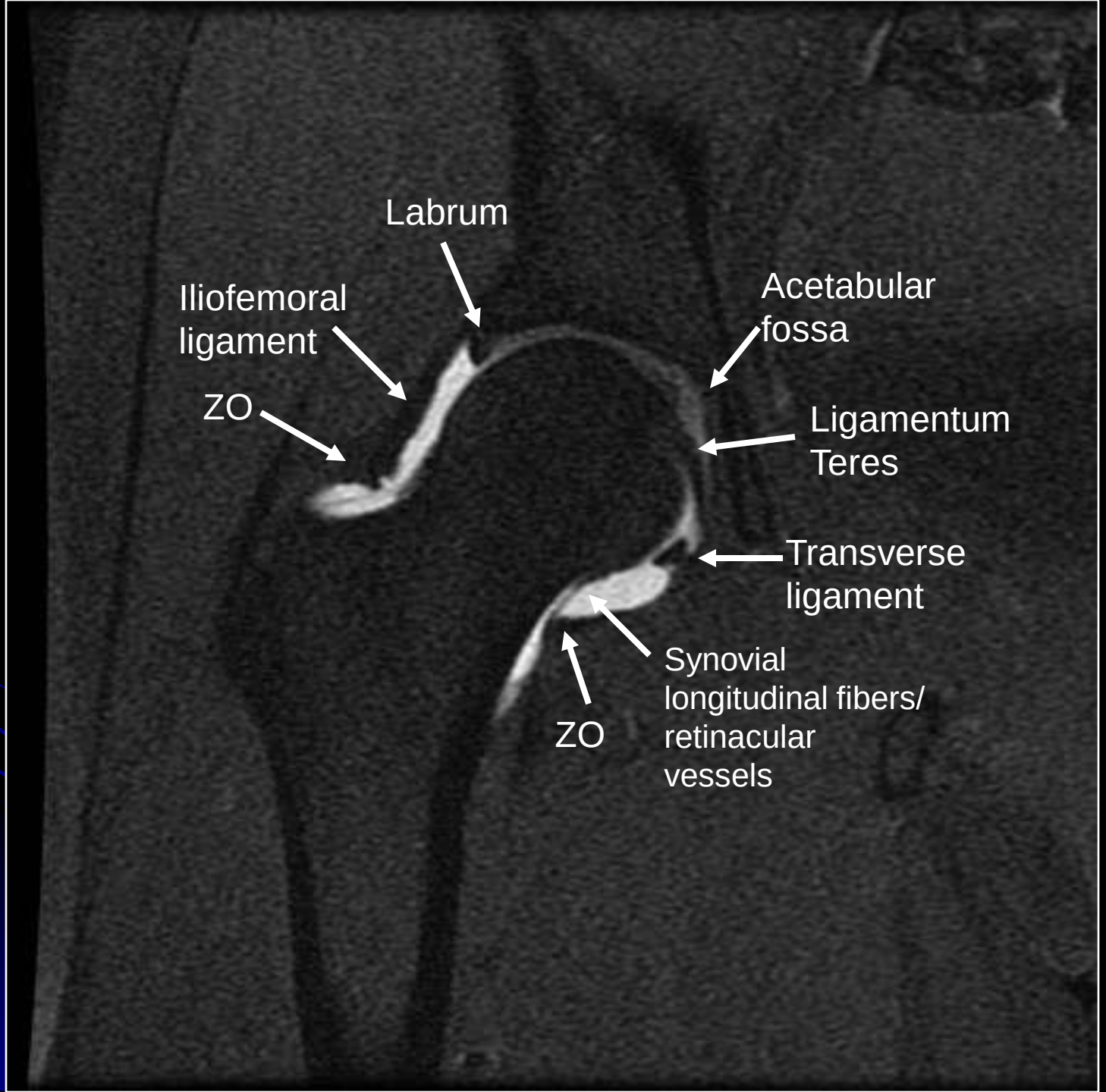

Coronal T1FS Anterior to Posterior
Iliofemoral ligament
Iliopsoas T.

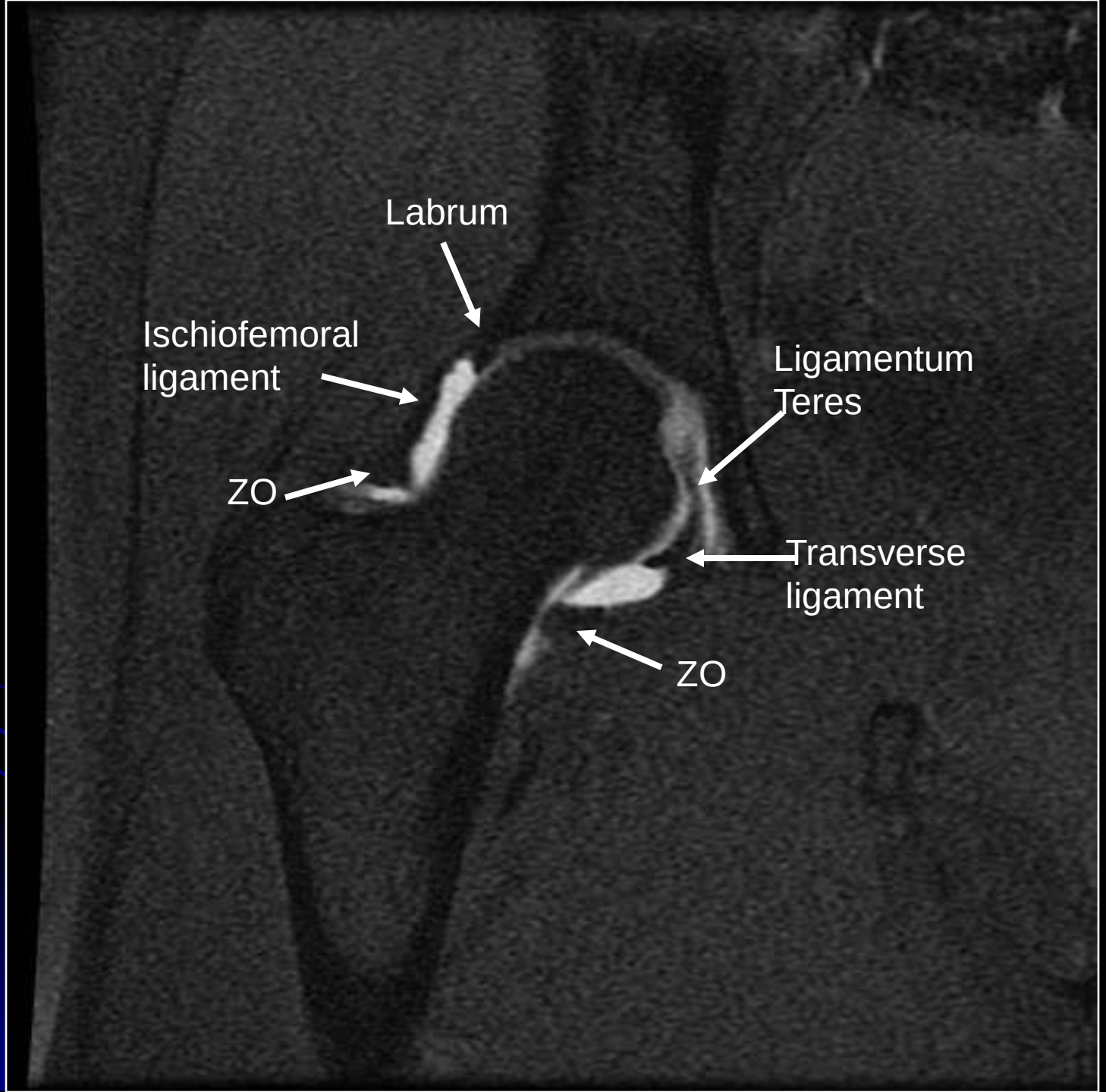

Anterior
Labrum
Iliofemoral
ligament
(lateral)
Iliopsoas t.
Iliofemoral
ligament
(medial)

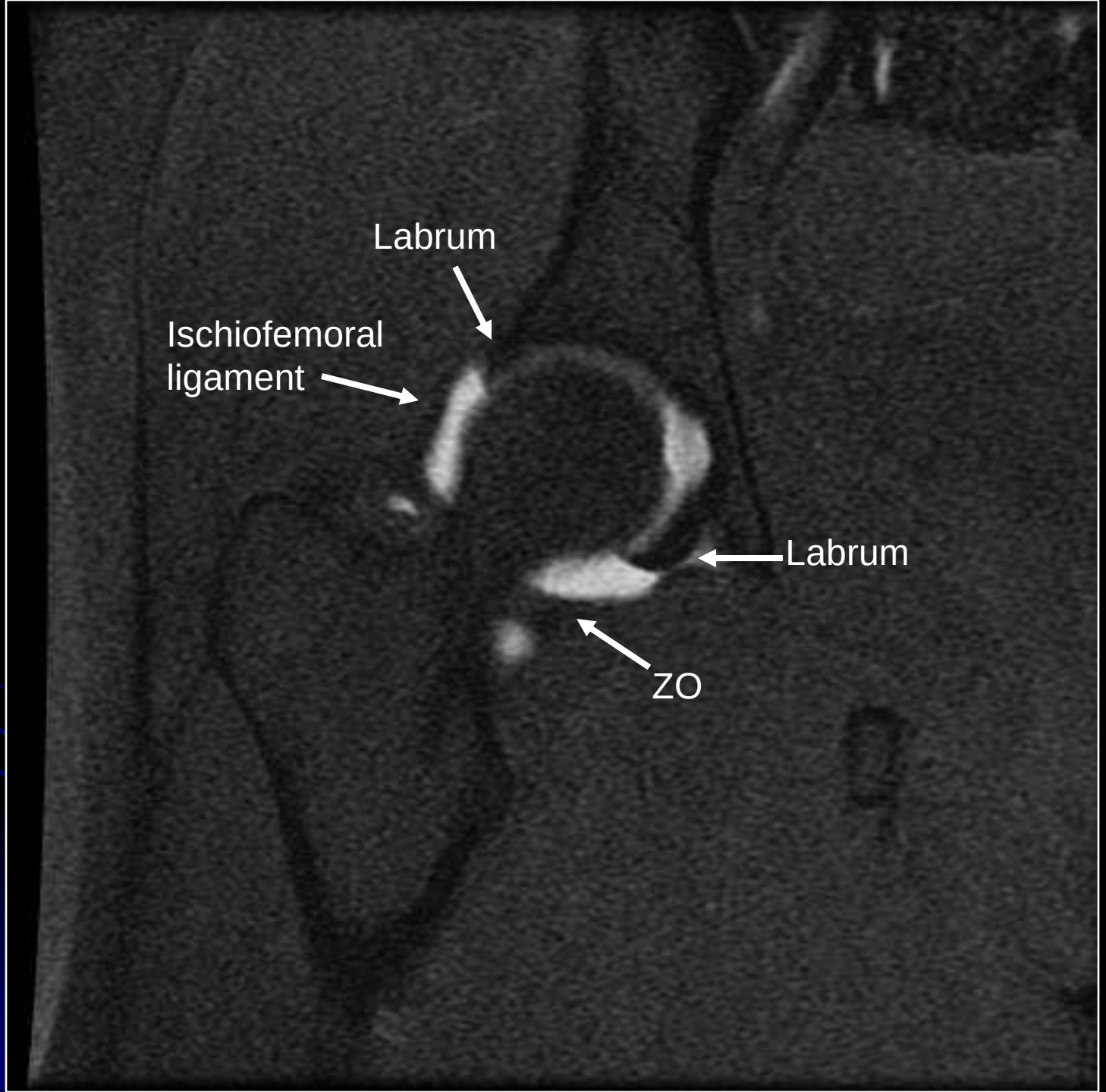

Iliofemoral ligament
Transverse ligament
Iliofemoral ligament (medial)

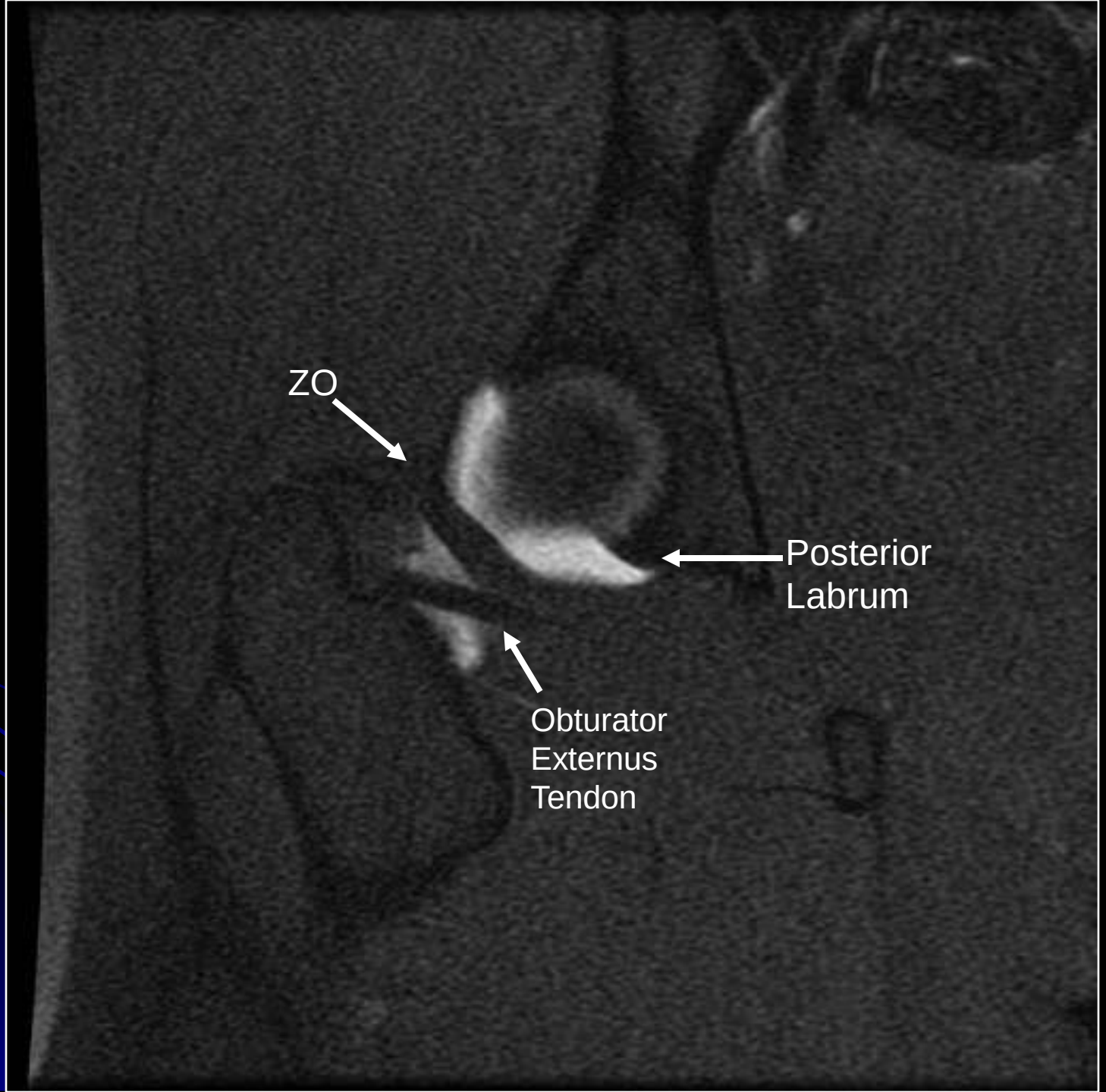

Labrum
Iliofemoral ligament
Fovea
Transverse ligament
Region of pubofemoral ligament

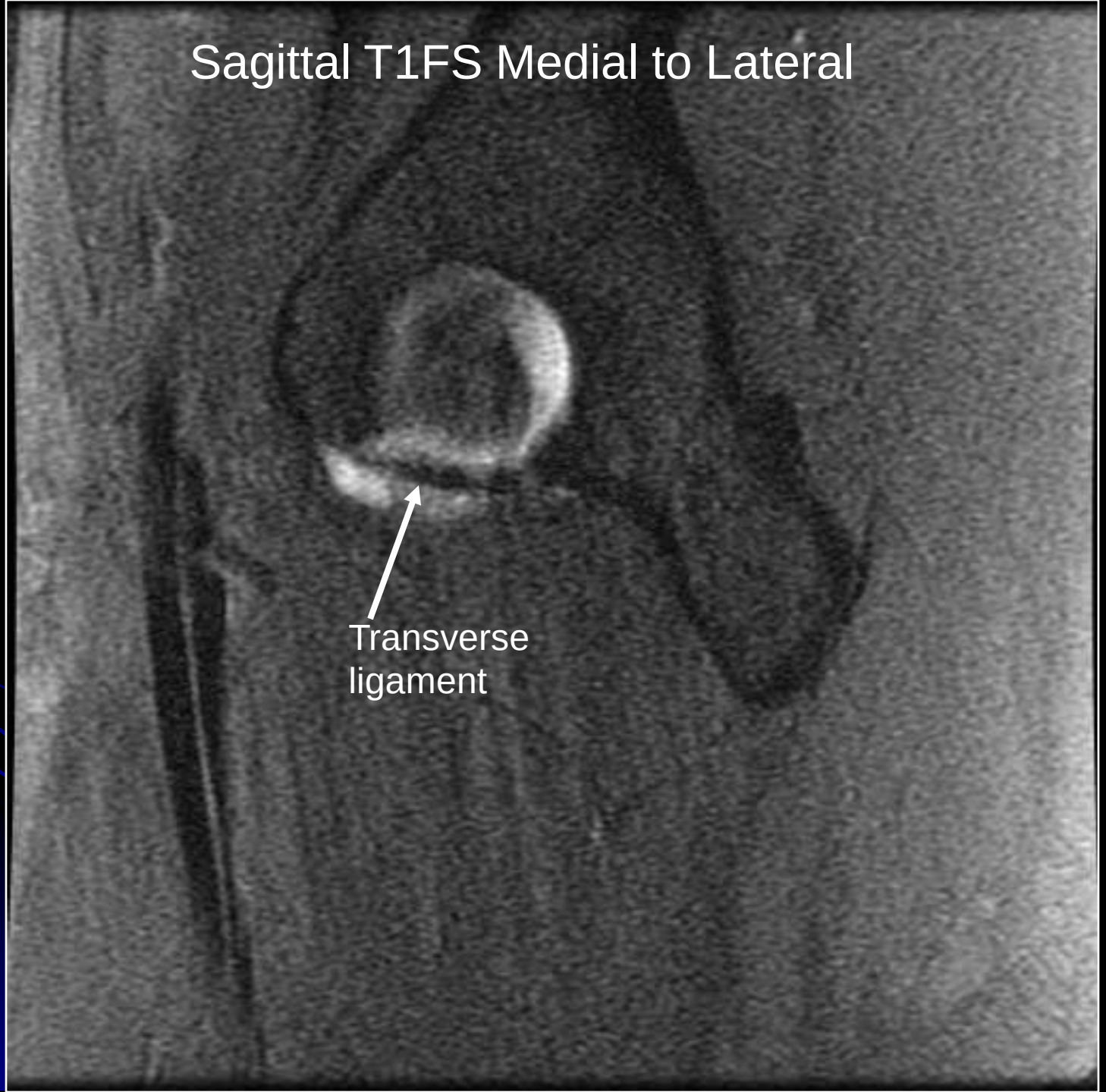

Labrum
Iliofemoral ligament
Ligamentum Teres
ZO
Transverse ligament
ZO


Labrum
Iliofemoral ligament
ZO
Acetabular fossa
Ligamentum Teres
Transverse ligament
Synovial longitudinal fibers/ retinacular vessels
ZO


Labrum
Ischiofemoral ligament
Ligamentum Teres
ZO
Transverse ligament
ZO


Labrum
Ischiofemoral ligament
Labrum
ZO

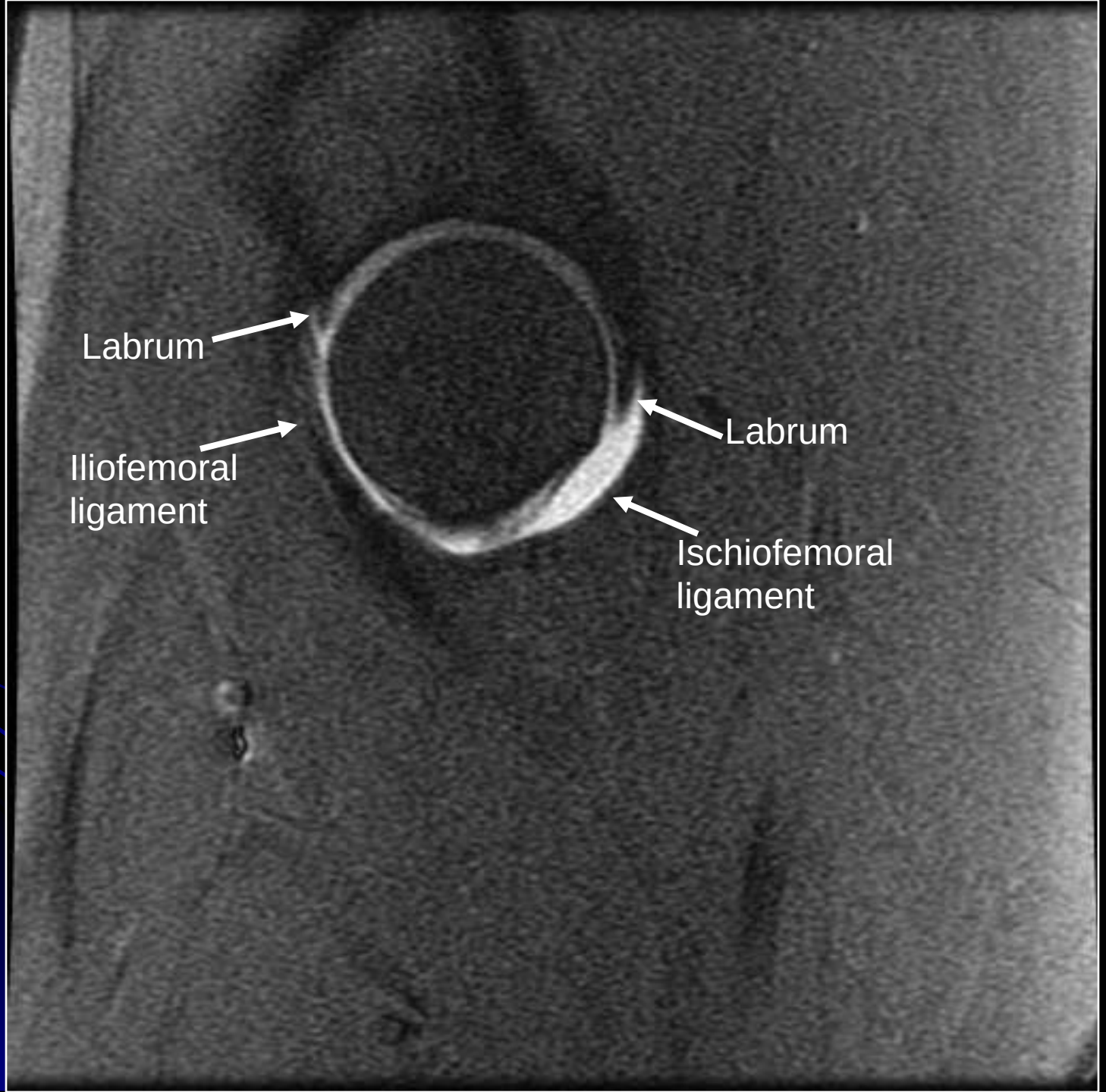

ZO
Posterior
Labrum
Obturator
Externus
Tendon


Sagittal T1FS Medial to Lateral
Transverse ligament


Transverse
ligament

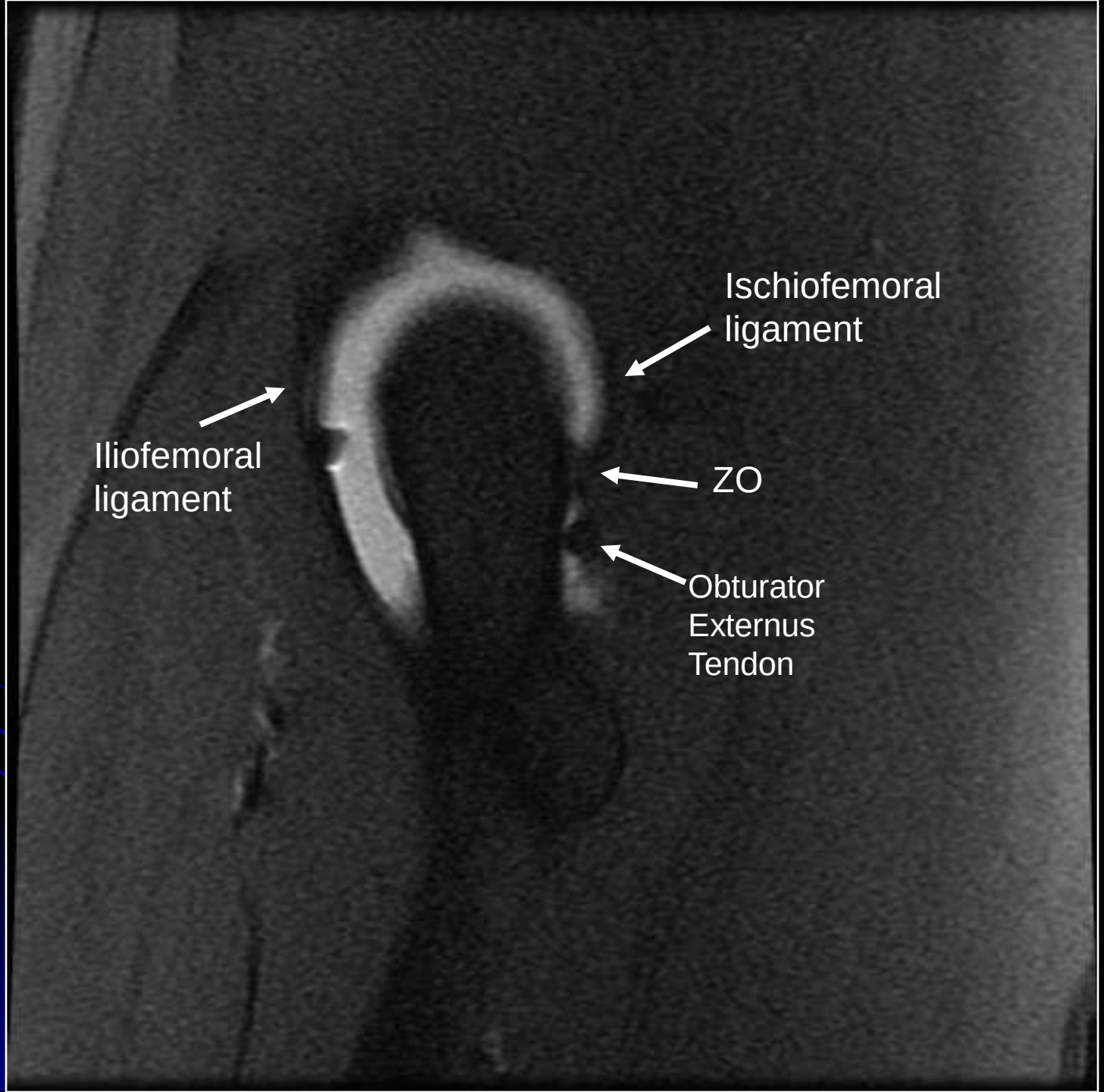

Iliopsoas t.
Labrum
Labrum

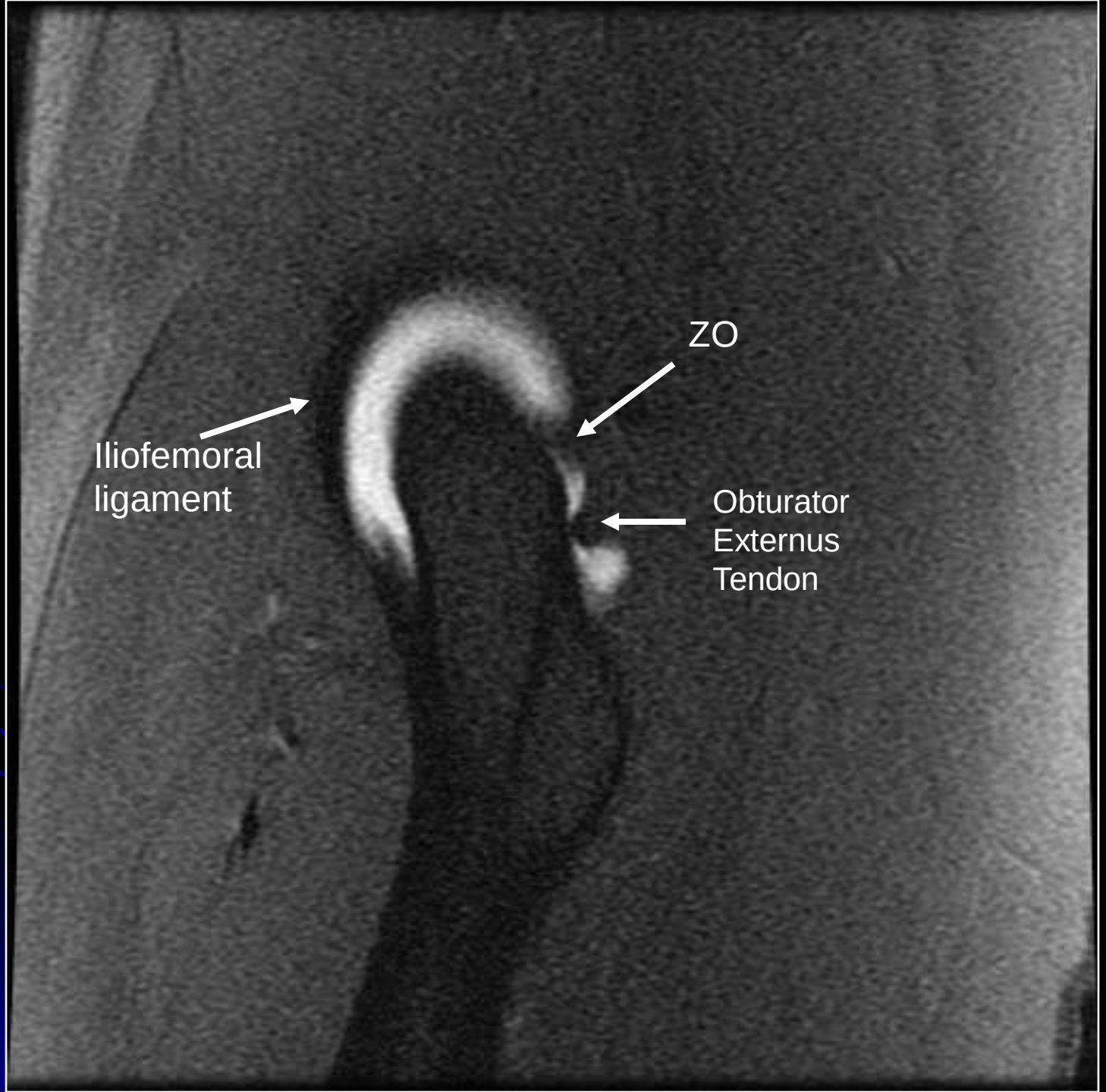

Labrum
Iliopsoas t.
Labrum

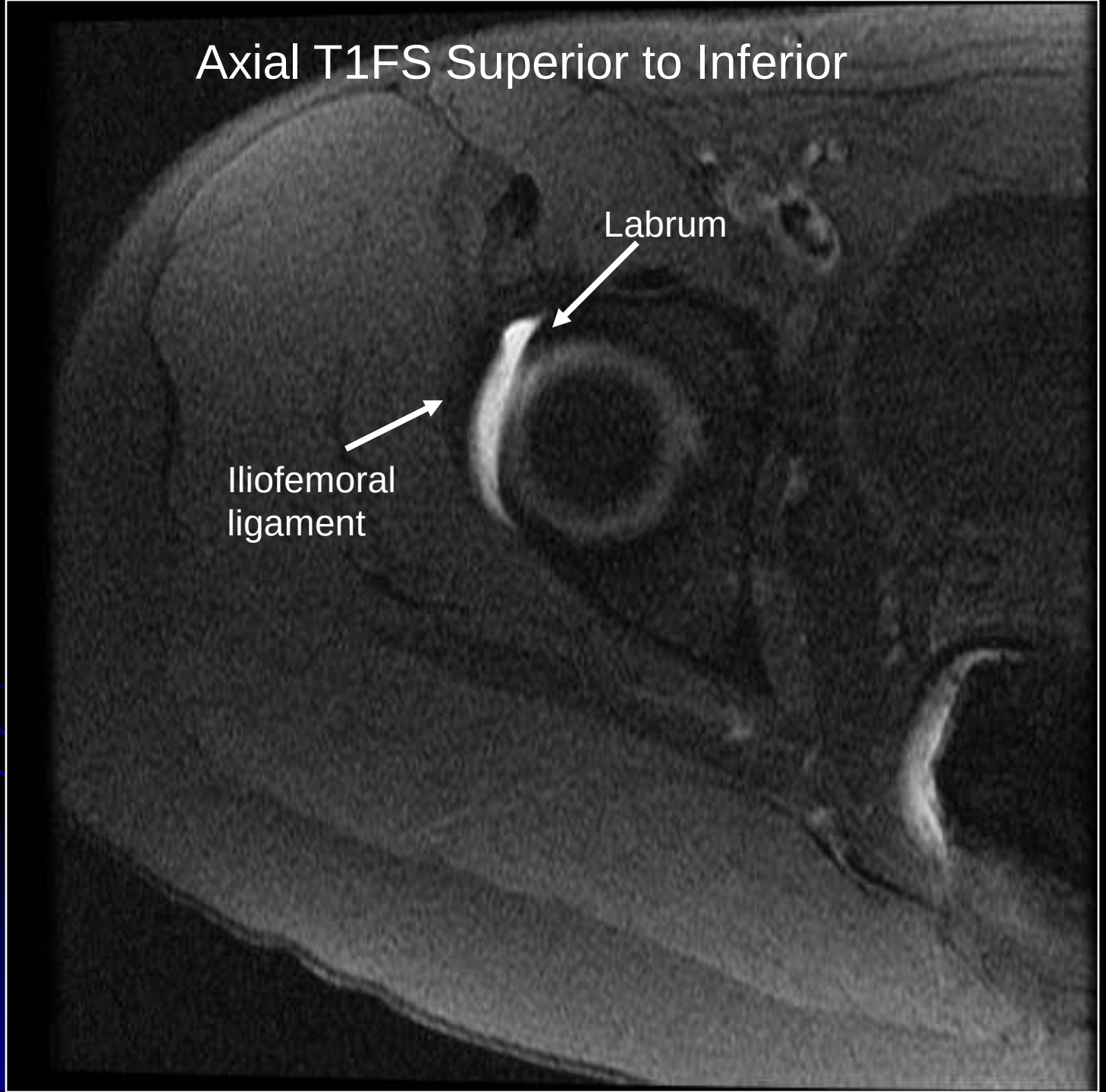

Labrum
Iliofemoral ligament
Labrum
Ischiofemoral ligament

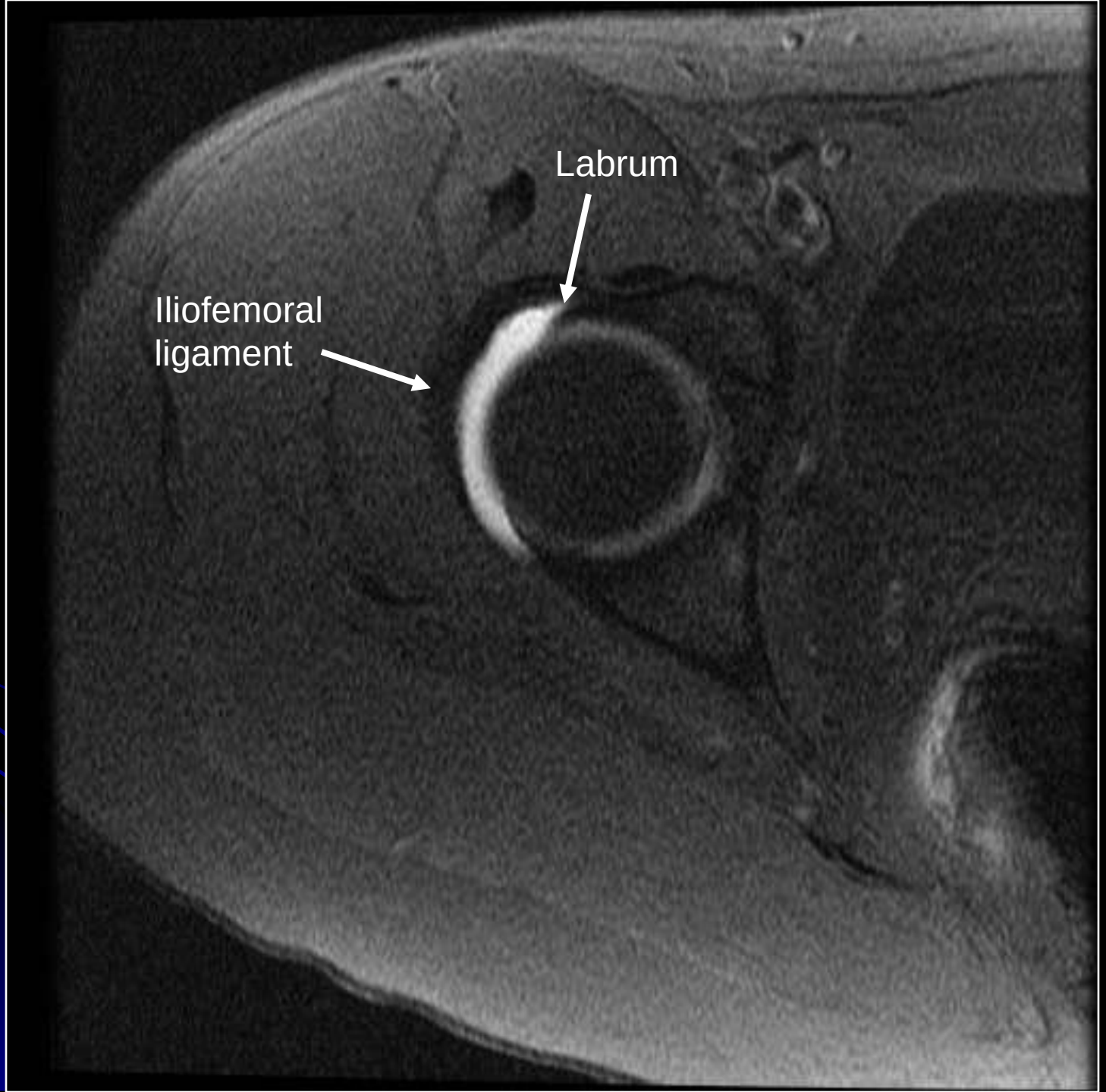

Iliofemoral ligament
Ischiofemoral ligament

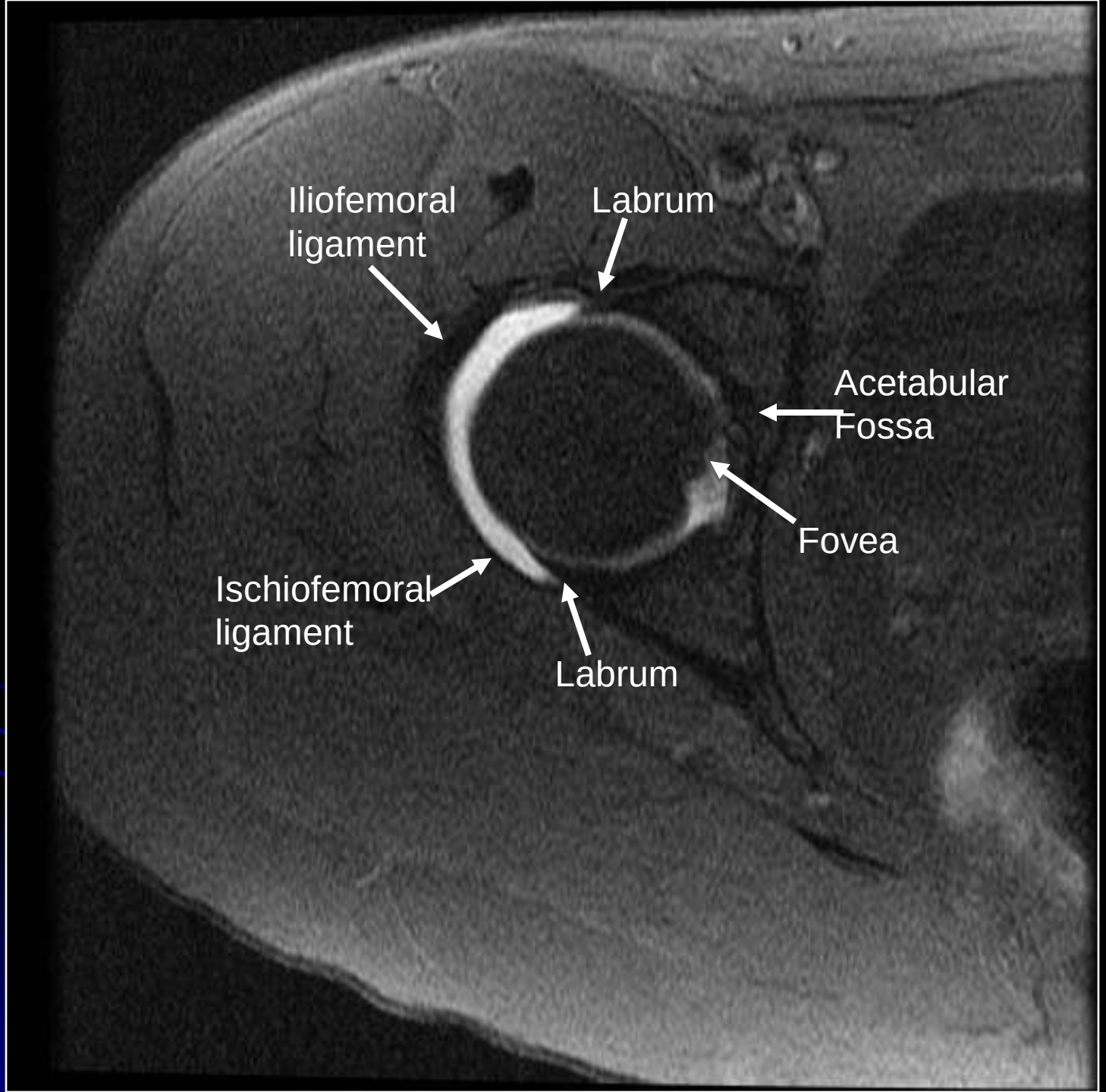

Iliofemoral ligament
Ischiofemoral ligament
ZO

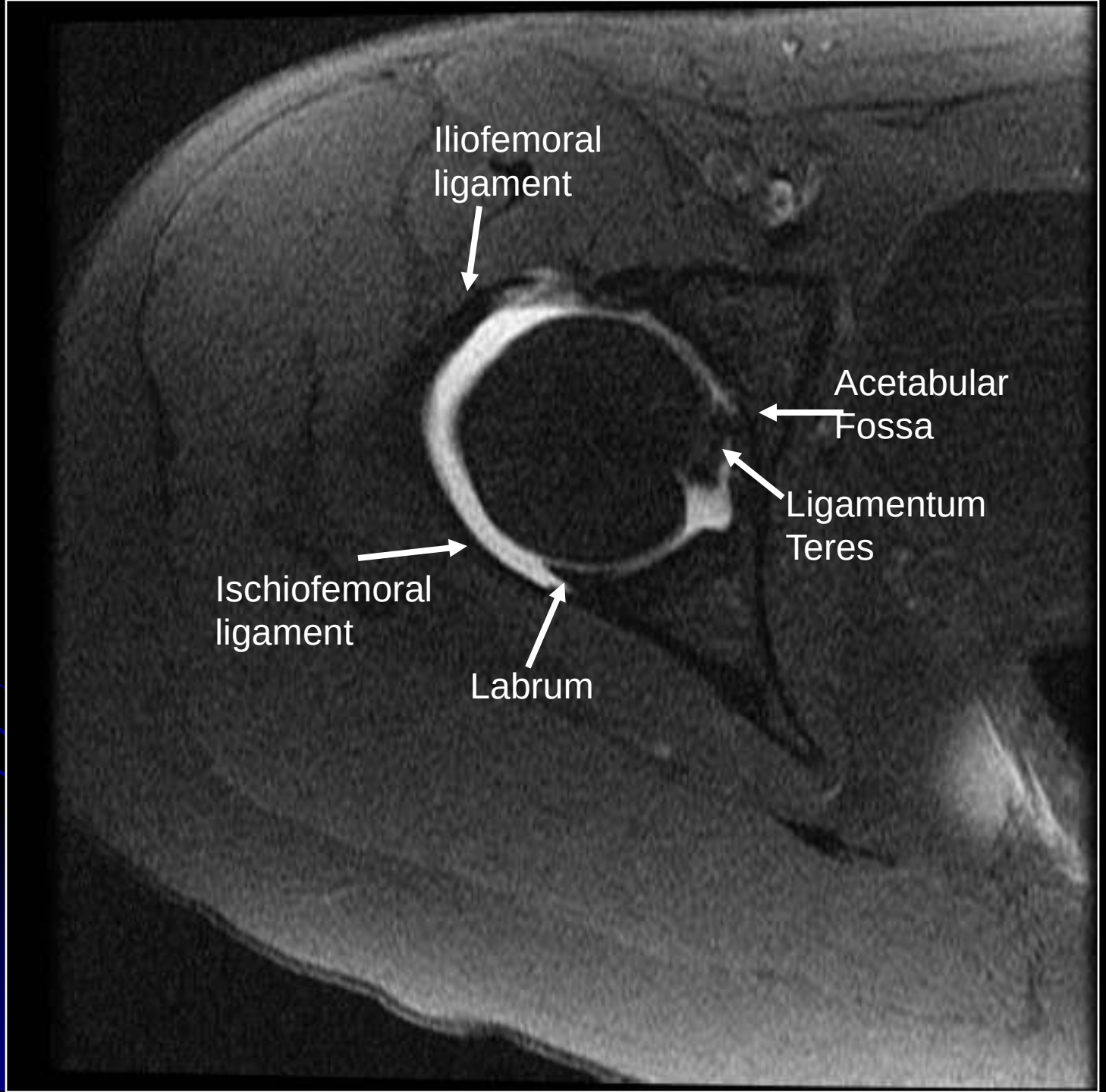

Ischiofemoral ligament
Iliofemoral ligament
ZO
Obturator Externus Tendon

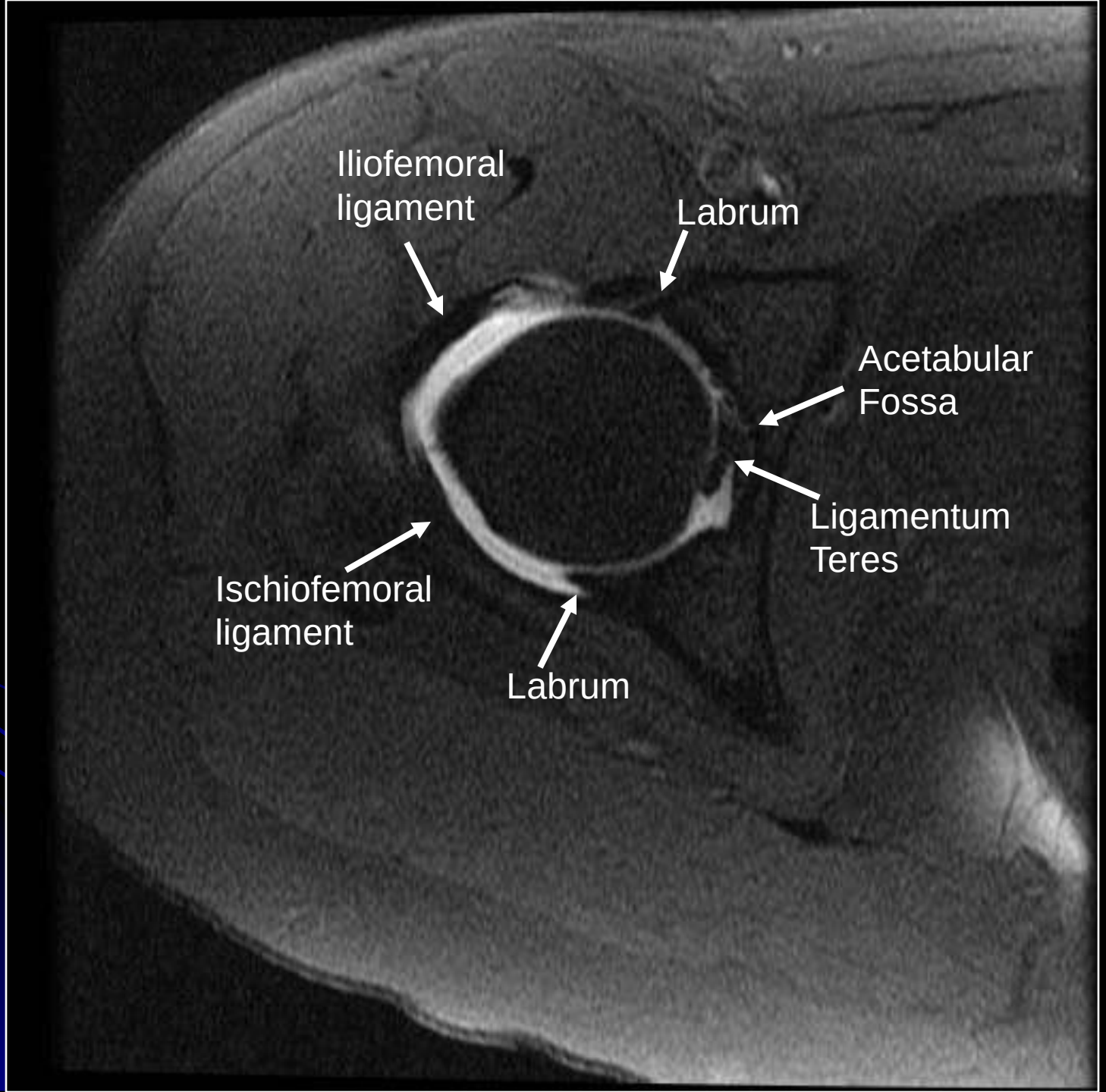

ZO
Iliofemoral ligament
Obturator Externus Tendon

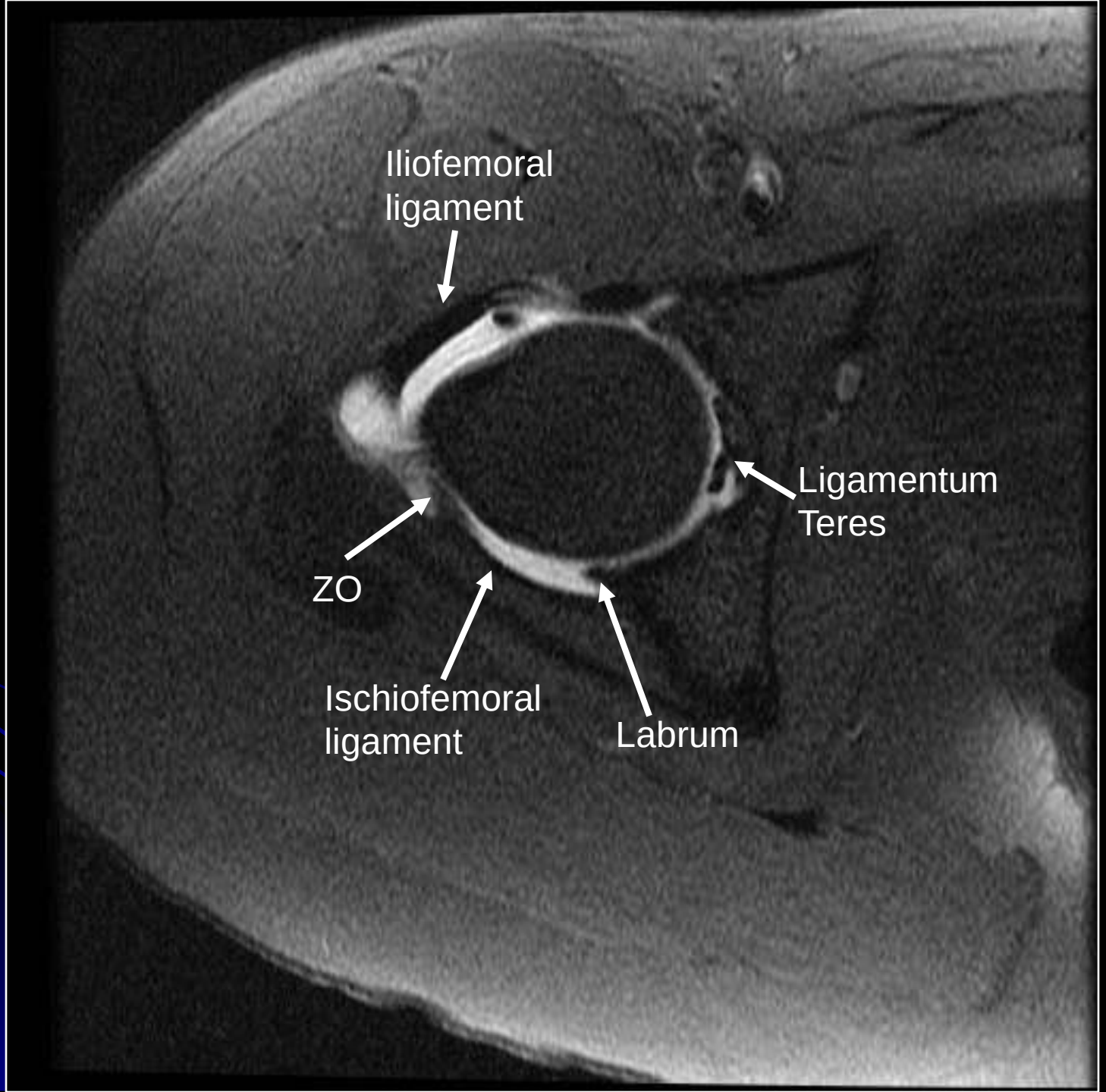

Axial T1FS Superior to Inferior
Labrum
Iliofemoral ligament

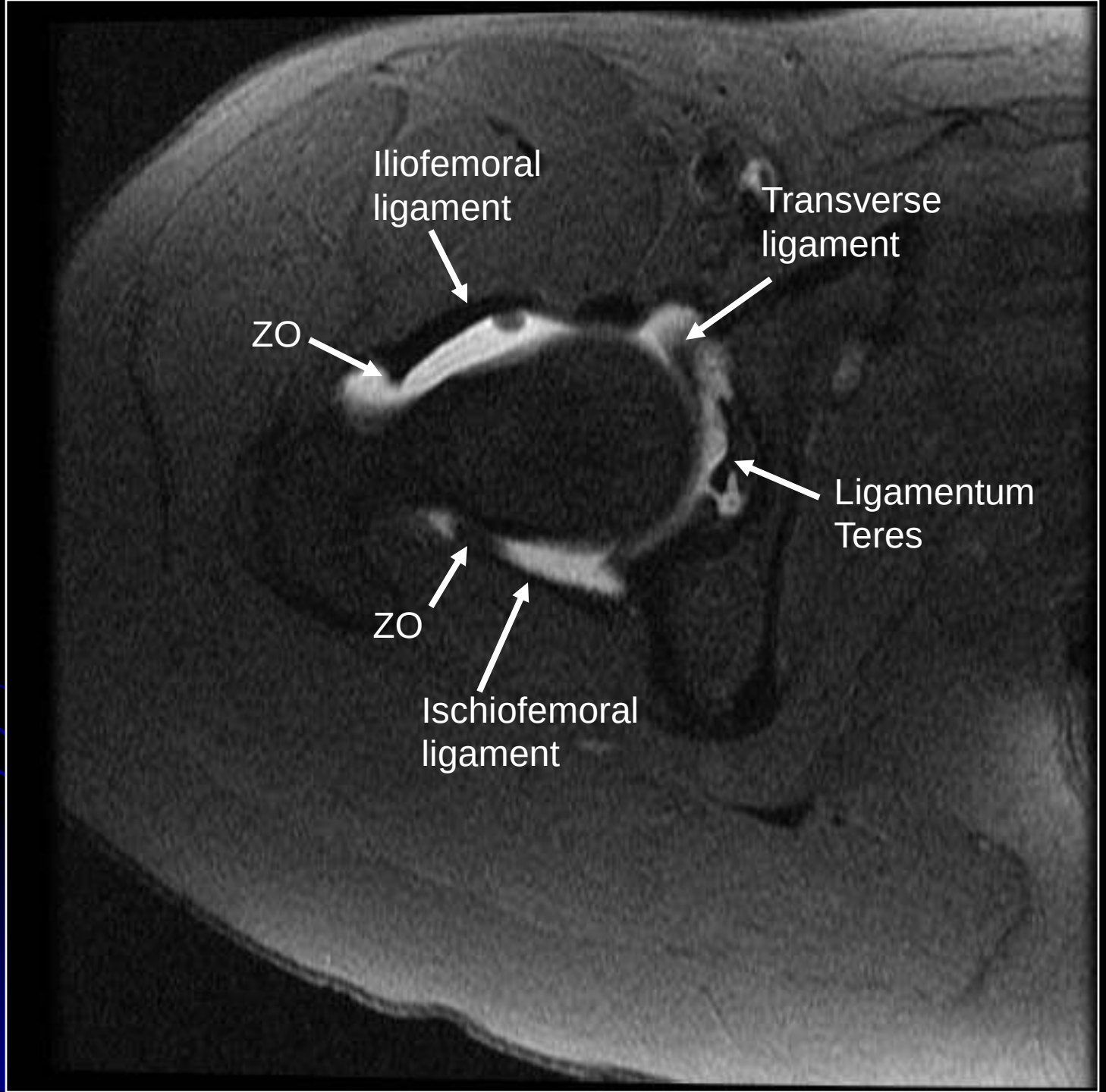

Labrum
Iliofemoral
ligament

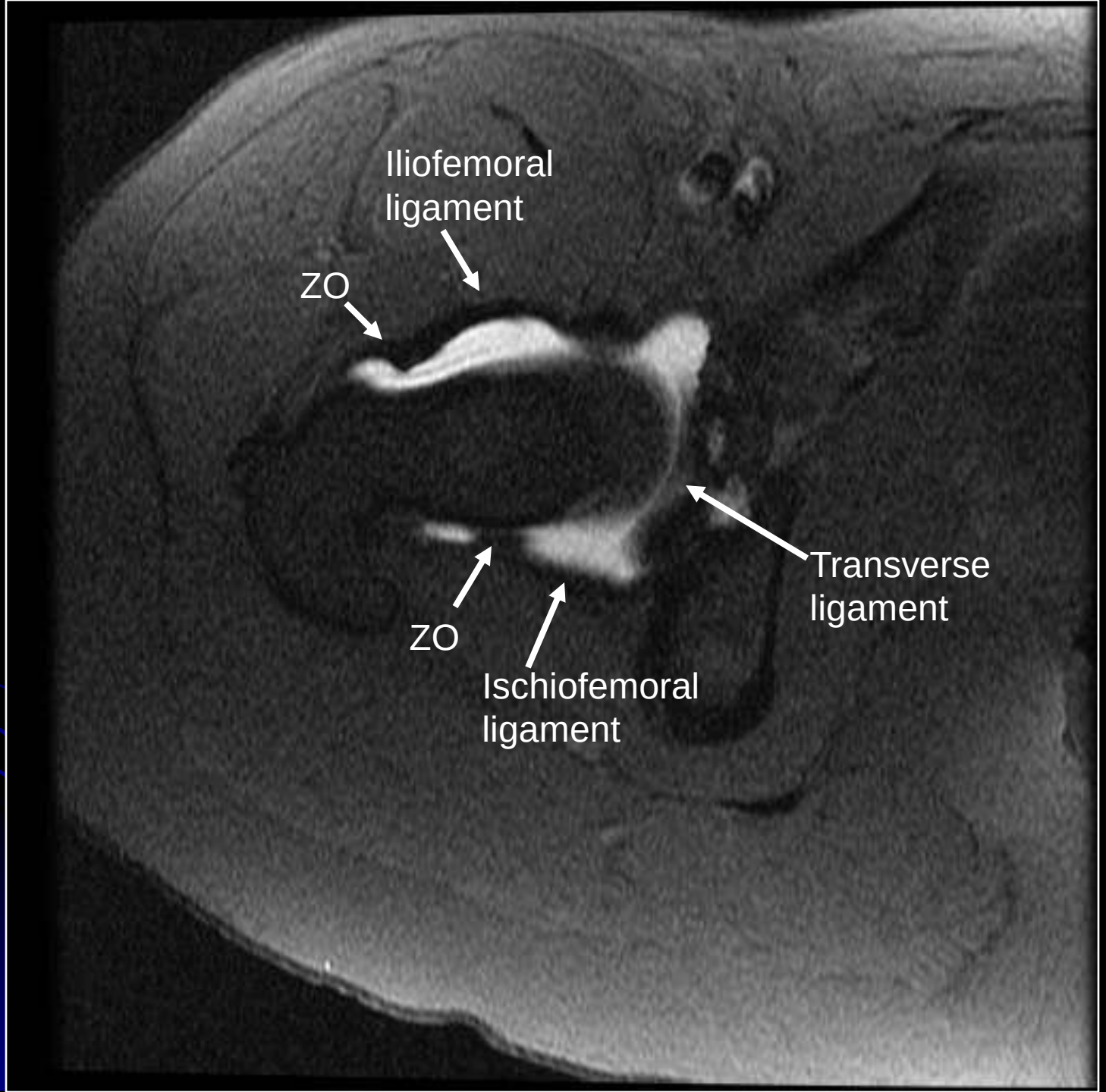

Iliofemoral ligament
Labrum
Acetabular Fossa
Fovea
Ischiofemoral ligament
Labrum

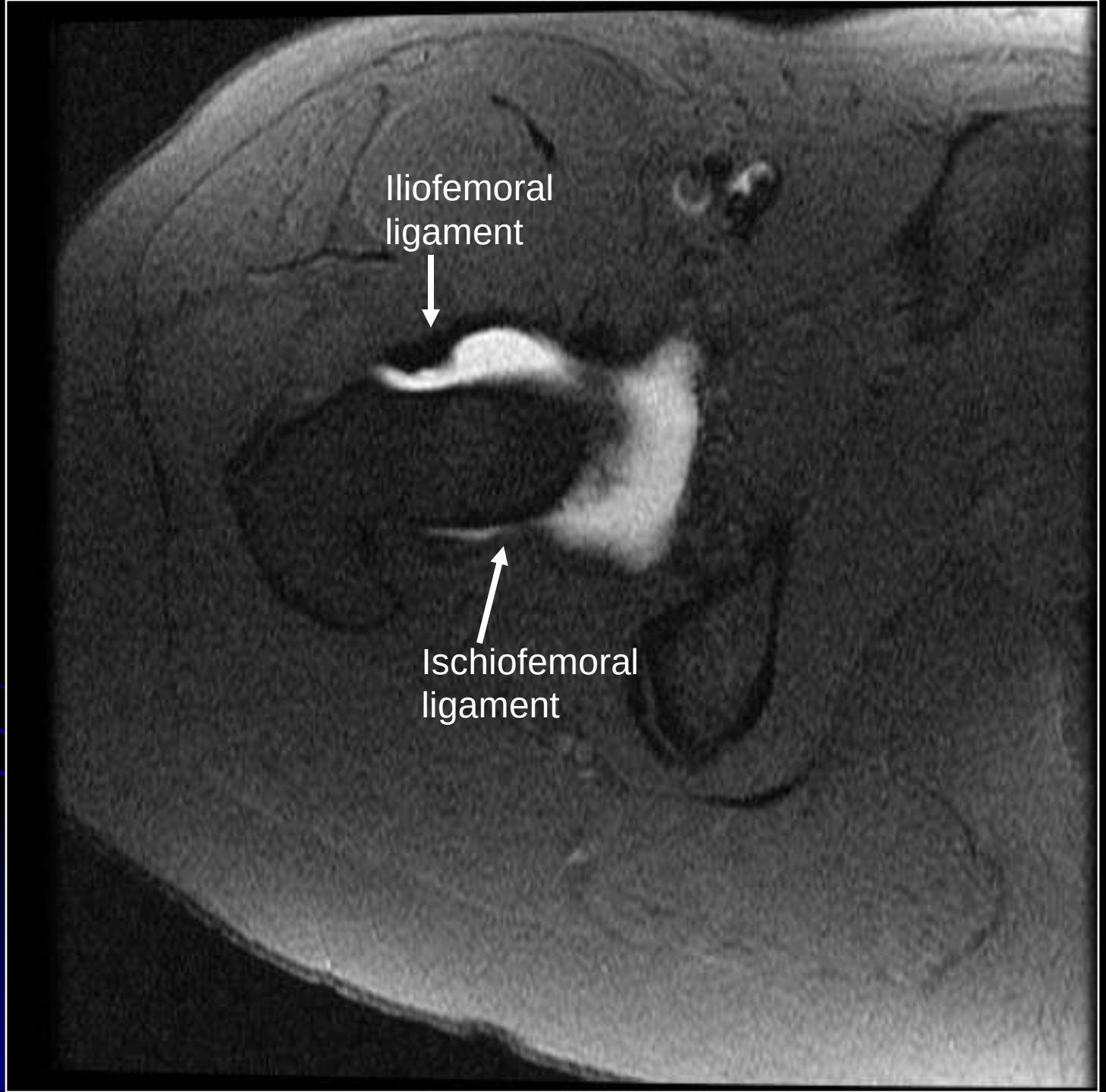

Iliofemoral ligament
Acetabular Fossa
Ligamentum Teres
Ischiofemoral ligament
Labrum


Iliofemoral ligament
Labrum
Acetabular Fossa
Ligamentum Teres
Ischiofemoral ligament
Labrum


Iliofemoral ligament
Ligamentum Teres
ZO
Ischiofemoral ligament
Labrum


Iliofemoral ligament
Transverse ligament
ZO
Ligamentum Teres
ZO
Ischiofemoral ligament


Iliofemoral ligament
ZO
ZO
Ischiofemoral ligament
Transverse ligament


Iliofemoral
ligament
Ischiofemoral
ligament

Pathology of Capsule and Ligaments

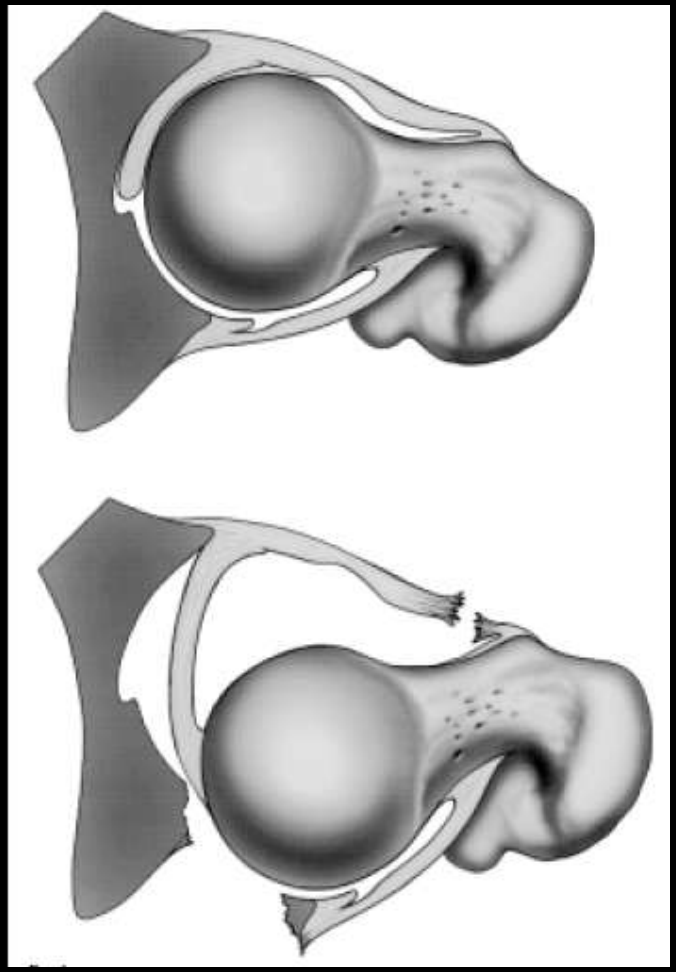
Capsular Laxity and Hip Instability

- Traumatic (acute): Dislocation or subluxation
- Atraumatic (non-acute):
  - Overuse (chronic repetitive microtrauma)
  - Connective tissue disorders (Marfan,Ehlers-Danlos)
- Capsular ligaments (iliofemoral ligament) and labrum are static stabilizers of hip
  - Once injured, the psoas major muscle (dynamic stabilizer) constantly contracts to provide hip stability
  - Leads to stiffness, flexion contractures of hip, back pain
- Treatment: Thermal capsulorrhaphy +/- plication and labral repair

Shindle M et al. Clin of Sport Med 2006(25)-309-326

Traumatic Posterior Subluxation

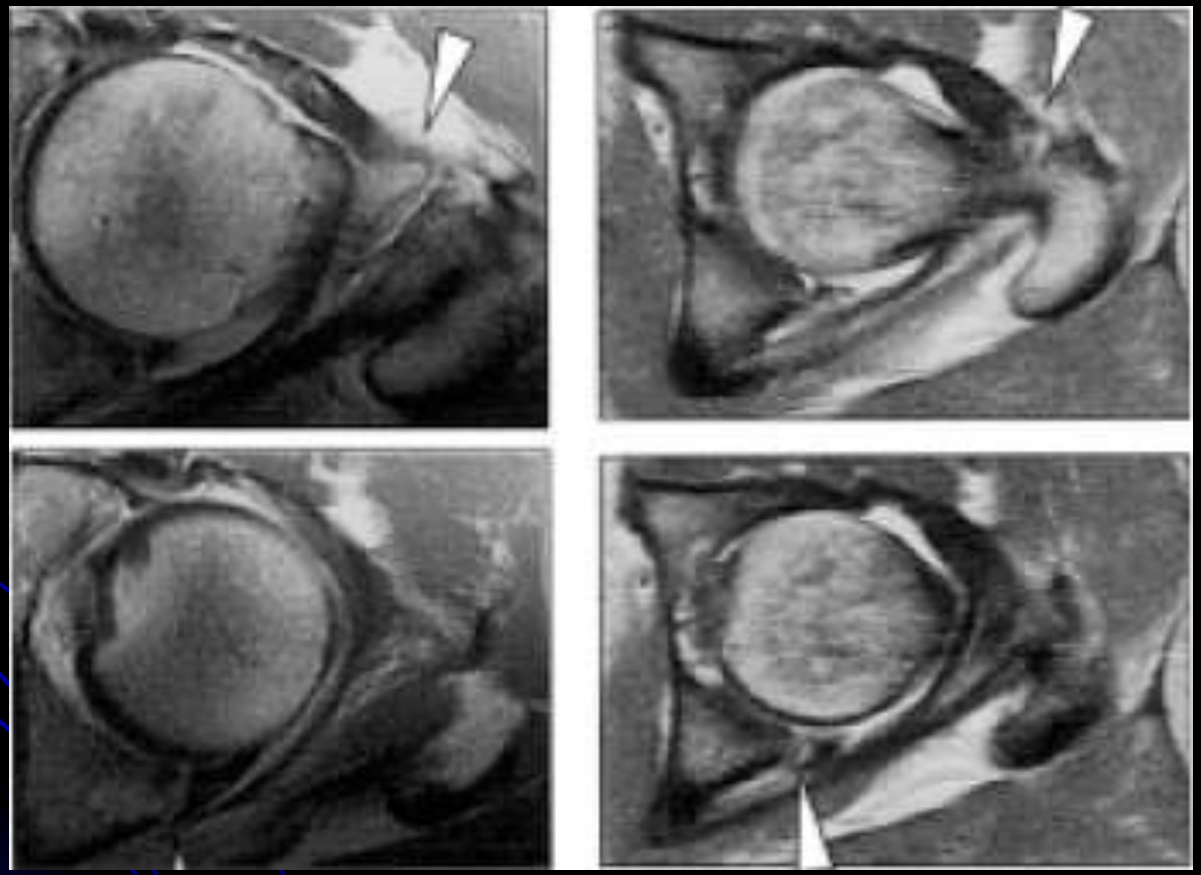
- Seen in athletes (American football)
- Fall on flexed adducted hip
- Low-energy trauma
- Difficult clinical diagnosis
- Avulsion fracture of posterior acetabulum
- Disruption of iliofemoral ligament and anterior capsule
- Hemarthrosis
- Risks: AVN, chondrolysis



Moorman CT et al. JBJS 2003; 85A(7):1190-6.

Traumatic Posterior Subluxation

THE JOURNAL OF BONE & JOINT SURGERY · JBJS.ORG
VOLUME 85-A · NUMBER 7 · JULY 2003



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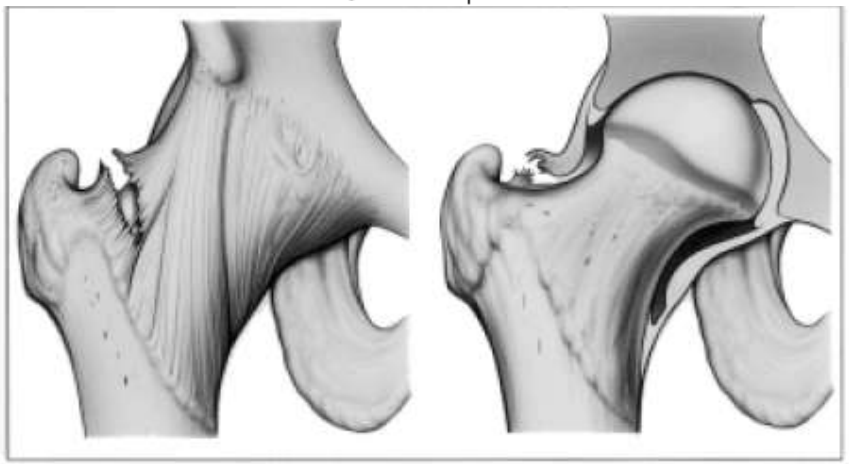


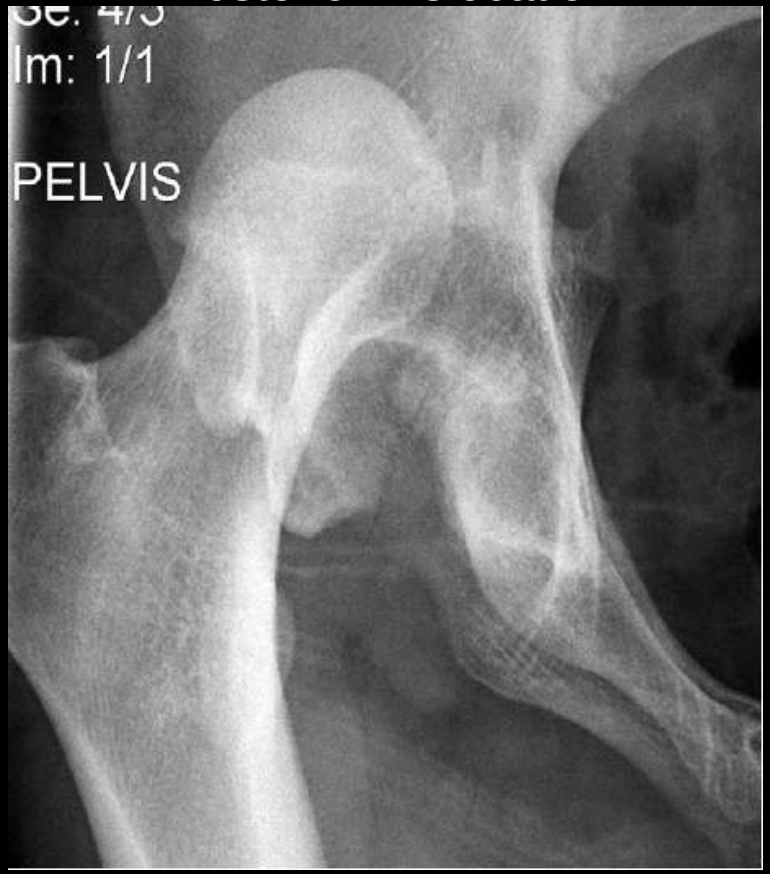
Patient #1

Patient #2

Hip Dislocation

- Posterior >> anterior dislocation
- Joint capsule is stronger anteriorly
- High-force impact
  - Flexed adducted internally rotated hip → Posterior dislocation
  - Abducted externally rotated hip → Anterior dislocation
- Risks: AVN, post-traumatic osteoarthrosis

Posterior Dislocation



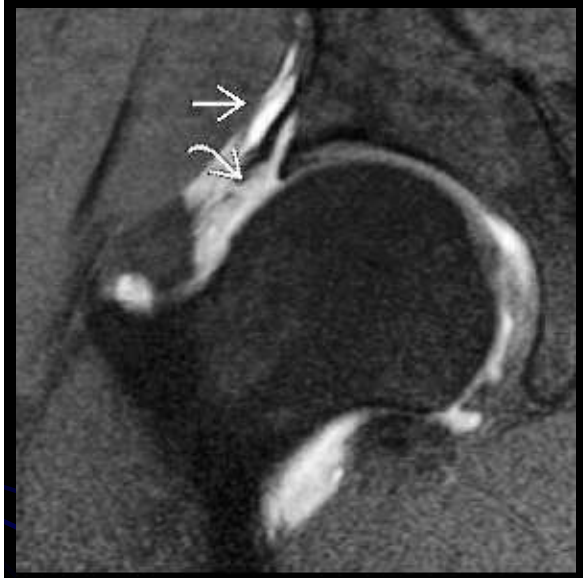
Philippon M et al. Arthroscopy 2009;25(2):169-174

Hip Dislocation

Imaging Findings

- Iliofemoral ligament disruption
  - 16 of 18 pts with traumatic dislocation[14]
- Labral and chondral injuries +/- entrapment
- Capsular/Ischiofemoral ligament disruption
- Ligamentum teres disruption[15]
- Femoral head or acetabular fracture
- Marrow and muscle edema
- Sciatic nerve injury

Ligamentous Injuries in Dislocation



Iliofemoral Ligament Disruption: contrast extends outside capsule

Ischiofemoral Ligament Tear: contrast extends outside posterior capsule

my.statdx.com

Traumatic Hip Dislocation in Professional Athletes[15]

TABLE 2. *Hip Pathologies Identified at Arthroscopy*

Patient No.	Months*	Spontaneous Reduction	Hip Pathology Identified at Arthroscopy						
			Labral	Adhesions	Capsule Tear	Ligamentum Teres	Cam	Pincer	Chondral Defect
1	7.3	N	Y	—	—	Y	Y	Y	Y
2	4.4	N	Y	—	Y	Y	Y	—	Y
3	4.0	N	Y	—	—	—	—	—	Y
4	3.3	N	Y	—	—	Y	—	—	Y
5	0.1	N	Y	—	—	Y	—	—	Y
6	3.1	N	Y	—	—	Y	—	—	Y
7	0	N	Y	—	—	Y	—	—	Y
8	6.6	Y	Y	—	—	—	—	Y	Y
9	1.5	N	Y	Y	Y	Y	Y	—	Y
10	2.1	N	Y	—	—	Y	Y	Y	Y
11	0.8	Y	Y	—	—	Y	Y	Y	Y
12	0.6	N	Y	—	—	Y	Y	—	Y
13	4.6	N	Y	Y	—	Y	Y	—	Y
14	18.5	N	Y	—	—	Y	Y	Y	Y

*Months from dislocation to hip arthroscopy.

Philippon M et al. Arthroscopy 2009;Feb 25(2):169-174

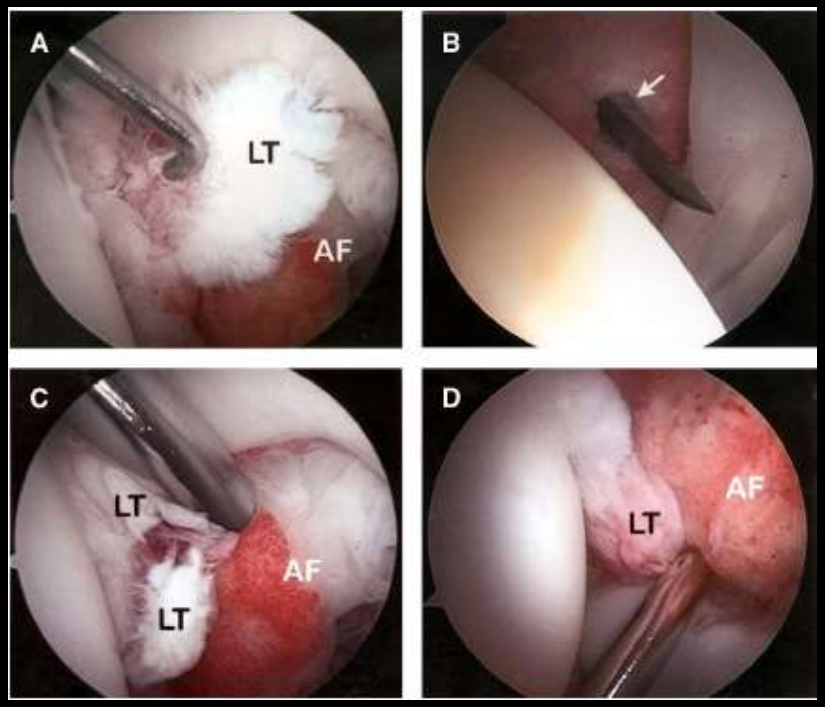
Ligamentum Teres Injuries

Gray and Villar Classification[17]

- Type I Complete Rupture:
  - Usually acute and associated with major trauma/surgery
  - Often associated with other significant abnormalities (labral or chondral injuries)
- Type II Partial Rupture:
  - Usually associated with chronic hip pain
  - Often seen in athletes (ballet dancers, martial arts or high impact sports).
  - Third most common finding at arthroscopy in young athletes
- Type III Degenerative:
  - Usually associated with osteoarthritis in older patients

Traumatic Ligamentum Teres Tear: A source of Hip Pain[16]

- Mechanism[9]:
  - Fall on flexed adducted hip
  - Twisting injury, ext rotation
  - Hyperabduction
- Clinical Symptoms:
  - Deep anterior groin pain
  - Locking, clicking, popping
- 23 cases of traumatic tears of LT (15 major trauma, 8 twisting)
- 2 detected by preop MRA (7 MRA, 20 MRI done)
- Young pts (avg age=28)
- 8 cases were isolated findings.
- Treatment:
  - Debridement of torn fibers
  - Improved sx after treatmt



Byrd T et al. Athroscopy 2004;20(4): 385-391

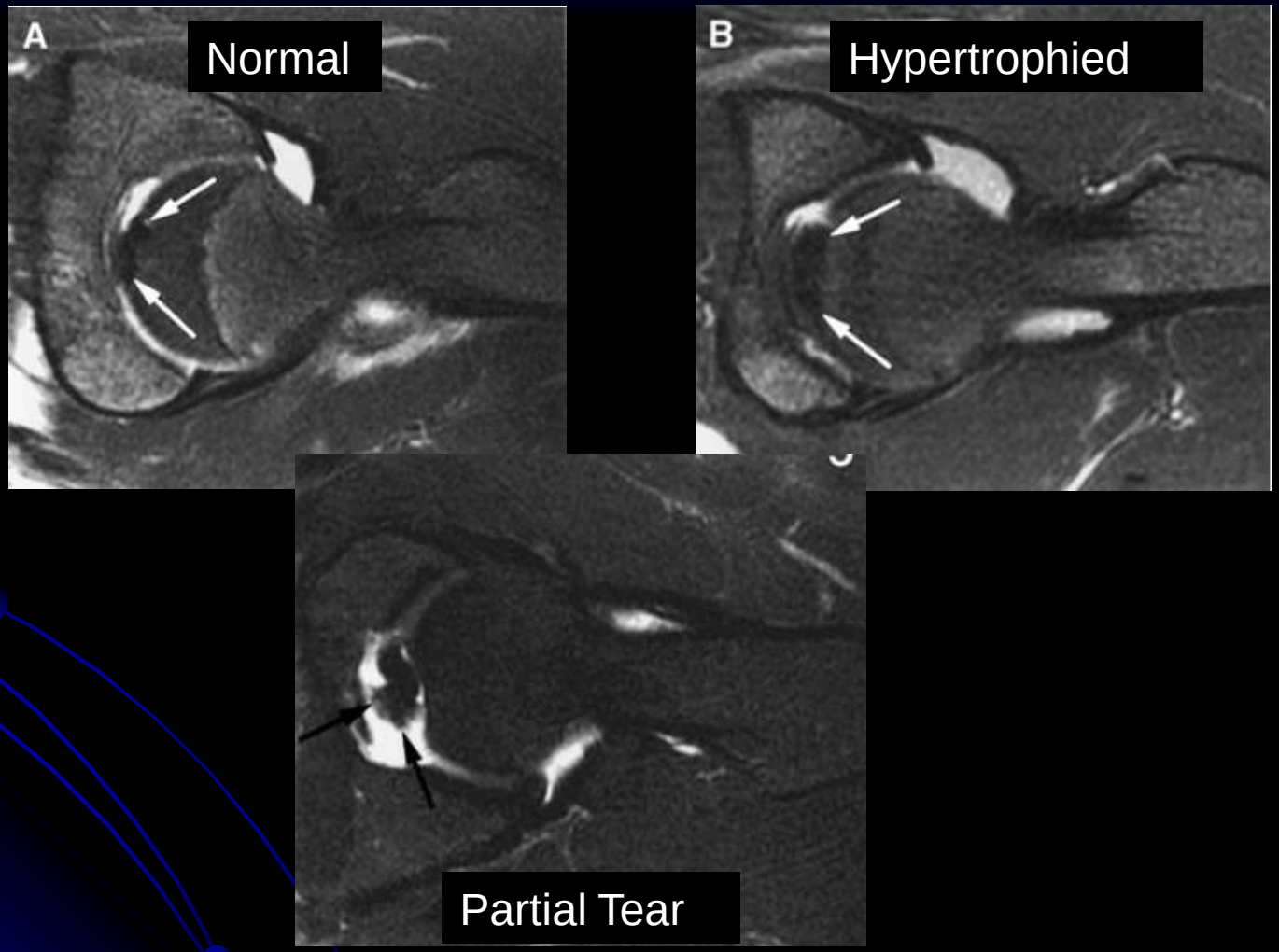
MR Imaging of Ligamentum Teres

MR Arthrogram[18,19]:

- Axial oblique planes may be optimal
- Normal: Homogeneous low SI on both T1 and T2W
- Partial Tear: Intermed/high T2 signal and abnormal morphology
- Hypertrophied ligament: 2 mm medial extension beyond foveal insertion on axial oblique images.
  - If ligament is hypertrophied, either abnormal T2 signal or morphology determines partial tear.
- Occasionally will see bony intra-articular fragments from avulsion injuries of LT (more common with complete/type I injuries

Armfield DR et al. Clin of Sport Med 2006(25):211-239

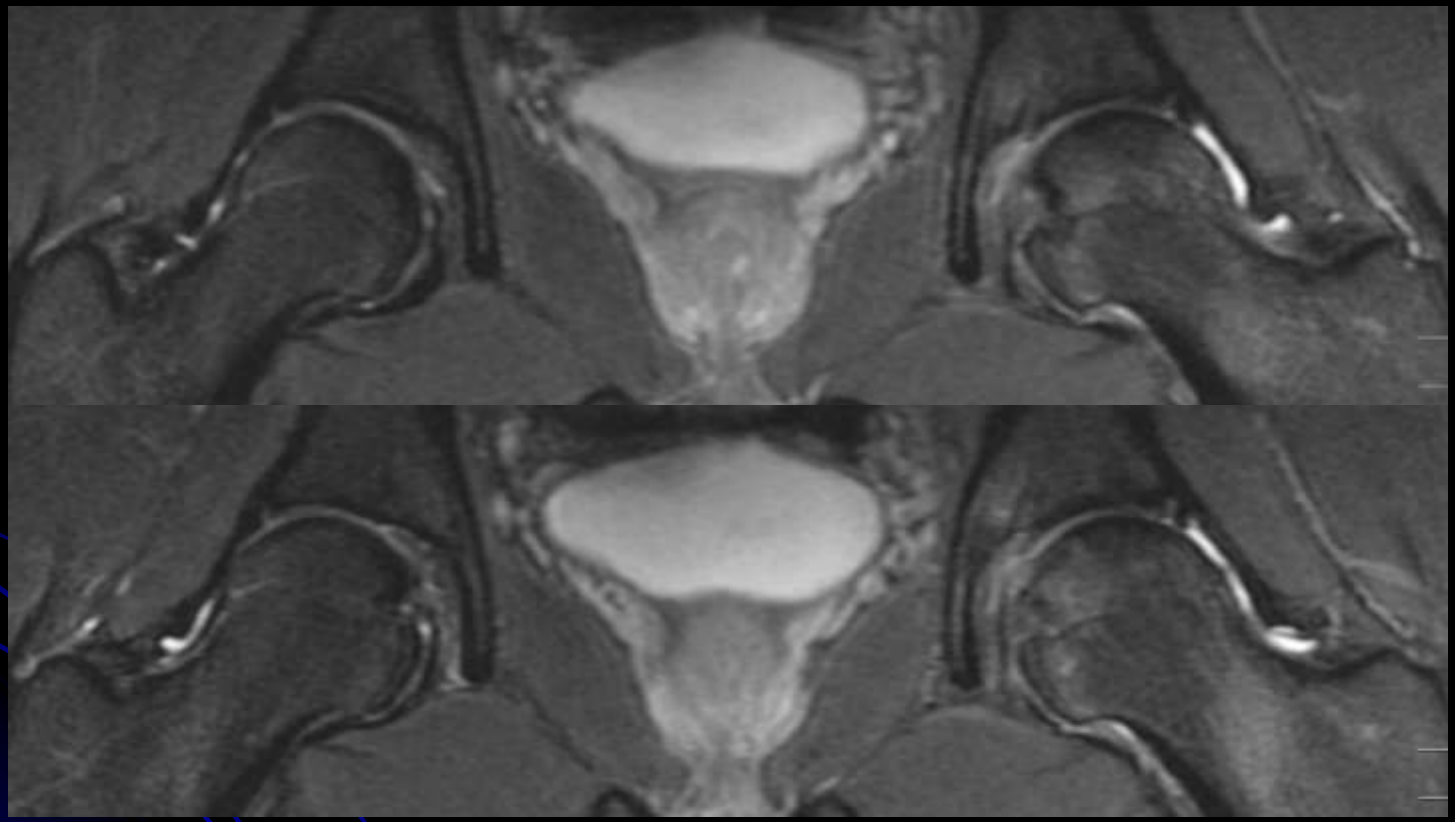
Ligamentum Teres Tears



Armfield DR et al. Clin of Sport Med 2006(25):211-239

24 yo professional soccer player with left hip pain

Coronal T2FS



Courtesy of Drs Craig Stewart and Tudor Hughes

24 yo professional soccer player with left hip pain

Axial T2 FS

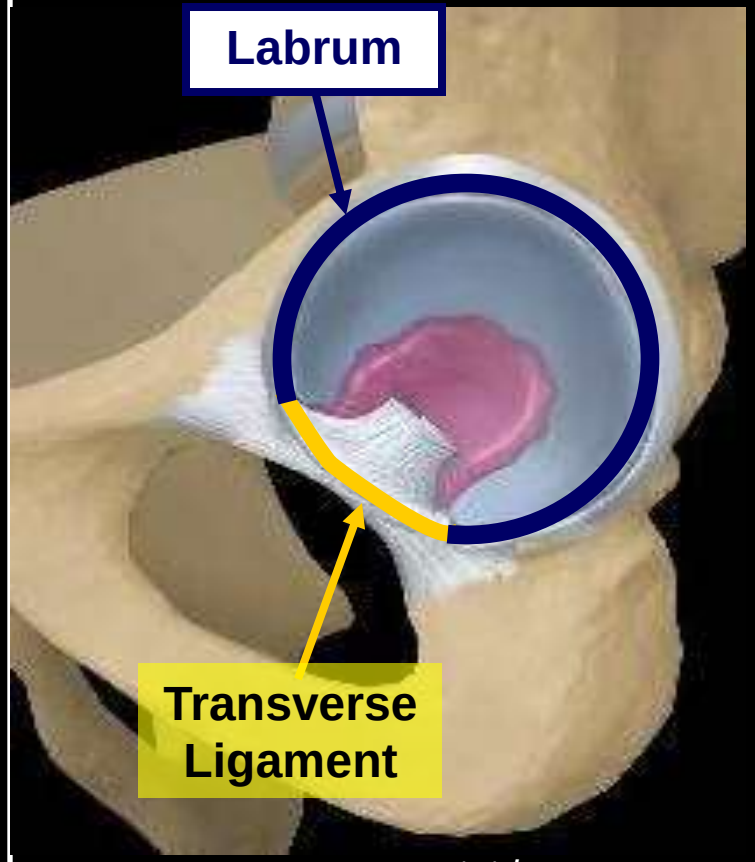
Arthroscopic Findings:

Type 2 partial tear of left ligamentum teres at its foveal attachment

Labrum: Normal Anatomy and Pathology

Labrum

- Fibrocartilaginous structure:
  - Attached to acetabular perimeter
  - Inferiorly, attached to transverse acetabular ligament
  - Collagen fibers contiguous with those in transverse ligament
- Morphology:
  - Anterior labrum: Wider and thinner
  - Posterior labrum: Less wide and thicker



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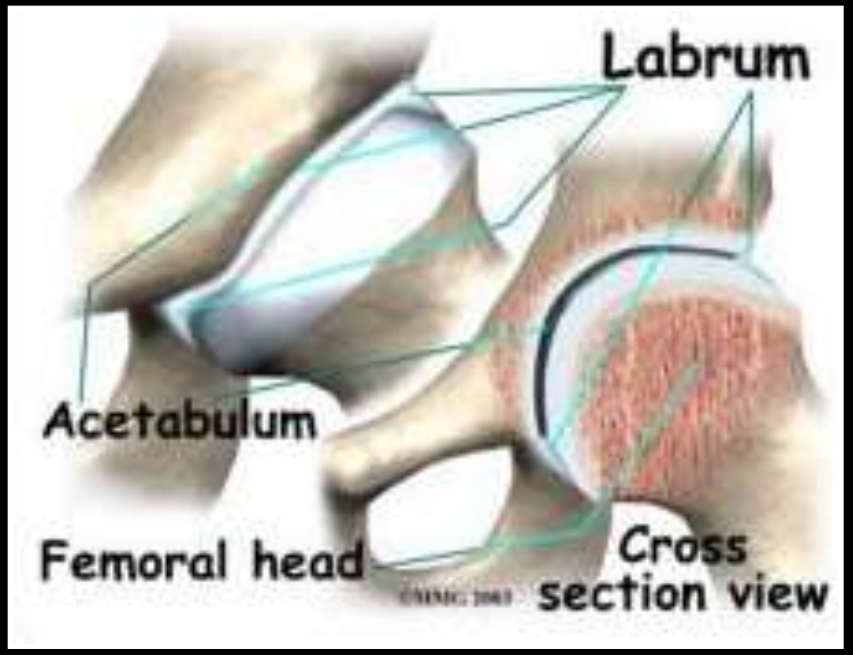
Labrum

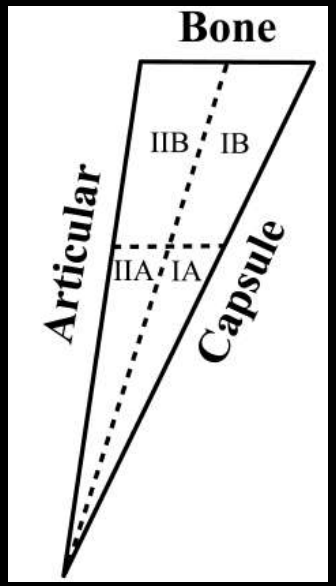
- Function:
  - Provides seal, keeping fluid btwn femoral head and acetabulum during mild compression
  - Helps contain femoral head during extreme ROM, esp hip flexion
- Histology[2]:
  - Dense connective tissue
  - Fibrocartilage
  - Collagen fibers (longitudinal circumferential bundles)
  - Neuroreceptors within labrum provide proprioception of hip[4]

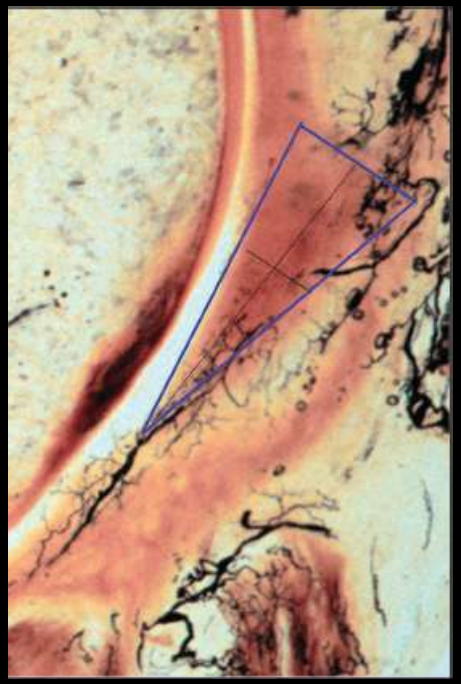


Labrum: Vascularity

- Most vascular at peripheral 1/3 of labrum[2]
- Kelly et al[3] divided labrum into capsular zone IA/IB and articular zone IIA/IIB
  - Capsular zone most vascular d/t abundant blood suppy from joint capsule
  - Some blood supply from adj bone
  - Least blood supply in central and articular labrum

Peripheral labral tears near capsulolabral junction may heal better.





Kelly et al. Arthroscopy 2005;21(1):3-11

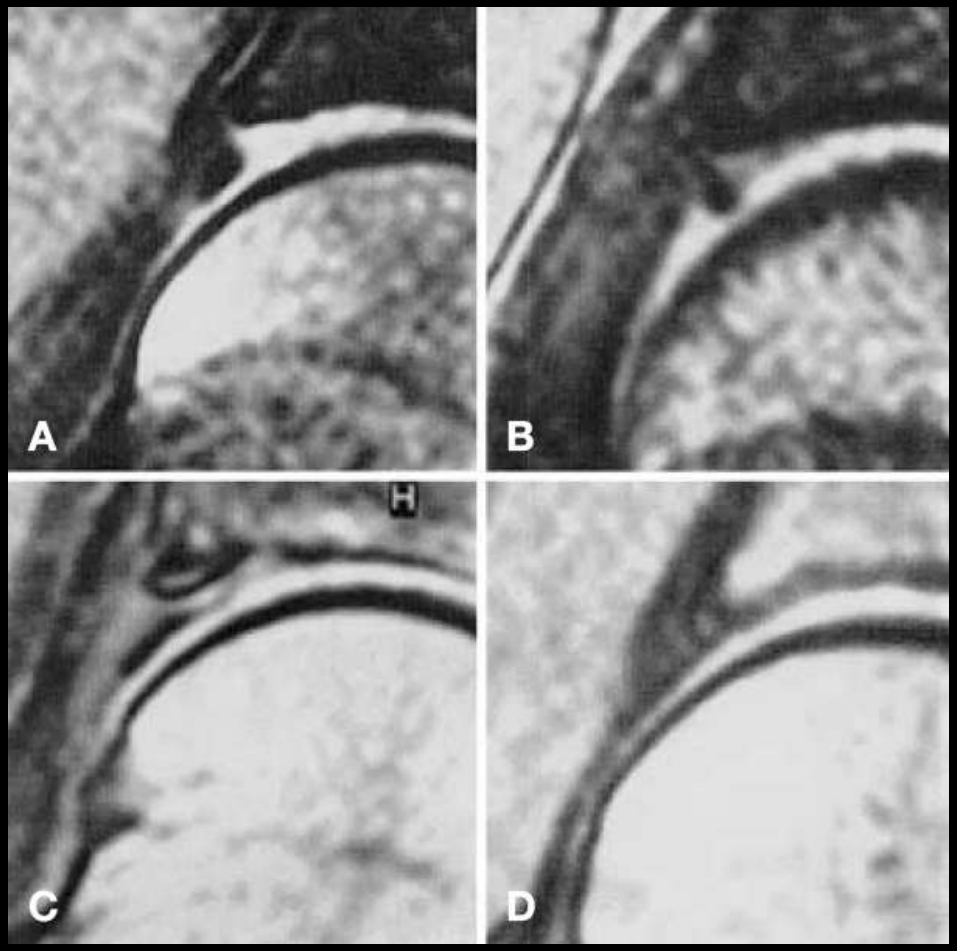
Shindle et al. JBJS 2008;90 Suppl 4:2-19

Labrum: MR Evaluation

- MR arthrography is sensitive and specific in detecting labral pathology
  - Debate that noncontrast MRI just as accurate[33]
- Radial imaging has been suggested as better way to evaluate labrum.

Labrum Types: MR Imaging[21,26]

- Triangular 69-80%
- Round 13-16%
- Irregular/Flat 7-13%
- “Absent” 1-2.5%
  - May not have been seen d/t technique
  - Degenerative or torn, not truly absent[22,23]



Aydingoz U et al. Eur Radiol 2001;11:567-574.

Normal Labrum: MR Imaging

MR Findings:

- Triangular (most common)
- Homogeneous dark signal intensity on all sequences
- Closely attached to articular cartilage
- Clock face: sagittal plane[25]
  - 12:00 superior
  - 3:00 anterior
  - 6:00 inferior
  - 9:00 posterior

Steinbach L et al. RadioGraphics 2002; 22:1223–1246

Labral Abnormalities/Tears

Causes

1. Degeneration
   - Intrasubstance abnl signal
2. Femoroacetabular Impingement
   - Cam type: femoral head/neck offset
   - Pincer type: abnormal acetabular morphology
   - Mixed type: most common
   - Developmental hip dysplasia
   - Coxa magna
3. Trauma
4. Repetitive activity in athletes

Clinical Findings:

- Asymptomatic: >70 yo
- Hip/Groin Pain
- Clicking

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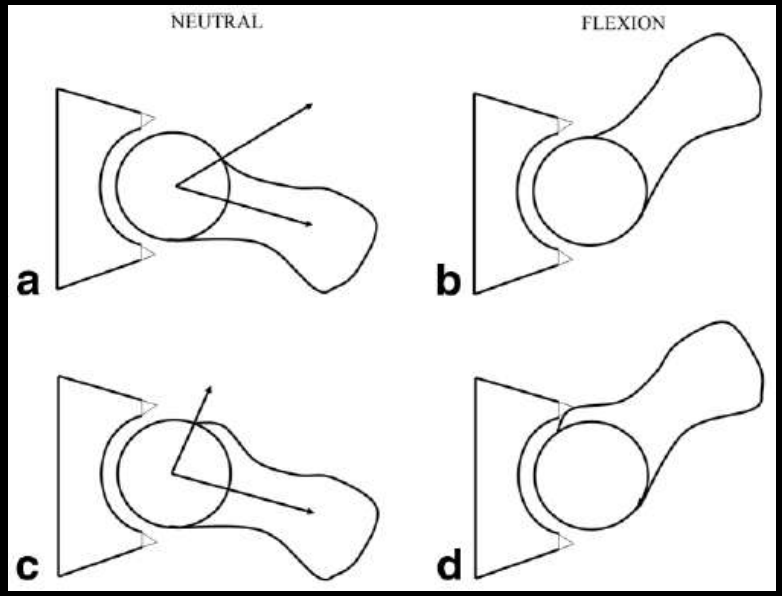
Femoroacetabular Impingement: Cam type

- Pain w/flexion and internal rotation and limited ROM w/internal rotation
- Offset at femoral head/neck junction causes impingement on labrum with flexion
- “Pistol grip” deformity
- Young athletic persons
- Labral and chondral abnormalities
- Alpha angle > 55˚
- Herniation pits may be early osteoarthrosis[29]



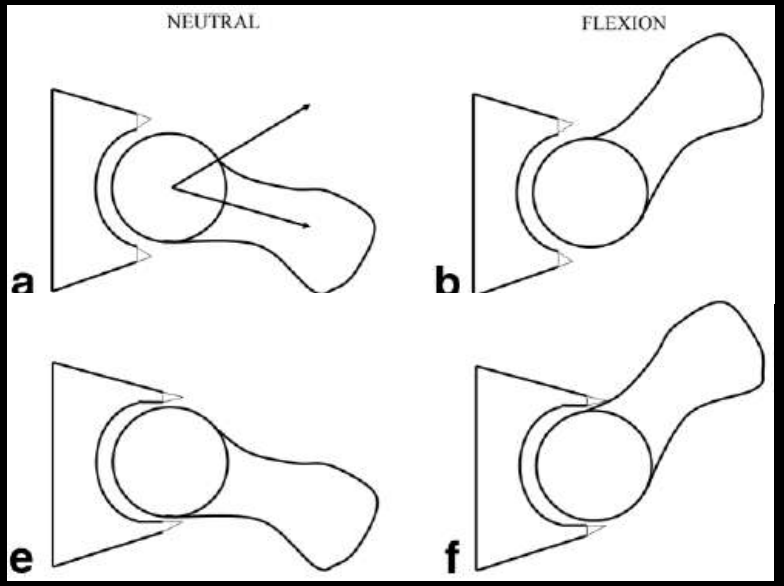
Normal (a/b): Labrum clears with flexion

Cam type (c/d): Femoral head/neck offset impinges on acetabular labrum

Hong R, Hughes T, Gentili A, Chung C. J of Mag Res Imag 2008;27:435

Femoroacetabular Impingement: Pincer-type

- Abnormal acetabular morphology
  - Acetabular protrusion
  - Acetabular retroversion
  - Os acetabuli
  - Trauma
- Older female patients
- Over-coverage of femoral head→linear contact on acetabular labrum
- Mostly labral abnormalities
- Contrecoup chondral injury in posteroinferior acetabulum and femoral head



Normal (a/b): Labrum clears with flexion

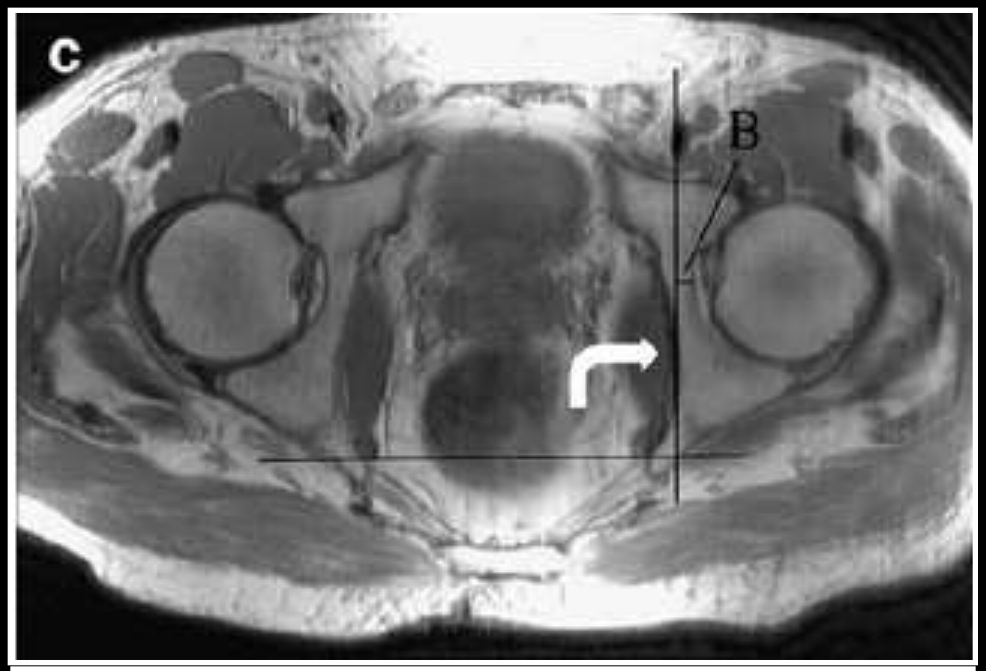
Pincer type (e/f): Over-acetabular coverage of femoral head. Abnormal linear contact on acetabular labrum on flexion

Hong R, Hughes T, Gentili A, Chung C. J of Mag Res Imag 2008;27:435

Acetabular Protrusio

Measure fr medial acetabular wall to ilioischial line

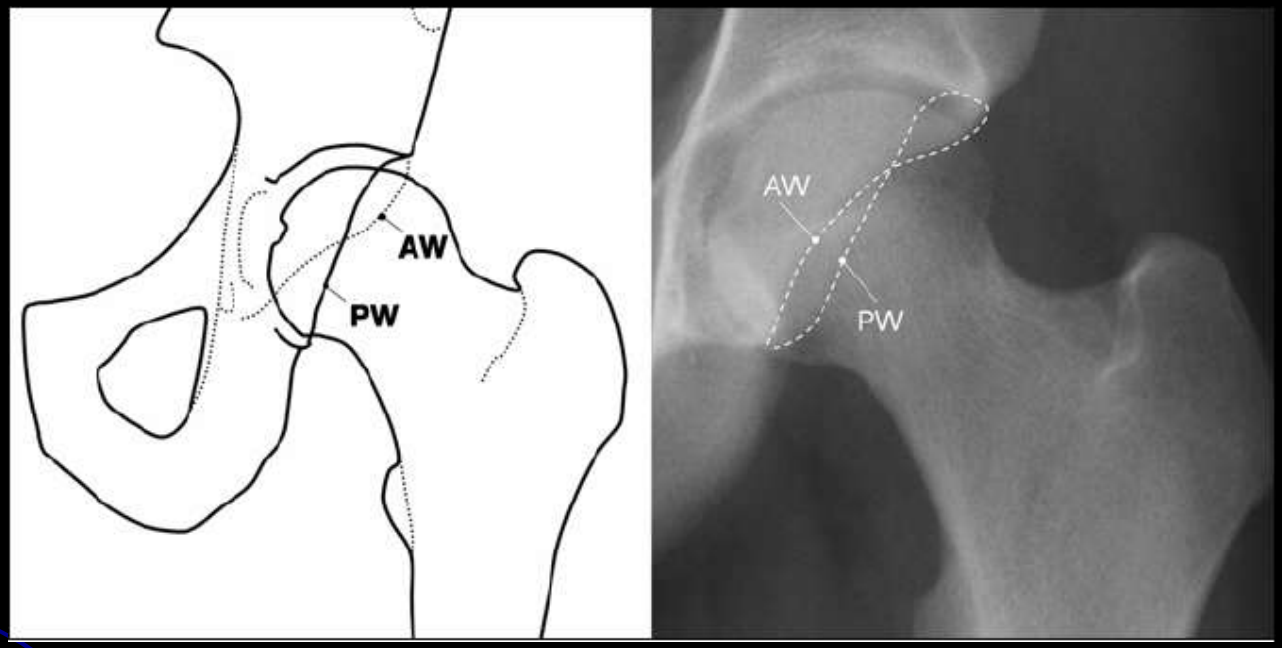
Acetabular Protrusio > 3mm in men; > 6mm in women



MR measurement B is the distance between the medial most point of the acetabular fossa and a line perpendicular to the horizontal axis that passes through the lateral most point of the posterior inner pelvic wall (curved arrow) at the level of the ischial spine.

Chen L, Boonthathip M et al. Skel Rad 2009(38):123

Acetabular Retroversion

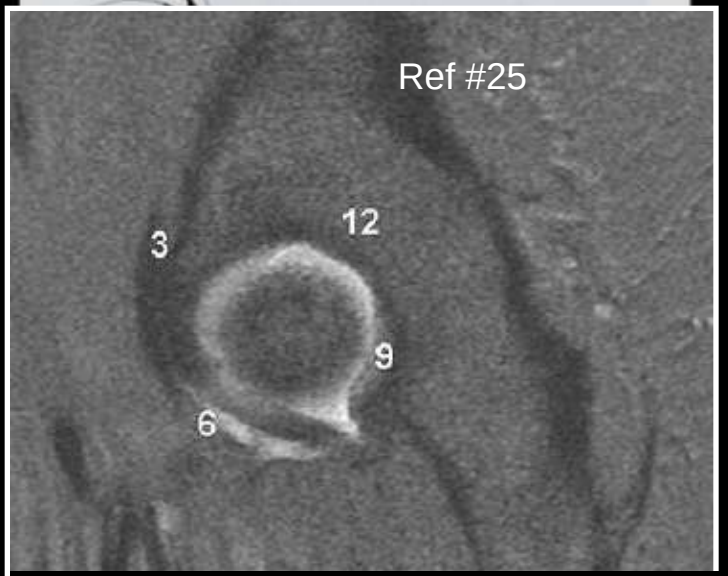


Anterior acetabular rim is more lateral and crosses over posterior acetabular rim. “Figure of 8” or crossover sign

Tannast M et al. AJR 2007;188(6):1540-52.

Labral Tears Classification

- Arthroscopic classification by Lage[27]
  - Radial flap
  - Radial fibrillated
  - Longitudinal peripheral
  - Unstable
- Initial MR Imaging classification by Czerny et al[28]
  - I. Intralabral signal
  - II. Contrast extends into labrum
  - III. Labral detachment
- BUT, these 2 systems do not correlate well with ea other[25]



Best to use clock-face

Resnick's MR Classification of Labral Tears

- Use sagittal plane for location of tear
- Coronal plane (cross reference to other planes) for type of tear
- **Types:**
  1. Longitudinal vertical
  2. Longitudinal horizontal
  3. Radial
  4. Complex
  5. Labral detachment
     - From bone or articular cartilage
  6. Acetabulolabral articular destruction (ALAD)

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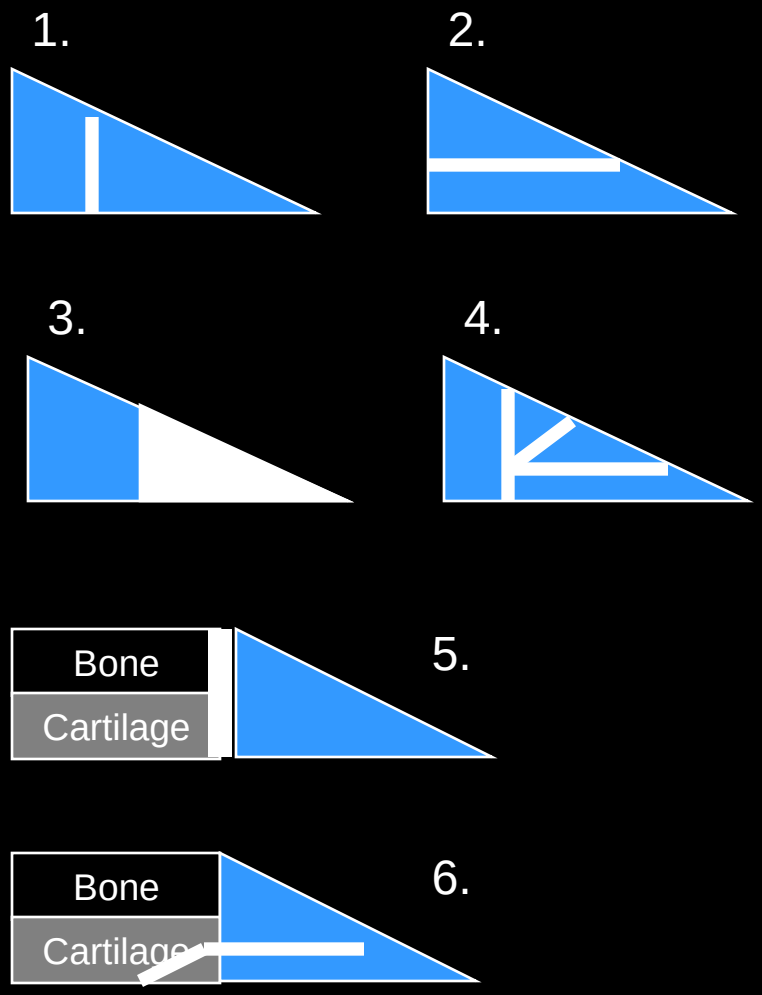
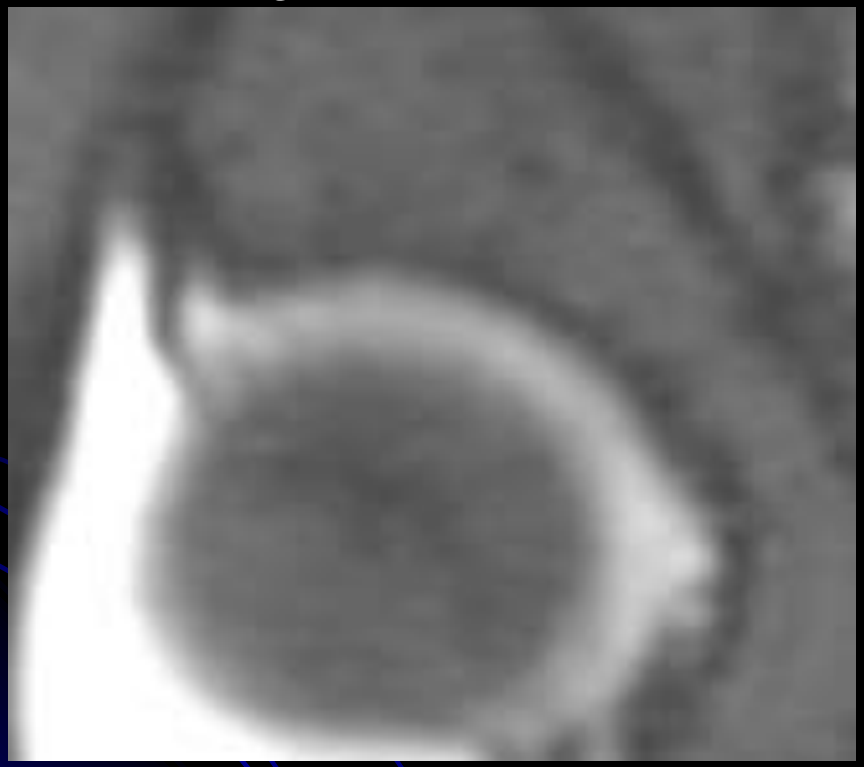


Labral Tears: Location is Everything

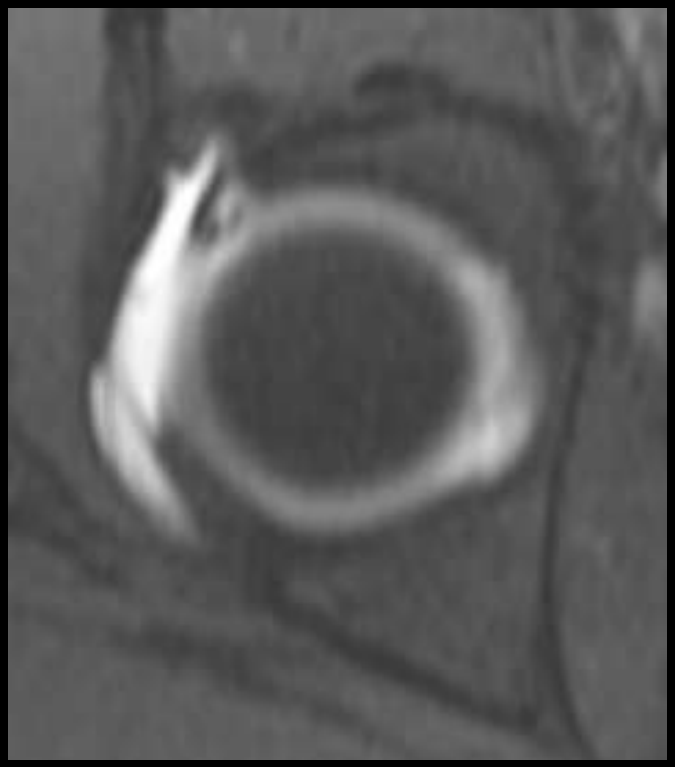
- Most tears are anterior or anterosuperior
  - Theories: poorer vascular supply, mechanically weaker and subject to greater stress
  - Marginal attachment to cartilage, parallel collagen fibers to cartilage[32]
- Posterosuperior tears can occur in younger pts and more common in Japan
- Normal labral variants are more likely in the lower quadrant

14 yo female ballerina with “snapping” sensation of right hip

MR Arthrogram: Coronal T1 FS



Axial T1 FS



Anterosuperior Labral Tear

Courtesy of Dr Tudor Hughes

68 yo woman with anterosuperior labral tear

Studler U et al. Radiology 2008;249(3):947-954.

38 yo male with avulsion of anterosuperior labrum

Dinauer et al. AJR 2004;183:1745-53

Labral Tears: Paralabral Cyst

38 yo female with right hip pain for 7 yrs, no trauma

Courtesy of Dr Tudor Hughes

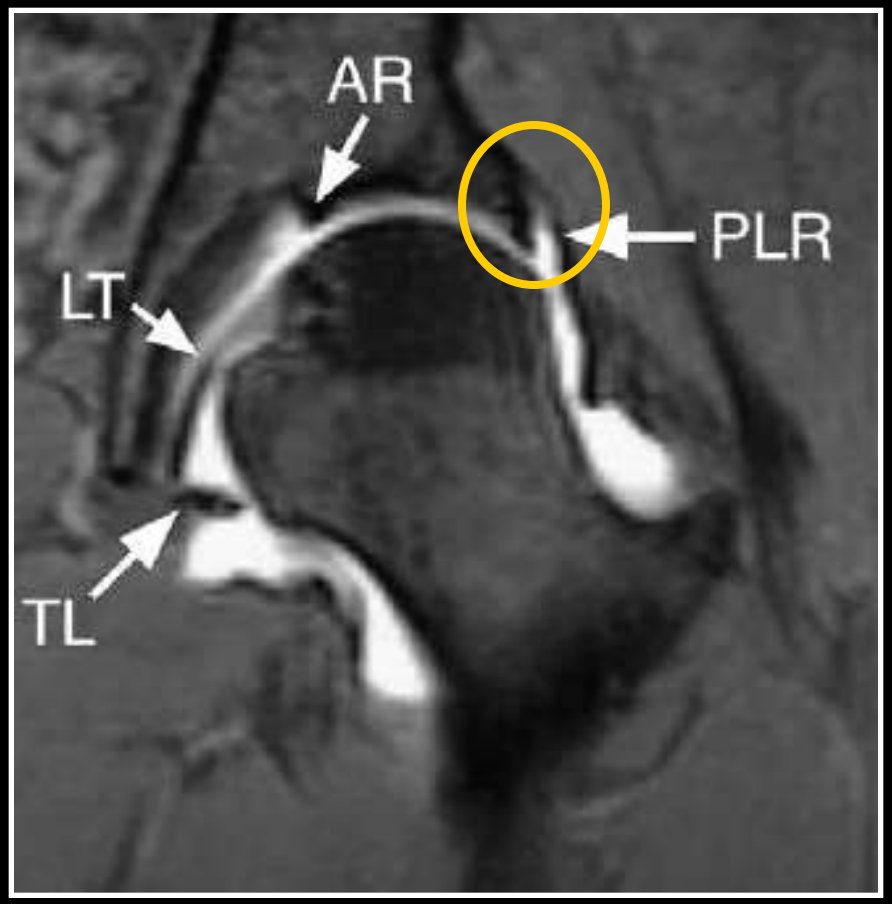
Acetabulolabral articular destruction (ALAD)

Courtesy of Dr Tudor Hughes

Labral Imaging Pitfalls

Terminology:

- Perilabral recess or sulcus: btwn labrum and capsule
  - NORMAL
- Sublabral recess or sulcus: btwn labrum and articular cartilage or subchondral bone
  - Normal or not??

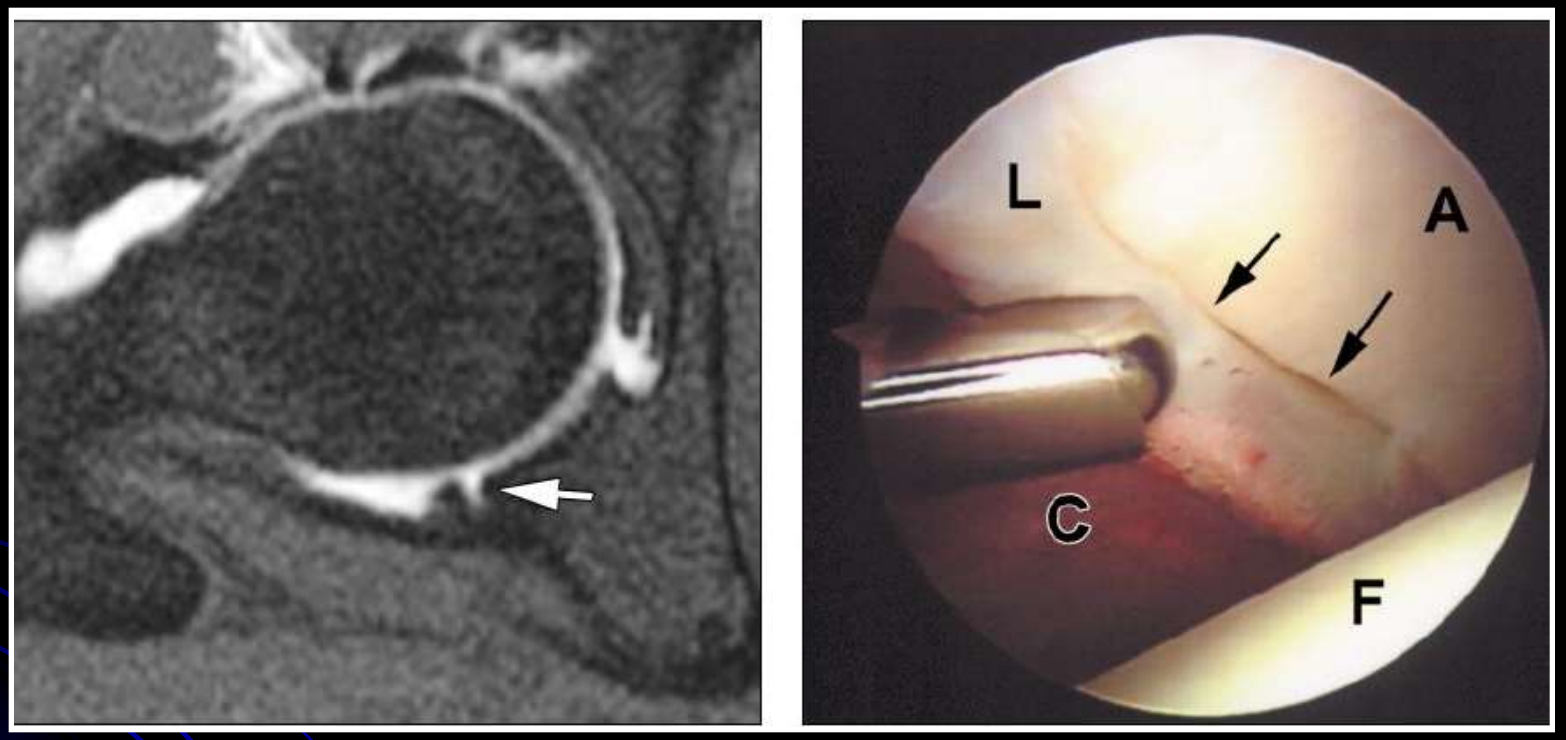


Normal Perilabral Recess[5]

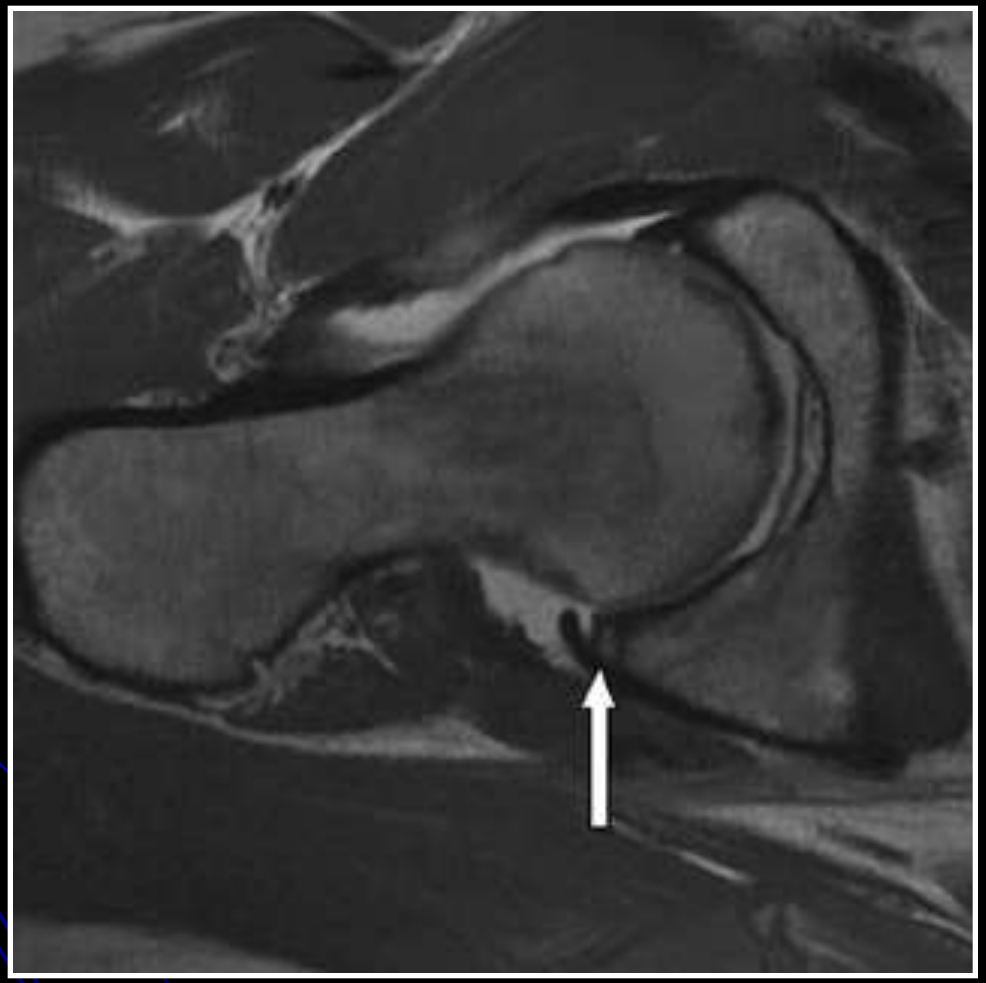
Sublabral Sulcus: Confusing Topic

- Breakdown of literature
  - 1981 Walker[34]: anterosuperior labral cleft in fetal labrum seen w/ light microscopy but not macroscopically, possible prep artifact?
  - 1994 Keene[38]: 100 pts arthroscopy. 2 posteroinferior sublabral sulci.
  - 1996 Petersilge[35]: 10 MRA. No sublabral sulcus.
  - 1999 Czerny[36]: 40 MRA; 6 cadavers. No sublabral sulcus.
  - 2004 Dinauer[37]: 54 MRA, 4 MRI. 13 Posteroinferior sublabral sulci.
  - 2006 Saddik[39]: 24 noncon MRI, 3 MRA. 12 anterosuperior, 14 posteroinferior, 2 anteroinferior, 2 posterosuperior sulci
  - 2008 Studler[40]: 57 MRA. 7 anteroinferior, 1 anterosuperior, 2 anterior sulci.
- Definition per above: Partial separation of labrum fr articular cartilage with normal underlying labrum. Gold standard was arthroscopy.
- BUT, there were some examples of sublabral sulcus on MR proven to be tear on arthroscopy

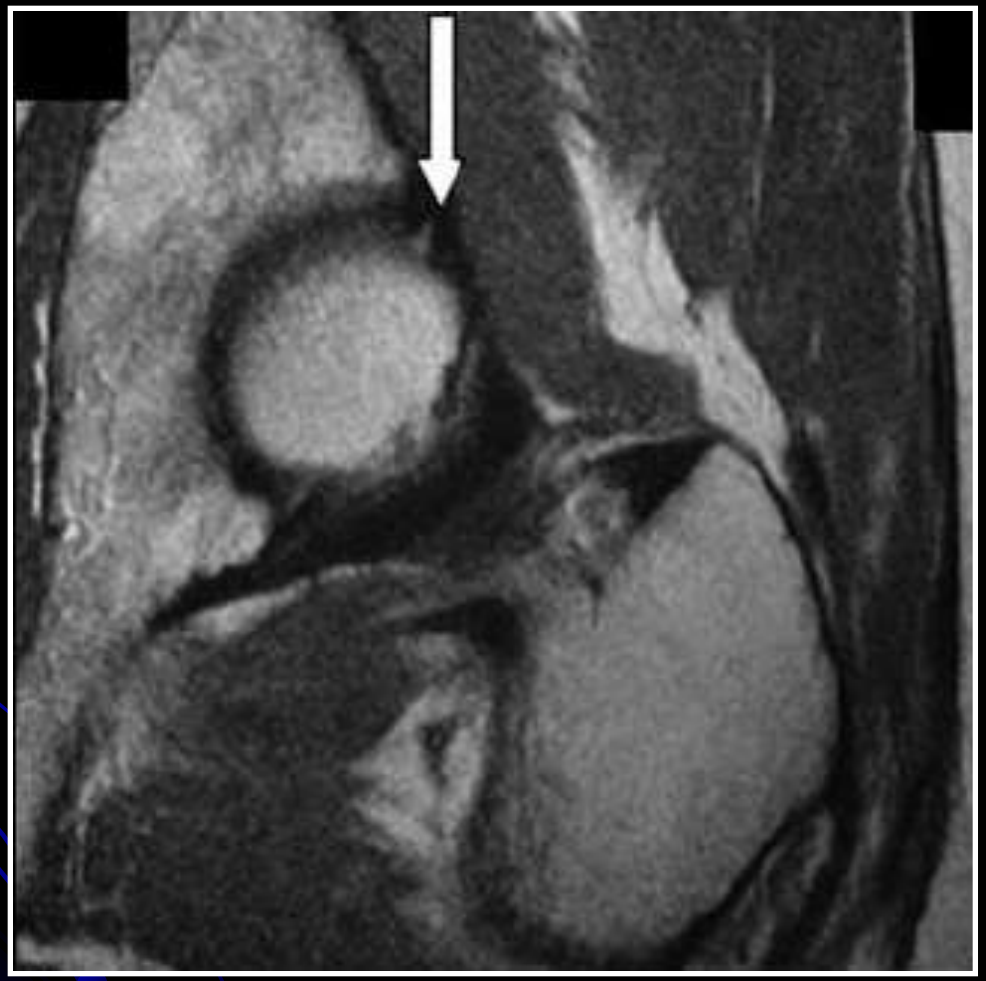
Posteroinferior Sublabral Sulcus[37]



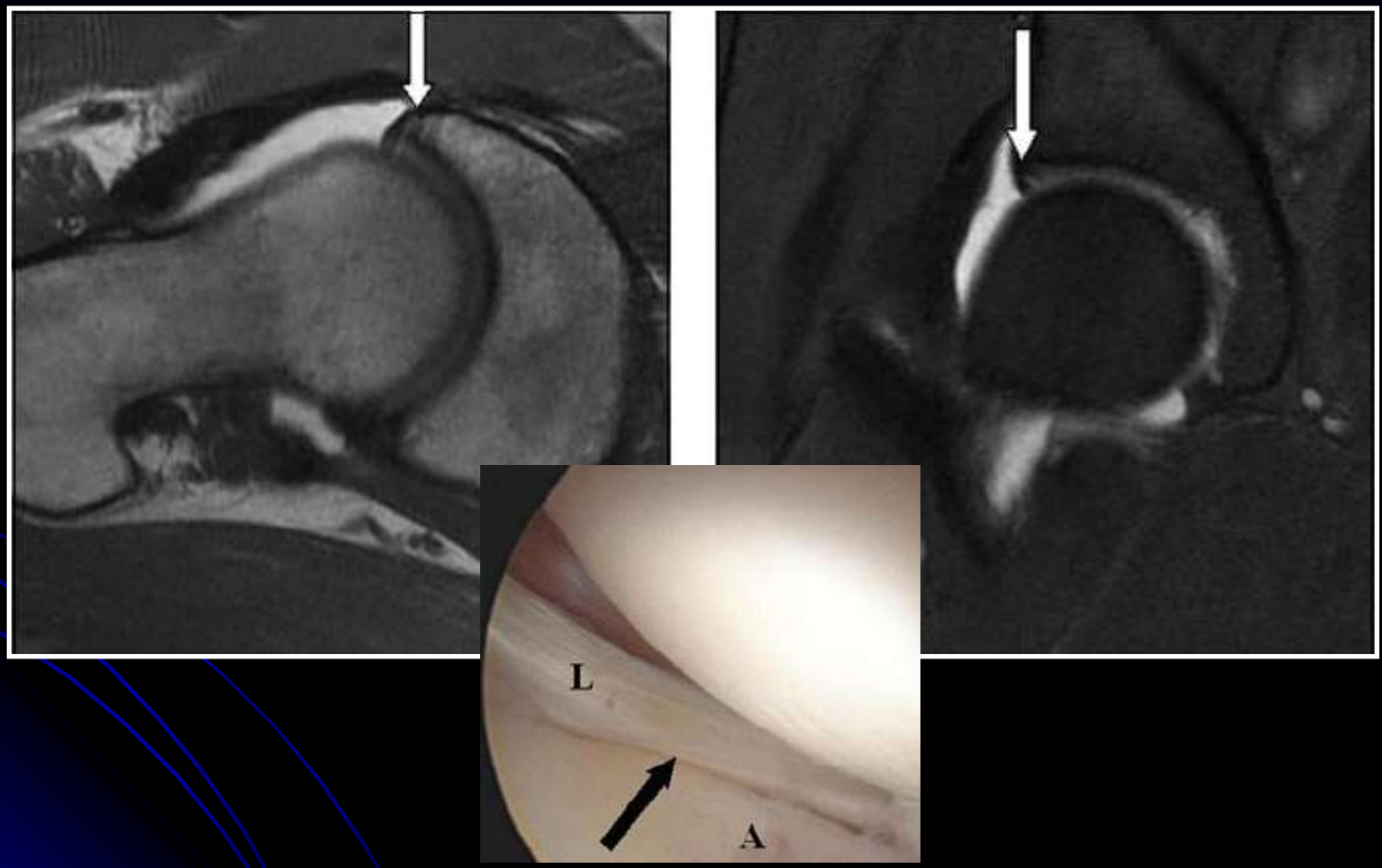
Posteroinferior Sublabral Sulcus[39]



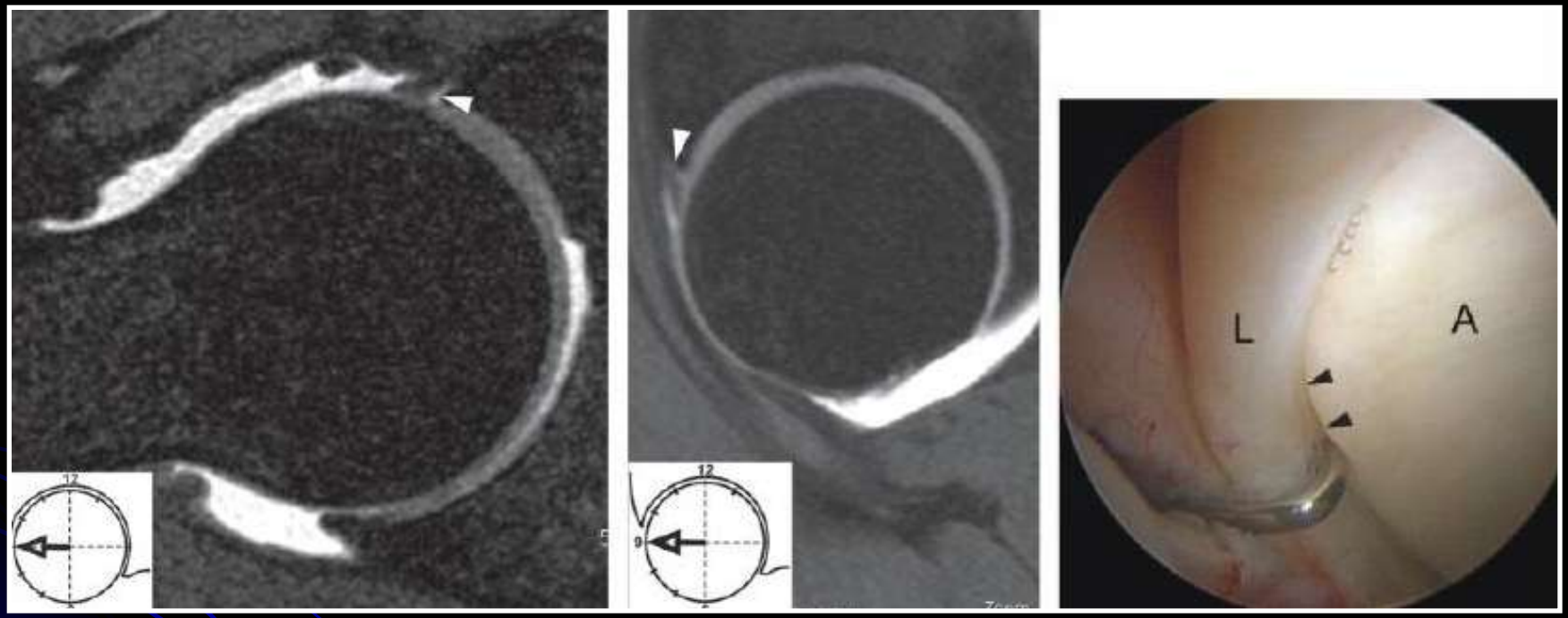
Posterosuperior Sublabral Sulcus[39]



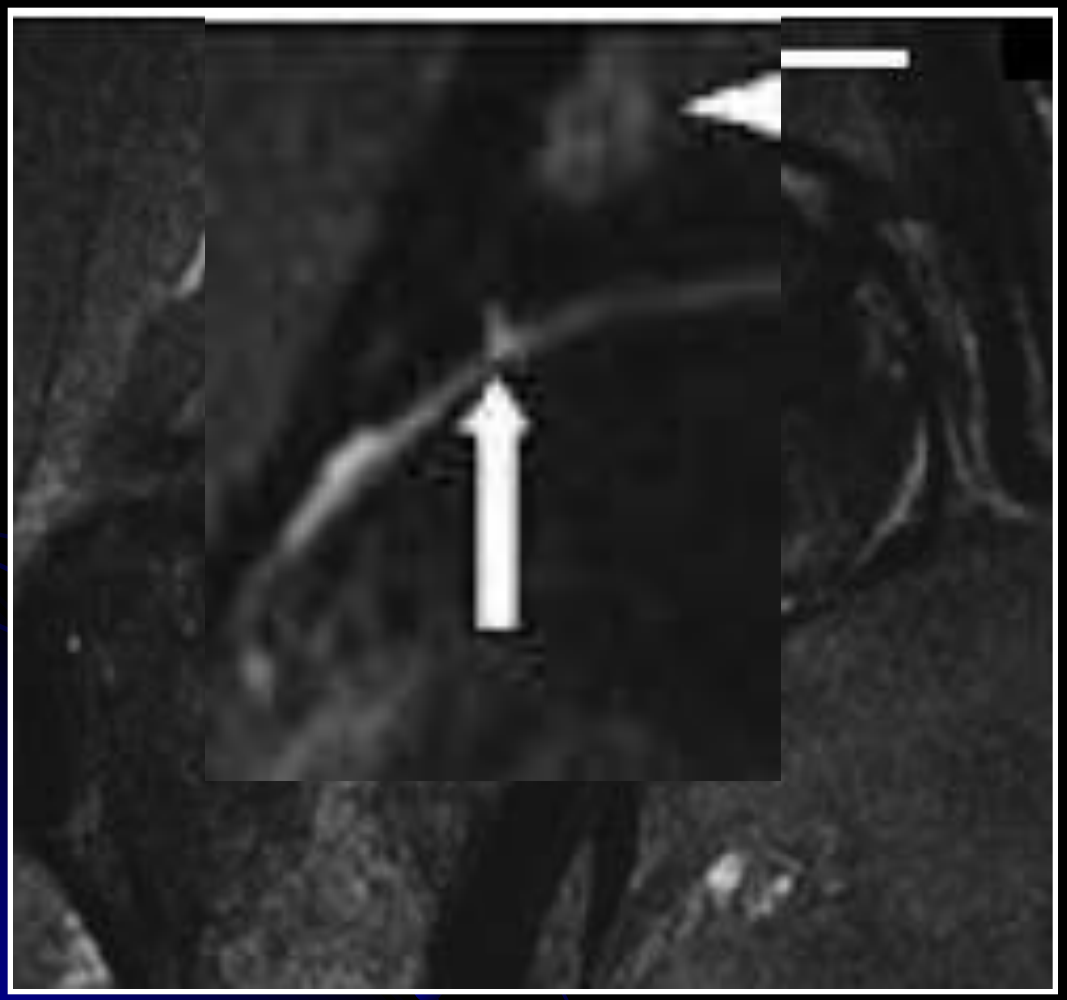
Anterosuperior Sublabral Sulcus[39]



Anteroinferior Sublabral Sulcus[40]

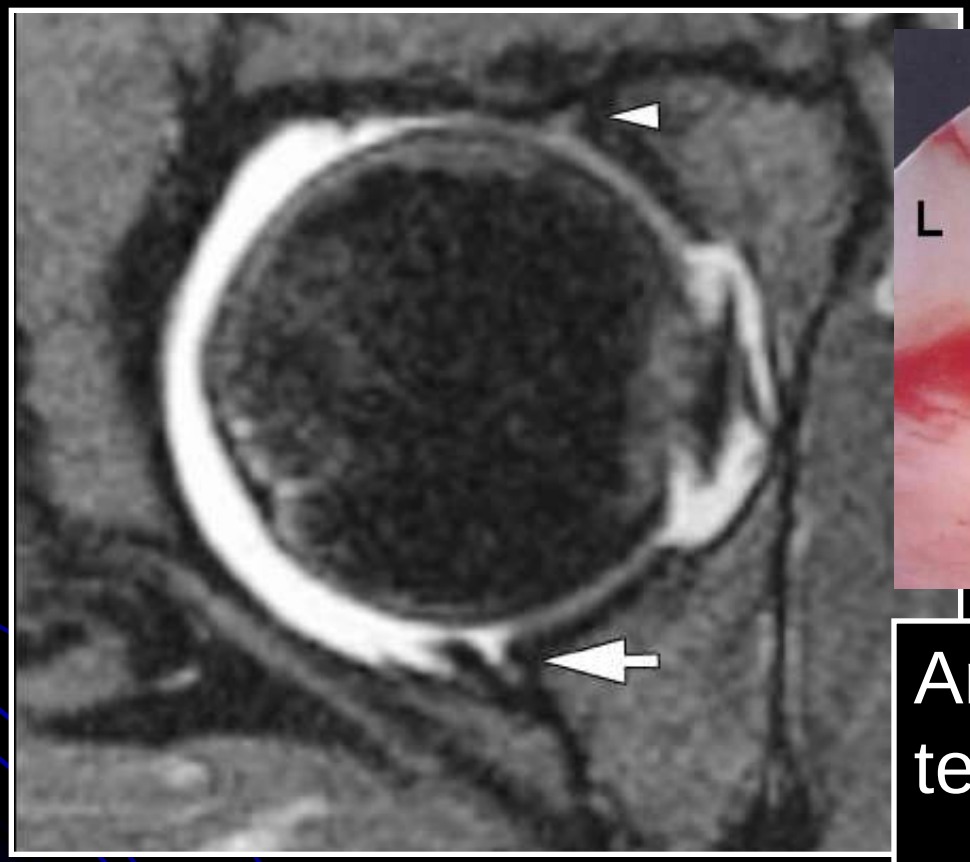


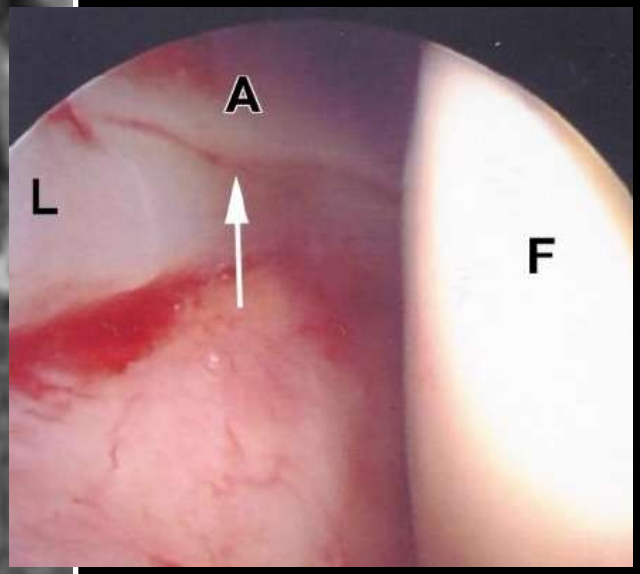
Tear or Sublabral Sulcus[39]?



Anterosuperior labral tear on arthroscopy

Tear or Sublabral Sulcus[37]?





Anterior labral tear

Posterior sublabral sulcus

Sublabral Sulcus: Bottom Line

- Describe the labral finding.
- Location is key.
- If in anterosuperior labrum, consider a tear.
- If in posteroinferior labrum, likely a sulcus since most labral tears are anterosuperior in location.
- In other quadrants, be careful dismissing finding as normal sulcus.

Miscellaneous: Supraacetabular Fossa Stellate Crease/Lesion

Supraacetabular Fossa and the Stellate Crease or Lesion

Supraacetabular Fossa

- Normal notch within the acetabulum deficient of cartilage
- Located above the acetabular fossa at 12:00
- Usually seen in young people

Stellate Crease

- Normal area of stellate appearance of deficient cartilage at or near supraacetabular fossa, seen on arthroscopy

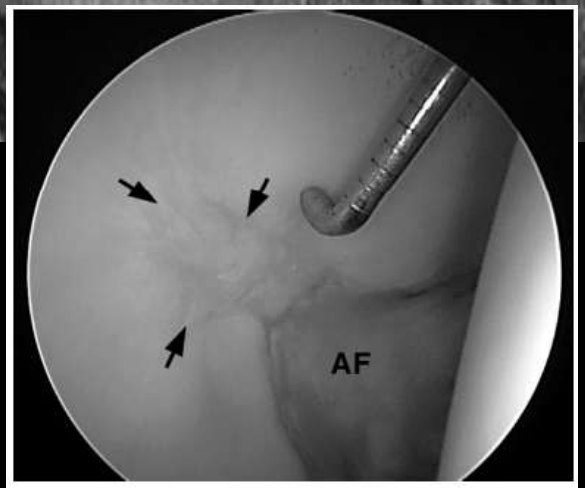
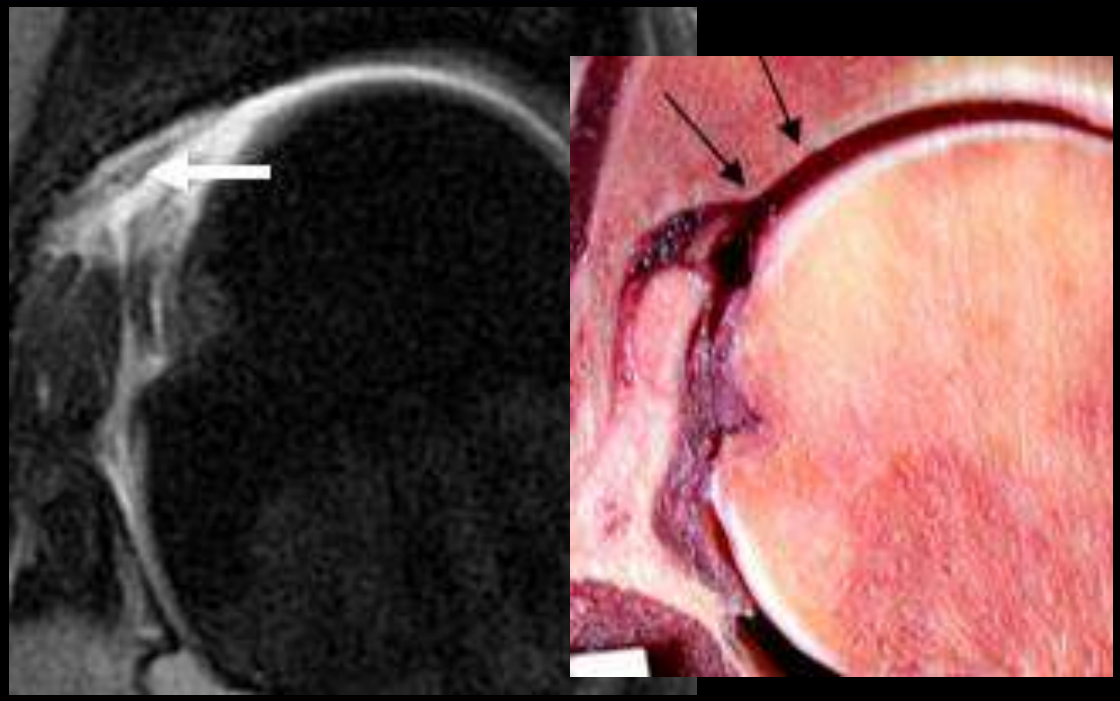


FIG. 27. The stellate crease is frequently found directly superior to the acetabular fossa (AF) characterized by a stellate pattern of chondromalacia (arrows). This appears to be a normally occurring process, even in young adults, without clear prognostic significance. (Courtesy of J. W. Thomas Byrd, MD.)

Stellate Lesion

- A subchondral osseous fragment within the stellate crease
- A plica attached to the medial aspect of the fragment, extending medially and inferiorly
- May be symptomatic
- Hip plica described in arthroscopy literature[41]



Courtesy of Drs Resnick and Sampatchalit

Stoller D. MRI in Orthopaedics and Sports Medicine 3rd Edit.

Summary

- Normal anatomy and pathology of the capsule, ligaments and labrum of the hip
- Pitfalls in imaging of the labrum
- Stellate lesion

Thank you! Come visit in SF!

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