Hip and Thigh Ultrasound

Jon A. Jacobson, MD

FACR, FAIUM, FSRU, RMSK

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Disclosures

- Consultant: Bioclinica
- Contractor: POCUS PRO
- Book Royalties: Elsevier
- Not relevant to this lecture

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Outline:

- Sonographic technique
- Normal anatomy
- Common pathology

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Sonographic Technique: *hip and thigh*

- Anterior:
  - Hip joint
  - Anterior hip muscles, iliopsoas bursa
  - Consider: symphysis pubis, inguinal hernia
- Lateral: gluteal tendons, bursae
- Medial: adductors
- Posterior: hamstring

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Sonographic Technique: Hip

- Anterior
  - Hip joint
  - Anterior musculature
  - Snapping iliopsoas
  - Iliopsoas bursa
  - Lateral femoral cutaneous nerve
- Transducers:
  - 10 – 15 MHz linear
  - <10 MHz curvilinear if needed

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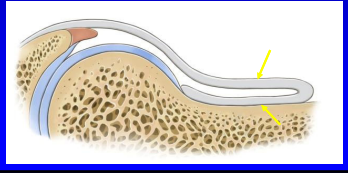
Hip: anterior recess

- Anterior and posterior layers
  - Fibrous tissue + minute layer of synovium
  - Hyperechoic
  - Each 2 - 4 mm thick

Radiology
1999; 210:499



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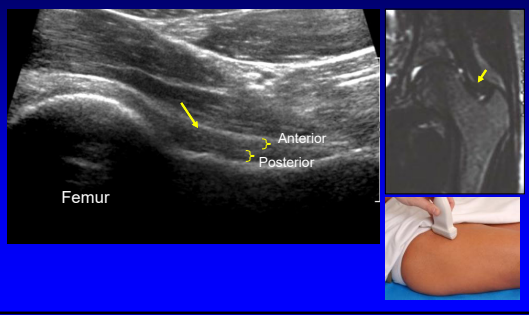
Hip: anterior recess



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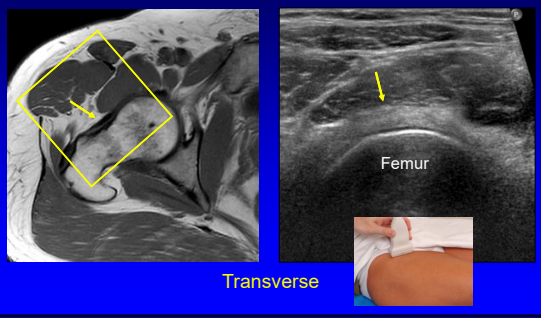
Hip Joint



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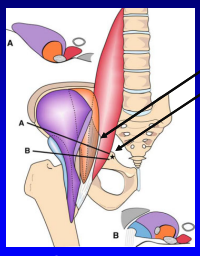
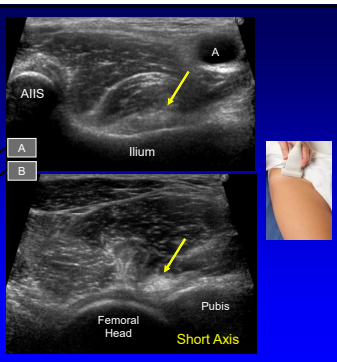
Iliopsoas Complex



From: Guillin R. et al. Eur Rad 2009; 19:995



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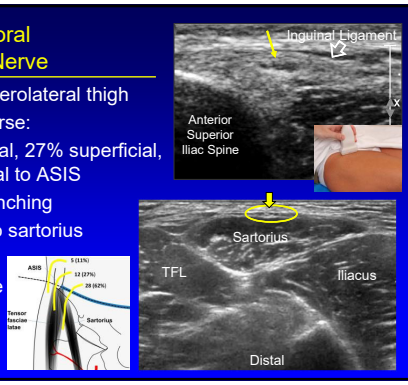
Lateral Femoral Cutaneous Nerve

- Sensory: anterolateral thigh
- Variable course:
  - 62% medial, 27% superficial, 11% lateral to ASIS
- Variable branching
- Superficial to sartorius
  - Lateral fat triangle

Rudin D et al. JBJS 2016; 98:561



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Sonographic Technique: Hip

- Lateral
  - Greater trochanter
  - Gluteal tendons
  - Bursae
  - Snapping hip
- Transducers:
  - 10 – 12 MHz linear
  - <10 MHz curvilinear if needed

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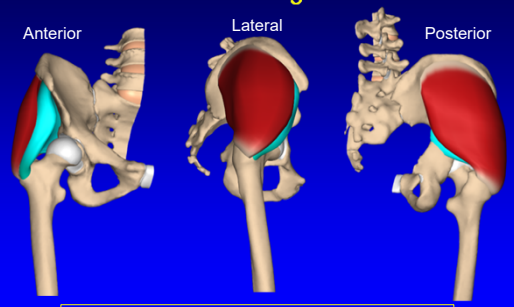
Greater Trochanter: gluteal tendons



Gluteus medius (red) Gluteus minimus (blue)

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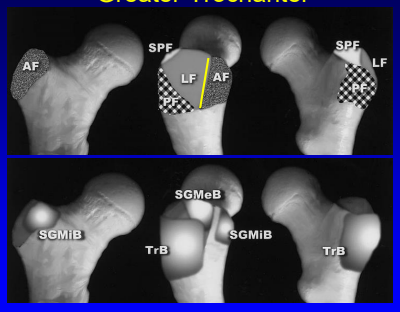
Greater Trochanter



FACETS: AF = anterior; LF = lateral; SPF = superoposterior; PF = posterior

Pfirrmann et al. Radiology 2001; 221:469

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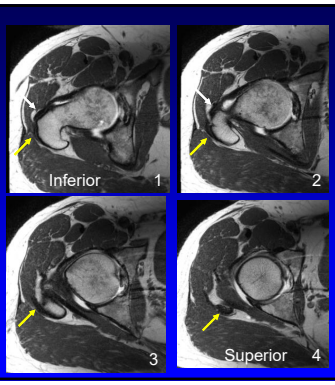
Greater Trochanter

Yellow arrow = gluteus medius

White arrow = gluteus minimus

Axial MRI



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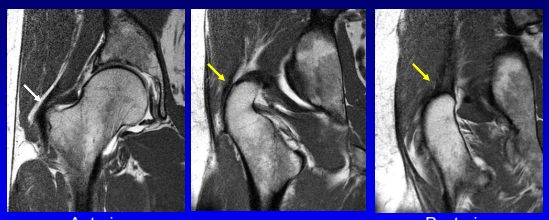
Greater Trochanter



Yellow arrow = gluteus medius
White arrow = gluteus minimus

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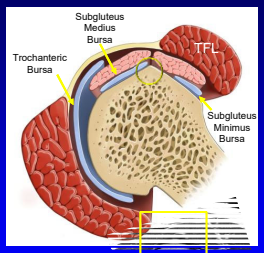
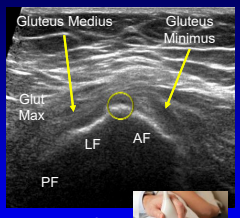
Greater Trochanter





AF: anterior facet
LF: lateral facet
PF: posterior facet

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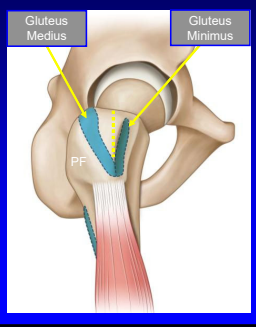
Gluteus Minimus and Medius: Long Axis



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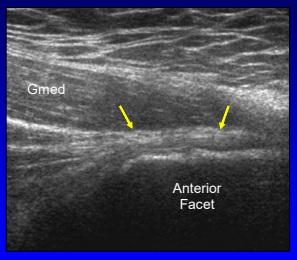
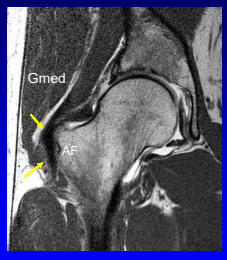
Gluteus Minimus: Long Axis





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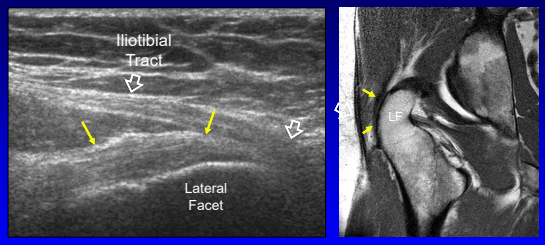
Gluteus Medius: Long Axis



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Sonographic Technique: Thigh

- Posterior:
  - Semimembranosus
  - Semitendinosus
  - Biceps femoris
    - Long and short heads
  - Sciatic nerve
- Transducers:
  - 10 – 12 MHz linear
  - <10 MHz curvilinear if needed

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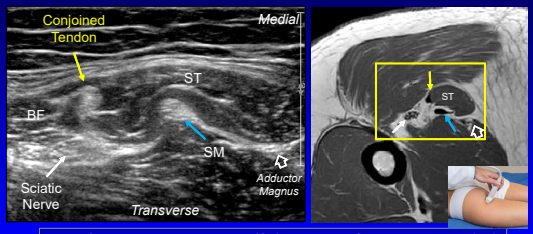
Proximal Hamstring: gluteal fold



Note: Conjoined semitendinosus (ST) and biceps femoris long head (BF) tendon (yellow arrow), semimembranosus (SM blue arrow), and sciatic nerve in a triangle configuration
Toggle transducer to eliminate anisotropy

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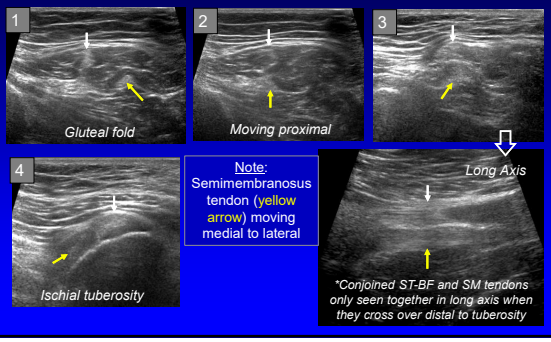
Proximal Hamstring: gluteal fold to ischial tuberosity



Note: Semimembranosus tendon (yellow arrow) moving medial to lateral

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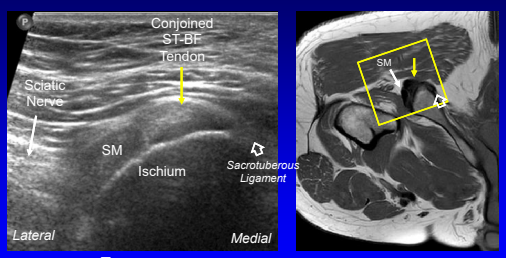
Proximal hamstring: at ischial tuberosity



Transverse

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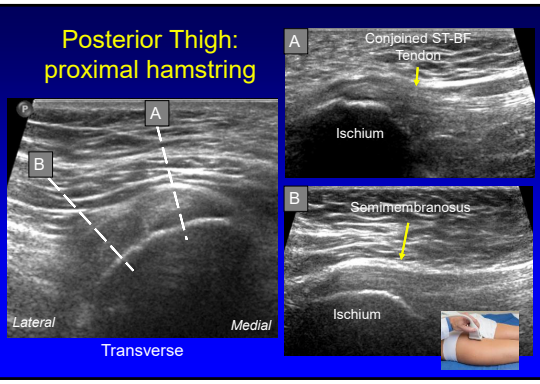
Posterior Thigh: proximal hamstring



Transverse

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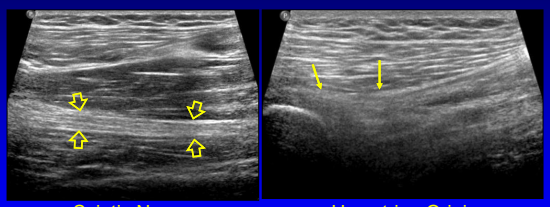
Posterior Thigh: longitudinal



Sciatic Nerve | Hamstring Origin

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Pathology:

- Joint abnormalities
- Bursal pathology
- Muscle and tendon injury
- Snapping hip syndrome
- Miscellaneous pathology

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Hip Effusion:

- Separation of anterior and posterior layers[1]
- Capsule distention at femoral neck > 7 mm or difference of 1 mm from opposite side[2]
- Extension & abduction improves visualization[3]
- Do not internally rotate hip: capsule thickens

[1]Radiology 1999; 210:449
[2]Scand J Rheumatology 1989; 18:113
[3]Acta Radiologica 1997; 38:867

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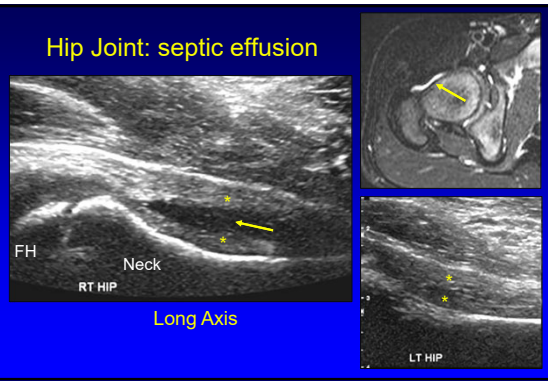
Hip Joint: septic effusion



Long Axis

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Hip Effusion: misconception

- It is <u>incorrect</u> to assume that joint fluid may not be seen anterior due to gravity
- Native hip: joint fluid distributes around femoral neck
- In no cases was fluid only seen posterior
- Exception: after hip surgery

Moss et al. Radiology 1998; 208:43

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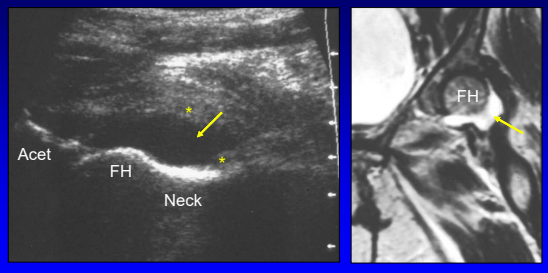
Hip Joint: aseptic effusion



Sagittal

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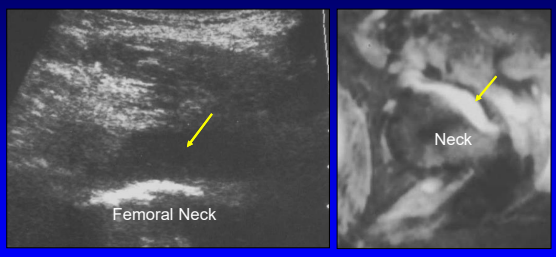
Hip Joint: aseptic effusion



Axial

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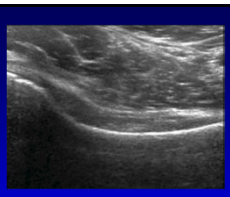
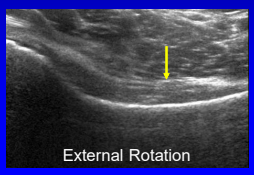
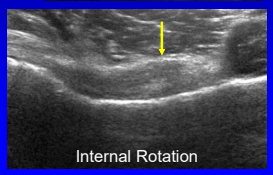
Pitfall: capsule thickening

- Internal rotation of hip:
  - Anterior hip capsule
  - Thicker, convex anterior







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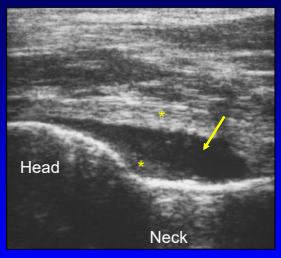
Hip Effusion:

- Cannot predict infection by ultrasound
- Negative power color Doppler does not exclude infection*
- Guided aspiration



* AJR 1998; 206:731

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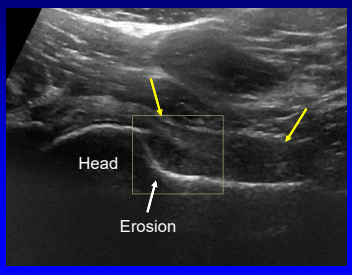
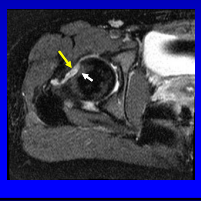
Pigmented Villonodular Synovitis





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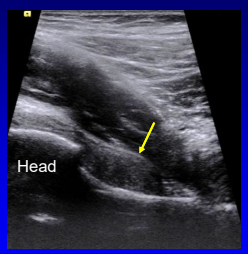
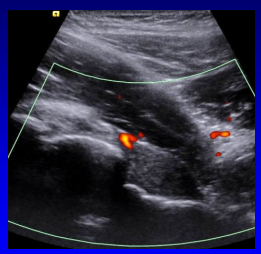
Juvenile Idiopathic Arthritis





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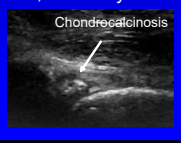
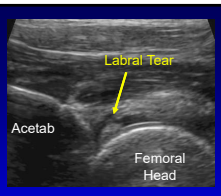
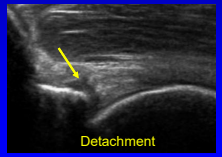
Hip Labrum

- Normal:
  - Hyperechoic, triangular
- Degeneration: hypoechoic
- Tear: anterior
  - Anechoic cleft
  - Sensitivity 82%, specificity 60%, accuracy 80%*







*Jin W et al. J Ultrasound Med 2012; 31:439

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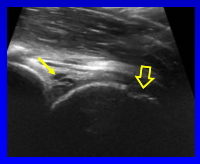
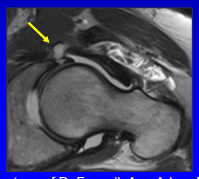
Labral Tear and Paralabral Cyst

- Associated with labral tear
  - Full-thickness or detachment
- Anechoic to hypoechoic
- Multilocular





Courtesy of D. Fessell, Ann Arbor, MI

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Femoroacetabular Impingement

- Pincer-type: deep acetabulum
- Cam-type
  - Broad irregular femoral neck
  - Possible cortical irregularity at US
- Associated with anterior labrum tear
- Consider dynamic evaluation

Radiology 2005; 236:588

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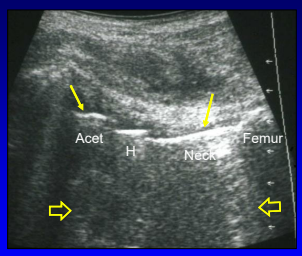
Total Hip Arthroplasty:

- Metal components demonstrate posterior reverberation
- Artifact occurs deep to prosthesis away from fluid collection (unlike MRI, CT)



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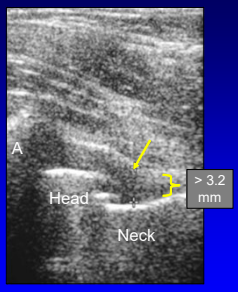
Hip Arthroplasty:

- Ultrasound cannot differentiate small effusion from post-op change[1]
- Suspect infection:
  - Pseudocapsule > 3.2 mm: suspect infection[2]
  - Extra-articular fluid collection
  - Not visualized with arthrography if non-communication



[1]Weybright PN et al. AJR 2003; 181:215
[2]AJR 1994; 163:381

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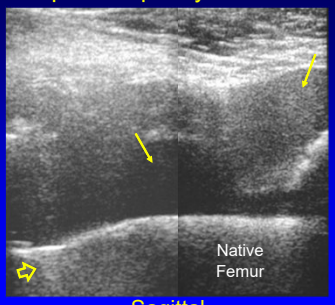
Hip Arthroplasty: infection

Superior

Inferior



Sagittal

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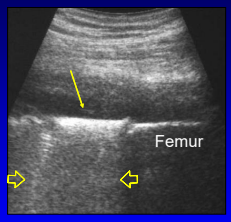
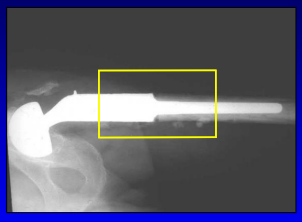
Hip Arthroplasty: infection





Coronal

Radiograph

Teaching Point:
Always screen soft tissues about an arthroplasty prior to fluoroscopic joint aspiration

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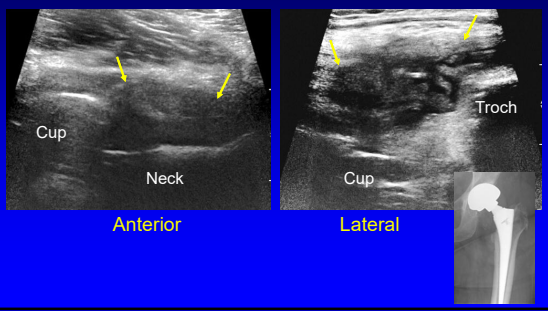
Metal-on-Metal Arthroplasty: pseudotumor



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Pathology:

- Joint abnormalities
- Bursal pathology
- Muscle and tendon injury
- Snapping hip syndrome
- Miscellaneous pathology

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Trochanteric Pain Syndrome:

- Most commonly caused by gluteus minimus and medius tendon abnormalities[1]
- Trochanteric bursitis: uncommon
  - 20% of symptomatic patients[2]
  - Not actually inflamed[3]
  - Not associated with pain[4]

[1]Eur Rad 2007; 17:1772
[2]Long SS et al. AJR 2013; 201:1083
[3]Clin Rheumatol 2008; 14:82
[4]Skeletal Radiol 2008; 37:903

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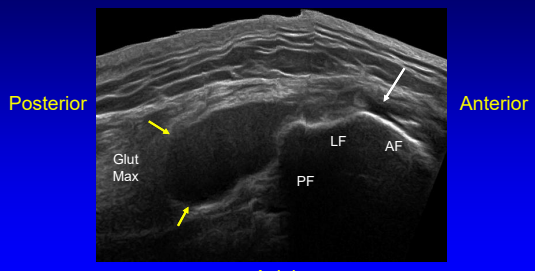
Trochanteric Bursal Fluid + Glut Min Tear



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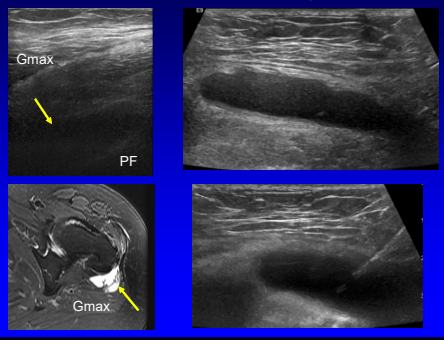
Trochanteric Bursitis: Septic

Note posterior location of bursa



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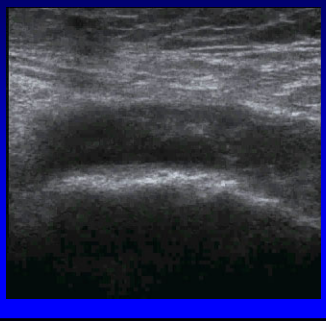
Trochanteric Bursitis



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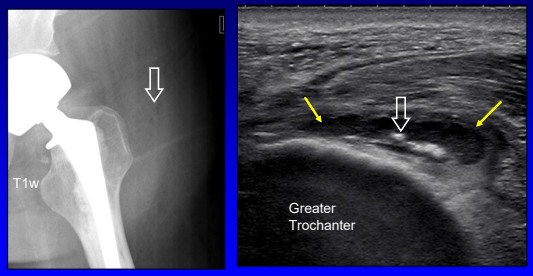
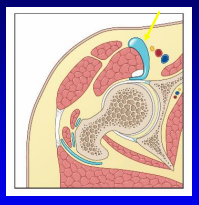
Trochanteric Bursa: infection + gas



49

Iliopsoas Bursa

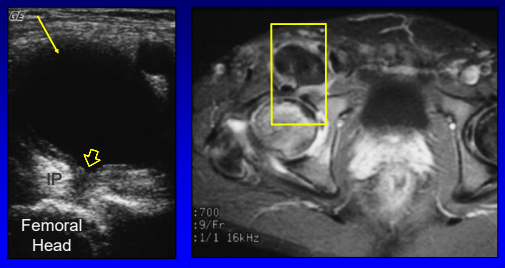
- Hip joint communication in 10%
  - Increased with hip joint pathology
  - After joint replacement
- May extend cephalad into abdomen
- May be mistaken for psoas abscess
  - Look for hip joint communication



Radiology 1995; 197:853

50

Iliopsoas Bursal Fluid

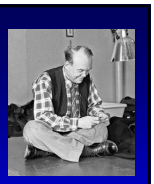


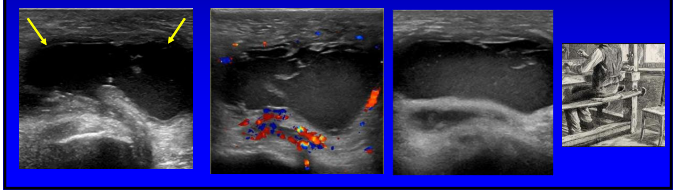
Axial T1w post-gadolinium

51

Ischial or ischiogluteal Bursa

- Uncommon
- "Weaver's or Tailor's Bottom"
- Between ischial tuberosity and gluteus maximus





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Pathology:

- Joint abnormalities
- Bursal pathology
- Muscle and tendon injury
- Snapping hip syndrome
- Miscellaneous pathology

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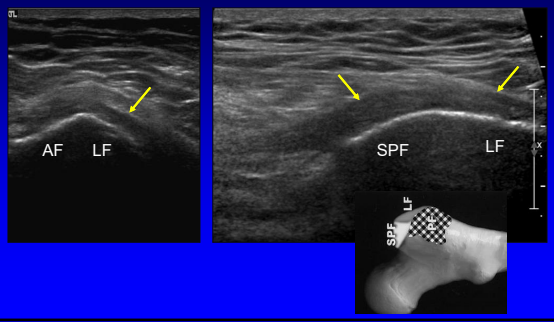
Muscle and Tendon Injury

- Tear:
  - Anechoic or hypoechoic defect
  - Partial-thickness tear
  - Full-thickness tear: retraction
- Tendinosis:
  - Hypoechoic, enlarged
  - No inflammation (not tendinitis)

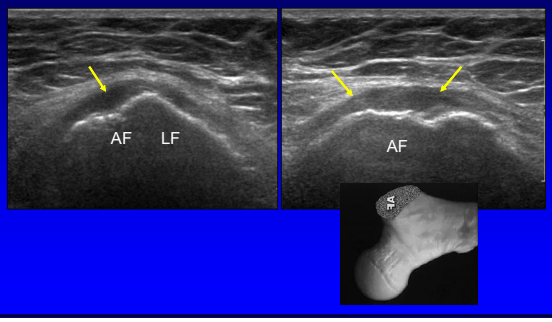
54

Tendinosis: Gluteus Medius



55

Tendinosis: Gluteus Minimus



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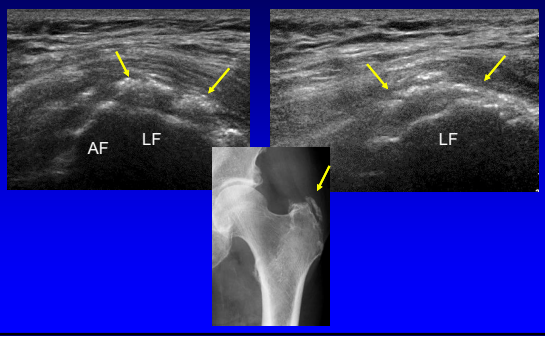
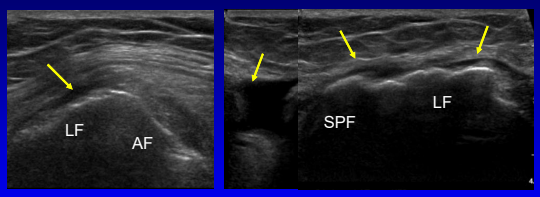
Calcific Tendinosis: Gluteus Medius



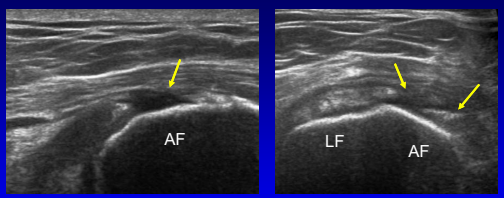
57

Tear: Gluteus Medius after THA



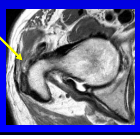
58

Tear: Gluteus Minimus



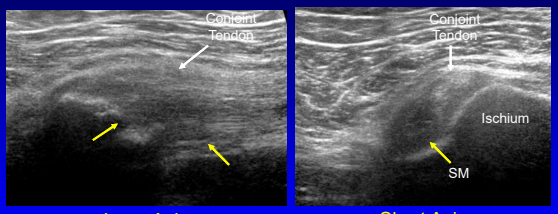
>2 mm cortical irregularity depth (x-ray) = 90% positive predictive value for gluteus tendon tear

Steinert et al. Radiology 2010; 257:754



59

Semimembranosus: tendinosis

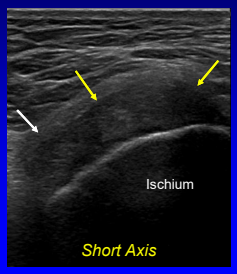


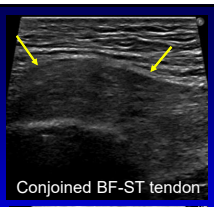
Long Axis

Short Axis

60

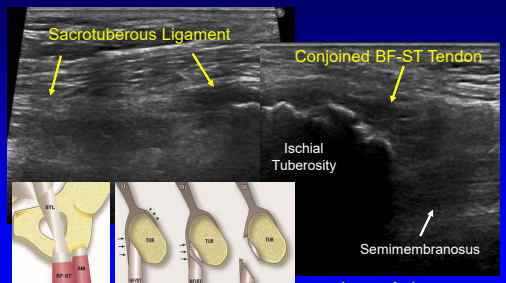
Conjoined Biceps Femoris-Semitendinosus: tendinosis





61

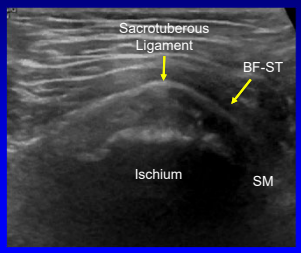
Conjoined BF-ST Tendon: partial tear



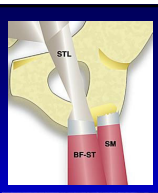
From: Bierry et al. Radiology 2014; 271:162

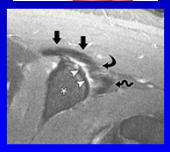
62

Snapping Conjoined Long Head Biceps Femoris, Semitendinosus + Sacrotuberous Ligament



Spencer-Gardner LS et al. PMR 2015; 7:1102





From Bierry G et al. Radiology 2014;271:162

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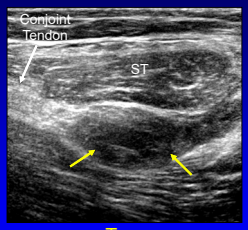
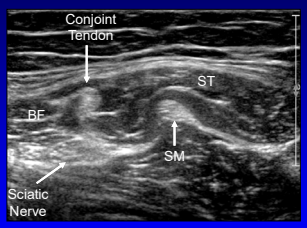
Semimembranosus Tear



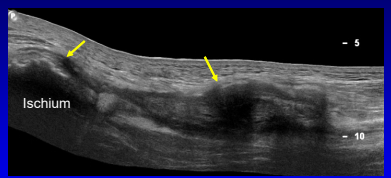
Tear



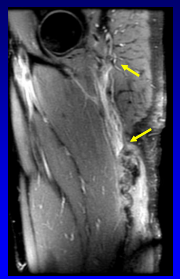
Normal

64

Hamstring: complete tear with retraction



Long Axis



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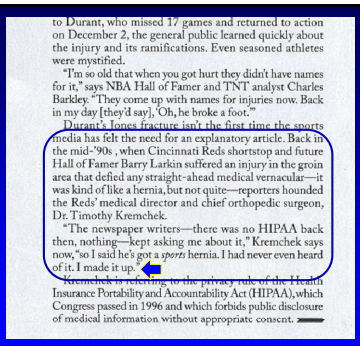
Sports Hernia?:

- A non-anatomic, non-diagnostic term attributed to many cause of groin pain
  - Tears or attenuation of inguinal structures
  - Bulge posterior wall of inguinal canal
  - Obturator nerve entrapment
  - Common aponeurosis abnormality:
    - Rectus abdominis and adductors tendons
  - Associated: pubic symphyseal instability, FAI

Omar IM et al. Radiographics 2008; 28:1415
Garvey JFW et al. Hernia 2010; 14:17
Hopkins JN et al. JBJS Reviews 2017; 5:1

66



to Durant, who missed 17 games and returned to action on December 2, the general public learned quickly about the injury and its ramifications. Even seasoned athletes were mystified.

"I'm so old that when you got hurt they didn't have names for it," says NBA Hall of Famer and TNT analyst Charles Barkley. "They come up with names for injuries now. Back in my day [they'd say], 'Oh, he broke a foot.'"

Durant's Jones fracture isn't the first time the sports media has felt the need for an explanatory article. Back in the mid-'90s , when Cincinnati Reds shortstop and future Hall of Famer Barry Larkin suffered an injury in the groin area that defied any straight-ahead medical vernacular—it was kind of like a hernia, but not quite—reporters hounded the Reds' medical director and chief orthopedic surgeon, Dr. Timothy Kremchek.

"The newspaper writers—there was no HIPAA back then, nothing—kept asking me about it," Kremchek says now, "so I said he's got a *sports* hernia. I had never even heard of it. I made it up."

Kremchek is referring to the privacy rule of the Health Insurance Portability and Accountability Act (HIPAA), which Congress passed in 1996 and which forbids public disclosure of medical information without appropriate consent.

Author: Joe Lemire, Hemisphere Magazine, Feb. 2015

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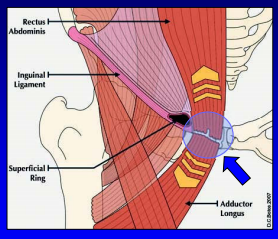
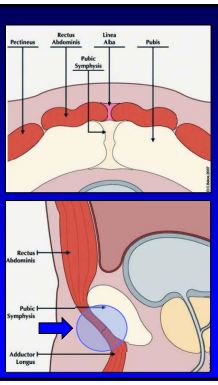
Rectus Abdominis + Adductor: "Sports Hernia"





Note: common aponeurosis

From: RadioGraphics 2008; 28:1415

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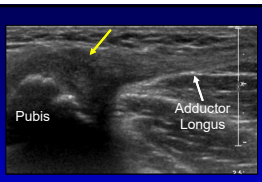
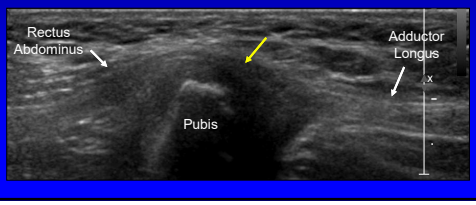
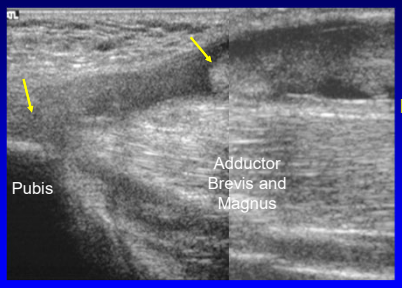
Rectus Abdominis / Adductor Tendinosis: "Sports Hernia"





69

Complete Tear: adductor longus



Long Axis

70

Pathology:

- Joint abnormalities
- Bursal pathology
- Muscle and tendon injury
- Snapping hip syndrome
- Miscellaneous pathology

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Snapping Hip Syndrome

- Painful snap with hip motion
- Intraarticular
- Extraarticular:
  - Anterior: iliopsoas tendon
  - Lateral: iliotibial tract or gluteus maximus

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Snapping Hip Syndrome: iliopsoas

- Image long axis to inguinal ligament superior to femoral head
- Extension of flexed abducted and externally rotated hip
- Abrupt movement of iliopsoas as iliacus muscle interposed between tendon and bone moves

Deslandes et al. AJR 2008; 190:576

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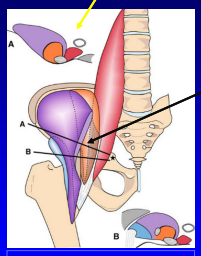
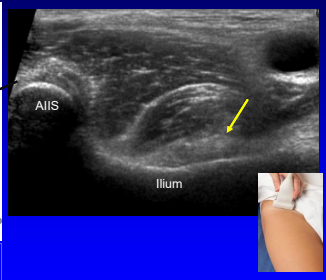
Iliopsoas Complex





Red: psoas major
Orange: medial iliacus fibers
Purple: lateral iliacus fibers

From: Guillin R. et al. Eur Rad 2009; 19:995

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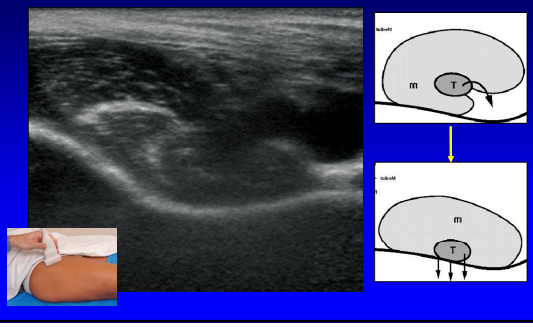
Snapping Hip Syndrome: *iliopsoas*



75

Snapping Hip: lateral

- Transverse over greater trochanter
- Hip external rotation / flexion
- Abrupt motion of iliotibial tract or gluteus maximus over greater trochanter

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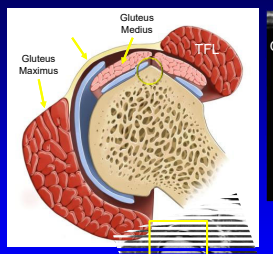
Snapping Gluteus Maximus / Iliotibial Band



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Pathology:

- Joint abnormalities
- Bursal pathology
- Muscle and tendon injury
- Snapping hip syndrome
- Miscellaneous pathology

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Lymph Node: malignant

- Gray scale:
  - Absent echogenic hilum
  - Narrow hilum with thick cortex
  - Round shape (not oval)
- Power Doppler:
  - Dense vascularity
  - Spotted, mixed, or peripheral (not hilar)
  - High resistance

Radiology 1992; 183:215

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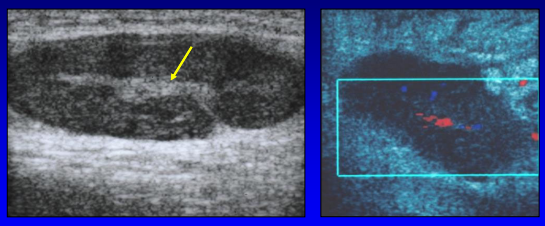
Lymph Node: reactive



Longitudinal color Doppler

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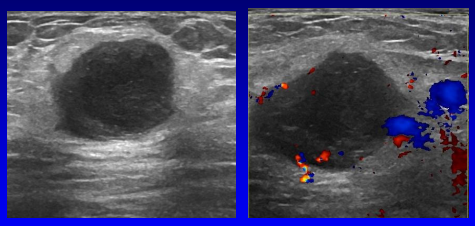
Lymph Node: Non-Hodgkins lymphoma



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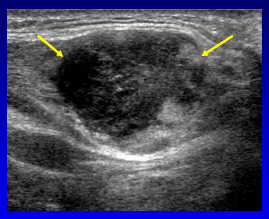
Undifferentiated Pleomorphic Sarcoma

- 70% intramuscular
- Hypoechoic
- May be heterogeneous
  - Necrosis
- Possible increased flow on color Doppler



Note: increased through-transmission

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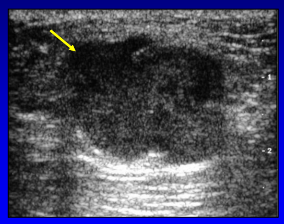
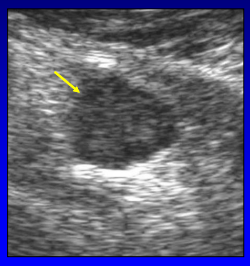
Recurrence: Ewing Sarcoma



Soft Tissue Metastasis: lung



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Take-home points: hip

- Joint effusion: anterior hip recess
- Greater trochanteric pain syndrome:
  - Gluteal tendon abnormality, not bursitis
- Tendon tendinosis: know bone footprints
- Snapping hip syndrome: dynamic evaluation
  - Iliopsoas
  - Iliotibial tract / gluteus maximus

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Thank you!
Syllabus on line and other educational material:
www.jacobsonmskus.com
Twitter handle: @jjacobsn

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