Disclosures:

• Consultant: Bioclinica
• Advisory Board: GE, Philips
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Pathology:

- Joint abnormalities
- Bursal pathology
- Muscle and tendon injury
- Snapping hip syndrome
- Miscellaneous pathology
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
Hip Joint: septic effusion

Long Axis

FH
Neck
RT HIP

LT HIP
Hip Effusion: misconception

- It is **incorrect** 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
Hip Joint: aseptic effusion

Sagittal

Acet
FH
Neck

FH

Sagittal
Hip Joint: aseptic effusion

Femoral Neck

Axial

Neck
Hip Effusion:

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

* AJR 1998; 206:731
Synovial Hypertrophy: Infection

Longitudinal color Doppler

Acet
Head

Longitudinal
color Doppler
Pigmented Villonodular Synovitis
Juvenile Rheumatoid Arthritis

Head
Hip Labrum

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

Labral Tear and Paralabral Cyst

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

Note: labral tear (yellow arrow) and osseous bump (white arrow)

Courtesy of M. van Holsbeeck, Detroit, MI
FAI: Ultrasound

- Ultrasound can demonstrate a bony protuberance and non-spherical head associated with CAM FAI
- Alpha angle measurements
  - Buck et al.: unreliable
  - Lerch et al.: strong correlation with MRI

Femoroacetabular Impingement

Sagittal-oblique
Total Hip Arthroplasty:

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

Superior

Inferior

Native Femur

Sagittal
Hip Arthroplasty: infection

Teaching Point:
Always screen soft tissues about an arthroplasty prior to fluoroscopic joint aspiration
Metal-on-Metal Arthroplasty: pseudotumor

Anterior

Cup
Neck

Lateral

Cup
Troch
Pathology:

- Joint abnormalities
- Bursal pathology
- Muscle and tendon injury
- Snapping hip syndrome
- Miscellaneous pathology
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\(^4\)

\(^1\)Kong A et al. Eur Rad 2007; 17:1772
\(^2\)Long SS et al. AJR 2013; 201:1083
\(^3\)Sylva F et al. Clin Rheumatol 2008; 14:82
\(^4\)Blankenbaker DG et al. Skeletal Radiol 2008; 37:903
Trochanteric Bursitis
Trochanteric Bursal Fluid + Glut Min Tear

Axial
Trochanteric Bursitis
Trochanteric Bursa: infection + gas
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
Iliopsoas Bursal Fluid

Axial

T1w post-gadolinium

Femoral Head

IP
Ischial or ischiogluteal Bursa

- Uncommon
- “Weaver’s Bottom”
- Between ischial tuberosity and gluteus maximus
Pathology:

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

• Tear:
  – Anechoic or hypoechoic defect
  – Partial-thickness tear
  – Full-thickness tear: retraction

• Tendinosis:
  – Hypoechoic, enlarged
  – No inflammation (not tendinitis)
Tendinosis: tensor fascia lata

Ilium

Long Axis

Asymptomatic Side
Tendinosis: Gluteus Medius
Tendinosis: Gluteus Minimus
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
Tear: Gluteus Medius after THA
>2 mm cortical irregularity depth (x-ray) = 90% positive predictive value for gluteus tendon tear

Steinert et al. Radiology 2010; 257:754
Post-operative: Gluteus Medius

Long Axis

Short Axis
Calcific Tendinosis: Gluteus Medius
Sports Hernia?:

- Bulge posterior wall of inguinal canal
  - Direct inguinal hernia
- Osteitis pubis
- Common aponeurosis abnormality:
  - Rectus abdominis and adductors tendons
- Obturator nerve entrapment

Garvey JFW, et al. Hernia 2010; 14:17
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.
Rectus Abdominis + Adductor: “Sports Hernia”

Note: common aponeurosis

From: RadioGraphics 2008; 28:1415
Rectus Abdominis / Adductor Tendinosis: “Sports Hernia”
Rectus Abdominis / Adductor Injury: “Sports Hernia”
Complete Tear: adductor longus

Proximal

Pubis

Adductor Brevis and Magnus

Distal

Long Axis
Aponeurosis Tear (Indirect Head): Rectus Femoris

Short Axis

Long Axis
Aponeurosis Tear (Indirect Head): Rectus Femoris

Short Axis

Long Axis
Calcific Tendinosis: rectus femoris
Rectus Femoris Injury

- Complete Tear
- Partial Avulsion

AIIS
Calcific Tendinosis

- Ultrasound-guided lavage and aspiration
- 20 gauge spinal needle

Before

After
Rectus Femoris Tear: full tear, pseudomass

Short Axis  Axial T1w post-gado
Rectus Femoris Tear: full tear, pseudomass

Long Axis
Semimembranosus Tear

Tear

Normal
Semimembranosus: tendinosis

Long Axis

Short Axis
Conjoined Biceps Femoris-Semitendinosus: tendinosis

Short Axis

Conjoined BF-ST tendon

Semimembranosus

Ischium
Conjoined BF-ST Tendon: partial tear

From: Bierry et al. Radiology 2014; 271:162
Hamstring: complete tear with retraction
Hamstring Tear:
FTT: Conjoint
PTT: semimembranosus
Biceps Femoris: remote tear

With muscle contraction

Long Axis
Semimembranosus: remote tear

Short Axis
Semimembranosus: remote tear

Long Axis
Seroma

Sagittal
Heterotopic Ossification:

- Hyperechoic
- Posterior acoustic shadowing and reverberation
- No surrounding soft tissue mass

J Ultrasound Med 1989; 8:463
Heterotopic Ossification

Longitudinal
Hamstring Tear:
FTT: Conjoint
PTT: semimembranosus

Conjoint Tendon

BF

ST

SM

Sciatic Nerve

Normal
Pathology:

• Joint abnormalities
• Bursal pathology
• Muscle and tendon injury
• Snapping hip syndrome
• Miscellaneous pathology
Snapping Hip Syndrome

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

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

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
Snapping Hip Syndrome: iliopsoas

Deslandes et al. AJR 2008; 190:576
Snapping Hip Syndrome: iliopsoas
Snapping Hip: lateral

- Transverse over greater trochanter
- Hip external rotation / flexion
- Abrupt motion of iliotibial tract or gluteus maximus over greater trochanter
Snapping Gluteus Maximus / Iliotibial Band
Pathology:

- Joint abnormalities
- Bursal pathology
- Muscle and tendon injury
- Snapping hip syndrome
- Miscellaneous pathology
Soft Tissue Abscess:

- Anechoic or hypoechoic
  - Less likely hyperechoic
- Posterior acoustic enhancement
- Swirling of contents with transducer pressure
- Hyperemia

AJR 1996; 166:149
Gluteus Muscle: abscess

Axial  

T1w post-gadolinium
Osteomyelitis:

- Soft tissue fluid collection adjacent to bone (adults)
- Subperiosteal fluid collection (children)
- Disruption of normal smooth bone cortex

Radiographics 1999; 19:585
Osteomyelitis: femur

Femur

Coronal
Inflammatory Myositis

- Acute: variable echogenicity, swollen
- Late:
  - Hyperechoic: fatty infiltration
  - Decreased size
- Possible hyperemia
- Infection, dermatomyositis, polymyositis
Polymyositis: sartorius

Transverse

Normal

Abnormal
Diabetic Muscle Infarction:

- Thigh and calf: long standing diabetes
- Hypoechoic, swollen, subfascial fluid
- Unlike abscess:
  - Muscle fibers and septa within
  - No anechoic or swirling fluid component

AJR 2000; 174:165
Diabetic Muscle Infarction: quadriceps

Transverse

Longitudinal
Diabetic Muscle Infarction: quadriceps

Transverse T2w  
T1w post-gadolinium
Posterior Thigh: Peripheral Nerves
Transection Neuroma:

- Neuroma formation:
  - Disorganized and tangled nerve end
  - Normal response to nerve transection
  - US important to determine if symptomatic

J Clin Ultrasound 1997; 25:85
Transection
Neuroma: sciatic
Meralgia Paresthetica

- Sensory: anterolateral thigh
- Hypoechoic enlargement
- Ultrasound-guided steroid injection
Lymph Node:

• Normal: echogenic hilum
  – Interfaces with fluid-filled sinuses
  – Not due to fat

• Abnormal: enlarged, short axis >1.5 cm

Radiology 1992; 183:215
Lymph Node: hyperplastic
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
Lymph Node: reactive

Longitudinal

color Doppler
Lymph Node: reactive
Lymph Node: B cell lymphoma

Case #1

Case #1

Case #2

Case #2
Lymph Node: Non-Hodgkins lymphoma

Case #2

Case #2
Lymph Node: angiosarcoma metastasis
Soft Tissue Sarcoma:

- Hypoechoic to mixed echogenicity
- US performs equal to MRI in detection of sarcoma recurrence\(^1\)
- US can detect non-palpable superficial recurrence\(^2\)

\(^1\)AJR 1991; 157:353
\(^2\)AJR 1997; 169:1449
Recurrent Sarcoma

Femur

Transverse

Longitudinal
Recurrence: Ewing’s Sarcoma
Take-home points

- Joint effusion: anterior recess
- Bursae: know locations
- Tendons: bone landmarks and footprints
- Snapping hip: dynamic evaluation