Lower Extremity Ultrasound with MRI Correlation

Jon A. Jacobson, MD, FACR

1

Outline

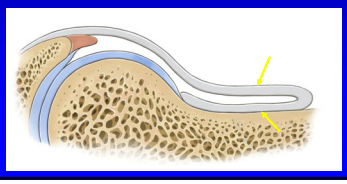
- Hip
  - Effusion
  - Trochanteric pain syndrome
  - Iliopsoas snapping
- Knee
  - Extensor mechanism
- Ankle and Foot
  - Achilles and peroneal tendons
  - Gout
  - Morton neuroma

2

Hip: anterior recess

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

Radiology 1999; 210:499



3

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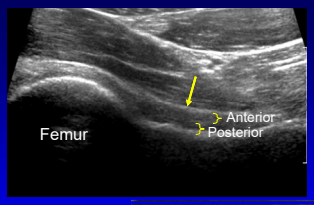
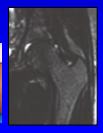
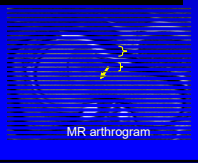
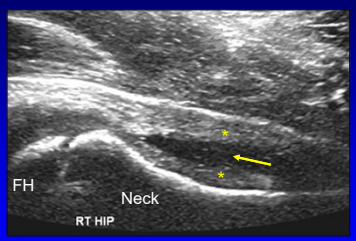




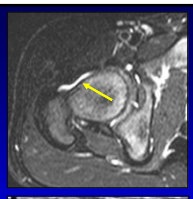


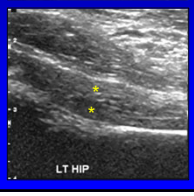
4

Hip Joint: septic effusion



Long Axis



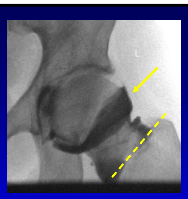


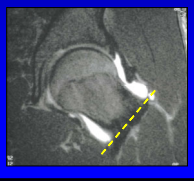
5

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

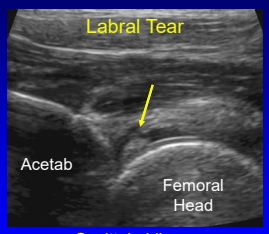




6

Hip Labrum

- Normal:
  - Hyperechoic, triangular
- Degeneration: hypoechoic
- Tear:
  - Anechoic cleft
  - Most common anterior
  - Possible paralabral cyst
  - Sensitivity 82%, specificity 60%*

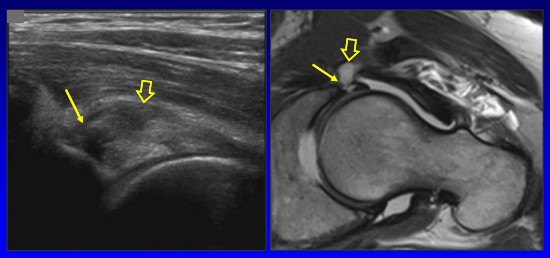


Sagittal-oblique

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

8

Labral Tear and Paralabral Cyst

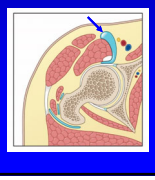


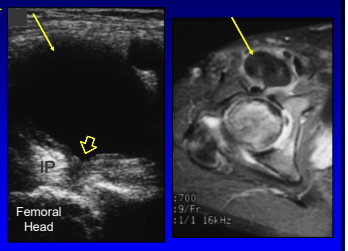
Courtesy of D. Fessell, Ann Arbor, MI

9

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



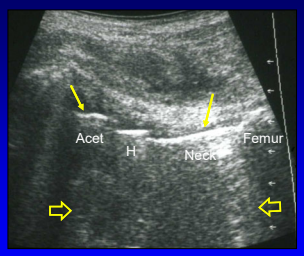


Radiology 1995; 197:853

10

Total Hip Arthroplasty:

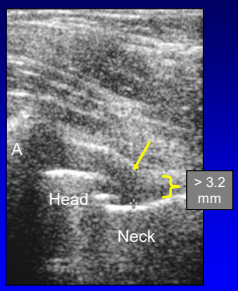
- Metal components demonstrate posterior reverberation
- Artifact occurs deep to prosthesis away from fluid collection (unlike MRI, CT)



11

Hip Arthroplasty:

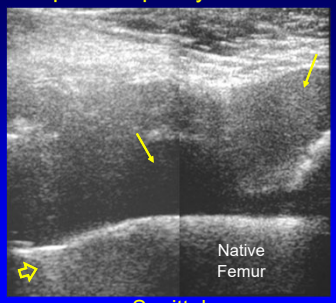
- Ultrasound cannot differentiate small effusion from post-op change[1]
- Suspect infection:
  - Pseudocapsule > 3.2 mm: suspect infection[2]
  - Extra-articular fluid collection
  - Not visualized with arthrography if non-communication



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

12

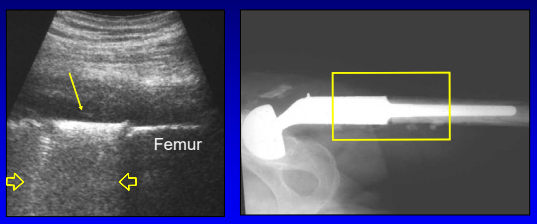
Hip Arthroplasty: infection



Sagittal

13

Hip Arthroplasty: infection



Coronal

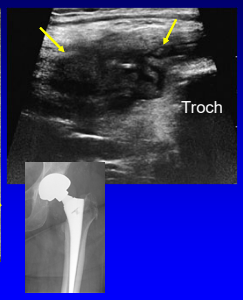
Radiograph

14

Metal-on-Metal: Pseudotumor

T1w

STIR



15

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16

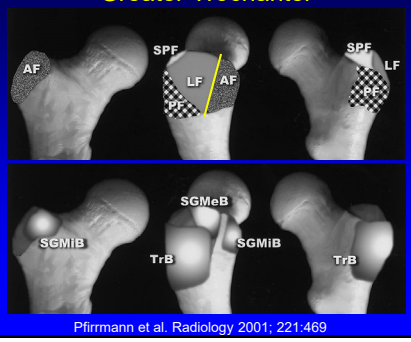
Trochanteric Pain Syndrome:

- 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

17

Greater Trochanter

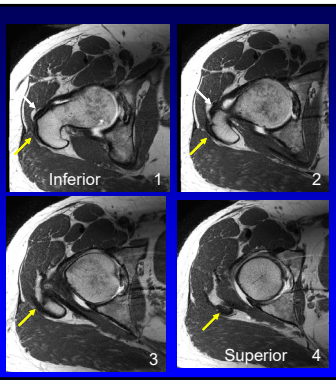


Pfirrmann et al. Radiology 2001; 221:469

18

Greater Trochanter

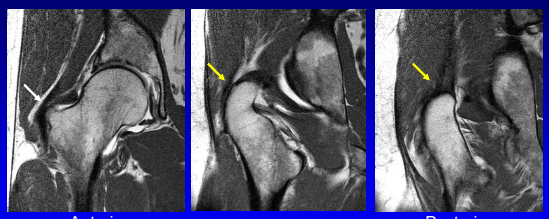
Yellow arrow = gluteus medius
White arrow = gluteus minimus



Axial MRI

19

Greater Trochanter



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20

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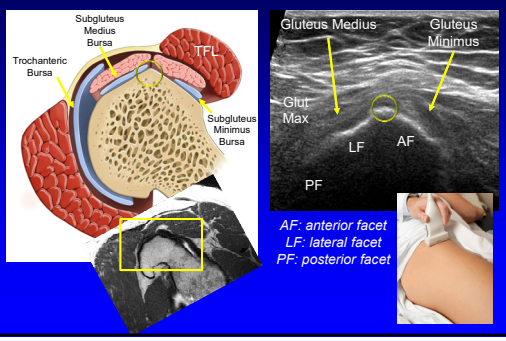


AF: anterior facet
LF: lateral facet
PF: posterior facet

21

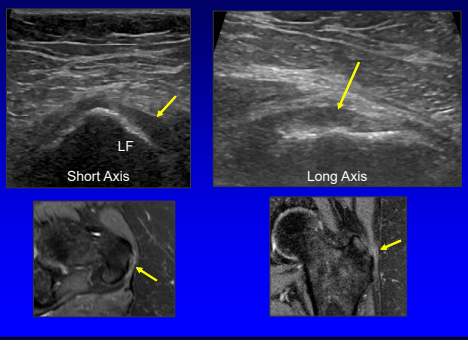
Gluteal Tendon Pathology:

- Tendinosis: hypoechoic, no defects
- Partial tear: anechoic clefts
- Complete tear: discontinuous tendon
- >2 mm cortical irregularity is associated with tendon tear
  - Positive predictive value = 90% (xray)*

*Steinert et al. Radiology 2010; 257:754

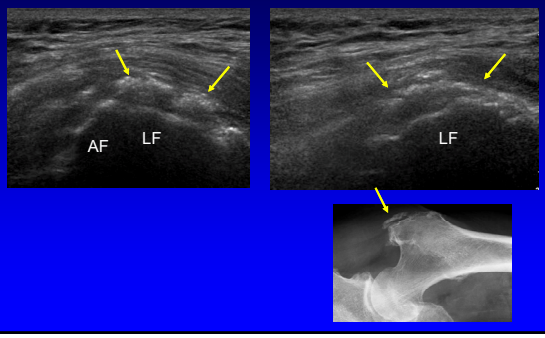
22

Gluteus Medius: tendinosis



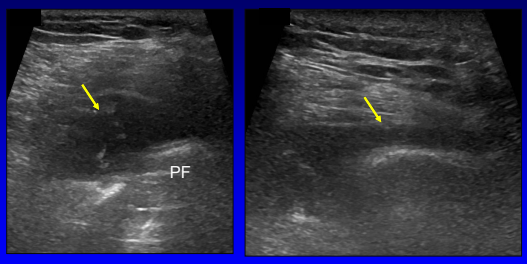
23

Calcific Tendinosis: Gluteus Medius



25

Trochanteric Bursitis



27

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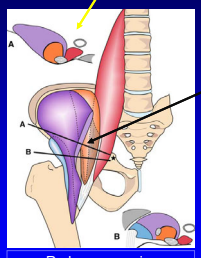
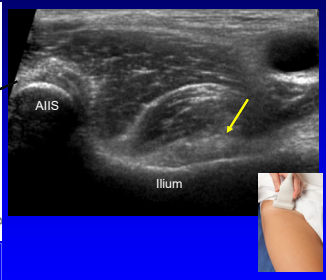
28

Iliopsoas Complex



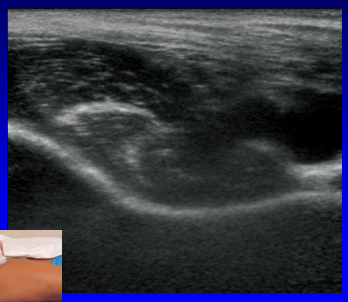


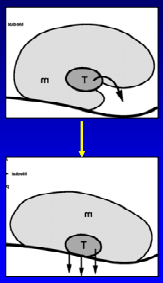
Red: psoas major
Orange: medial iliacus fibers
Purple: lateral iliacus fibers

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

29

Snapping Hip Syndrome: *iliopsoas*





30

Artificial Intelligence Failure: #21

Labradoodle versus Fried Chicken

32

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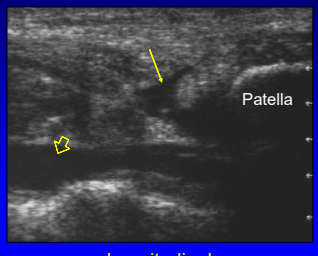
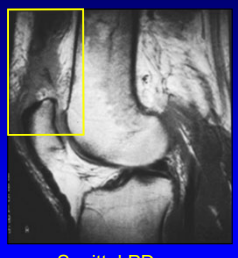
  - Gout
  - Morton neuroma

33

Quadriceps Tendon: full-thickness tear





Longitudinal

Sagittal PDw

34

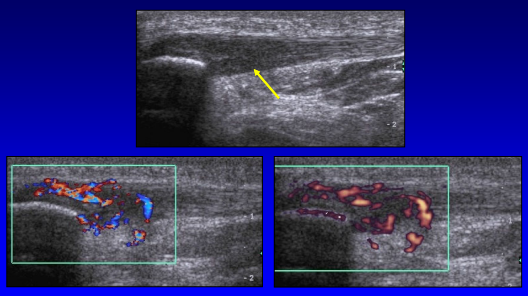
Patellar Tendinosis:

- Jumper's knee
- Hypoechoic swelling
- Mucoid degeneration, possible interstitial tearing
- Hyperemia: neovascularity
- No inflammatory cells

Radiology 1996; 200:821

36

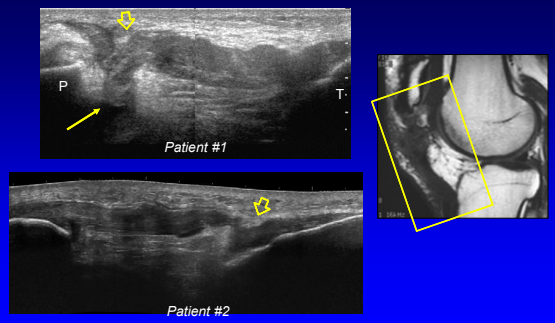
Patellar Tendon: tendinosis



color Doppler power Doppler

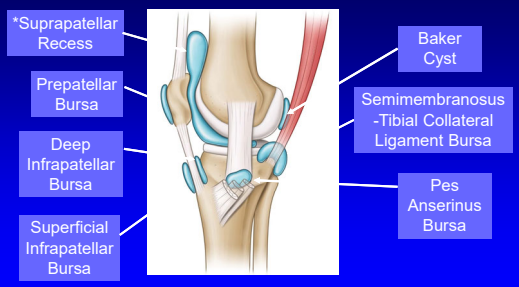
37

Patellar Tendon: full-thickness tears



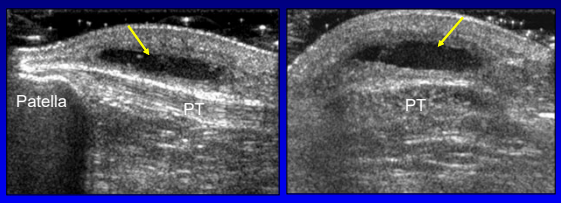
38

Knee Bursae



39

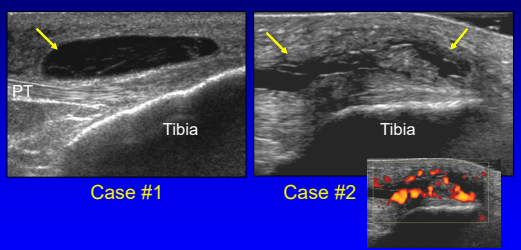
Prepatellar Bursa: aseptic fluid



Sagittal Axial

40

Superficial Infrapatellar Bursa

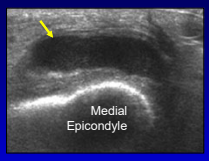


Case #1 Case #2

41

Adventitious Bursae:

- Site of friction
- Myxomatous degeneration of fibrous tissue
- Medial epicondyle:
  - Rider's bursa: horseback riding
  - Limbo-dancing
    - Trinidadian art form of limbo dancing



42

Artificial Intelligence Failure: #43

Chihuahua versus Blueberry Muffin

54

Outline

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- Knee
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- Ankle and Foot
  - Achilles and peroneal tendons
  - Gout
  - Morton neuroma

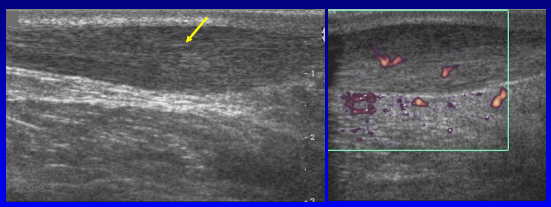
55

Achilles Tendon

- Locations:
  - 2 – 6 cm proximal to insertion
  - Calcaneal attachment: less common
    - Haglund syndrome
- Pathology:
  - Paratendinitis: no tendon sheath
  - Tendinosis: hypoechoic, enlarged
  - Partial tear: anechoic clefts
  - Full-thickness tear: retraction

56

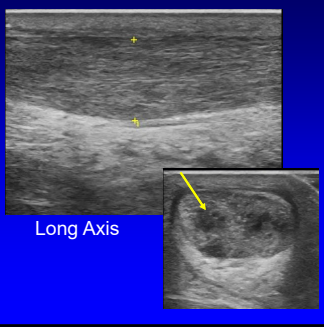
Tendinosis: Achilles



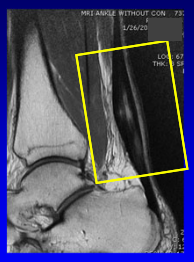
Longitudinal power Doppler

57

Achilles Tendon: partial-thickness tear

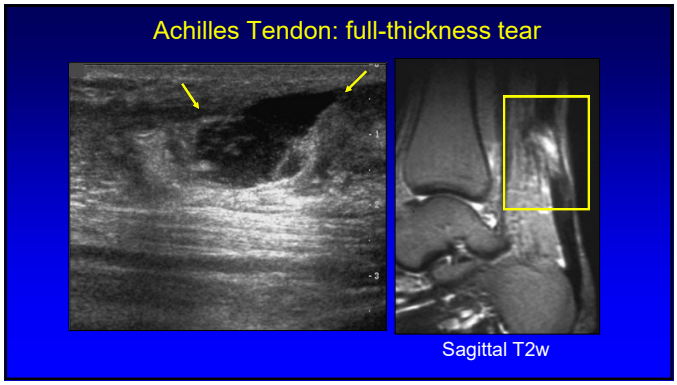


Long Axis



Courtesy of Jon Halperin, San Diego

58



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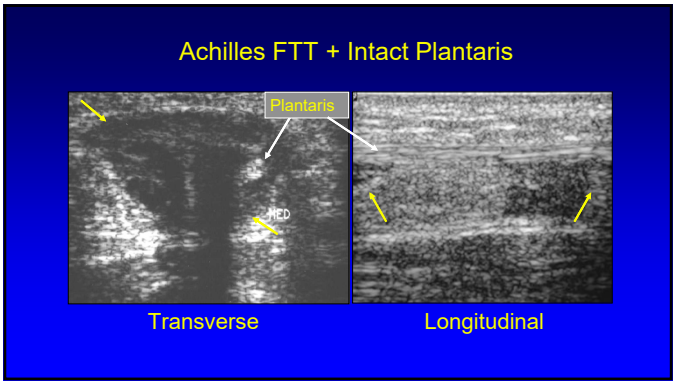

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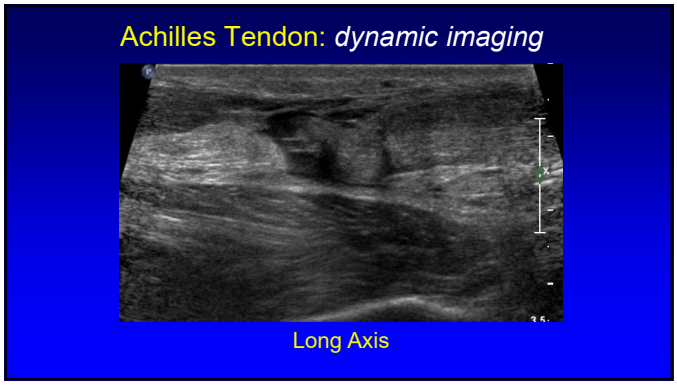
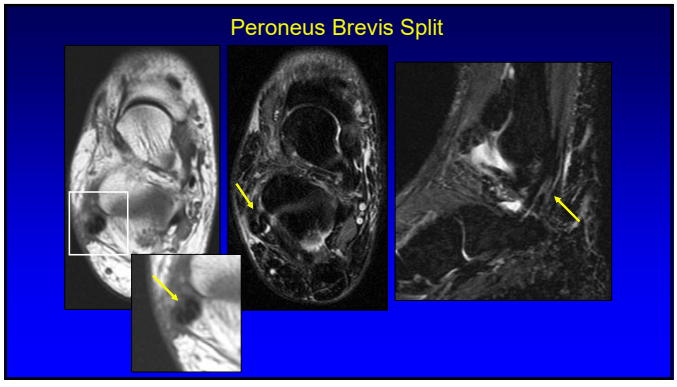
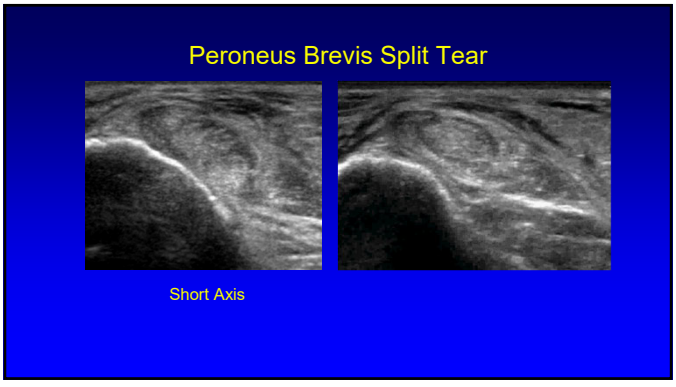


61

62

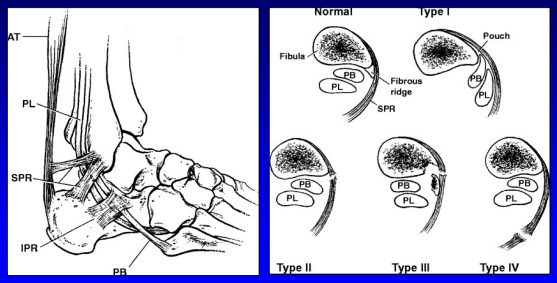


63



64

Peroneal Retinaculum



Rosenberg et al. AJR 2003; 181:1551

65

Peroneal Tendon Subluxation

- Abnormal movement may only occur dynamically
- Predisposes to peroneal tendon tears
  - Longitudinal split of peroneus brevis
- US: examine with dorsiflexion / eversion
  - 100% accurate US diagnosis

Neustadter et al. AJR 2004; 183:985

66

Intrasheath Subluxation

- Abnormal snapping of peroneal tendons
- No lateral displacement, intact retinaculum
- Associations:
  - Convex posterior fibula: 92%
  - Tendon tear in 86%
  - Low lying peroneus brevis muscle: 71%

J Bone Joint Surg Am 2008; 90:992
J Foot Ankle Surg 2009; 48:323

67

A rare image of shark stepping on a lego.

68

Outline

- Hip
  - Effusion
  - Trochanteric pain syndrome
  - Iliopsoas snapping
- Knee
  - Extensor mechanism
- Ankle and Foot
  - Achilles and peroneal tendons
  - Gout
  - Morton neuroma

69

Gout:

- Monosodium urate crystals:
  - Negative birefringence
- Stages:
  - Asymptomatic hyperuricemia
  - Acute gouty arthritis
  - Interval asymptomatic phase
  - Chronic tophaceous gout

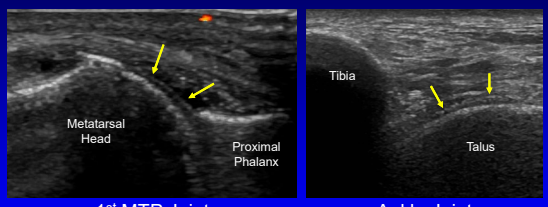
70

Gout:

- Joint effusion / synovial hypertrophy
- Double contour sign:
  - Monosodium urate crystal icing on cartilage
- Tophi:
  - Hyperechoic with hypoechoic rim
- Erosions:
  - Adjacent to tophi
  - Medial 1st metatarsal head

71

Gout: Double Contour Sign



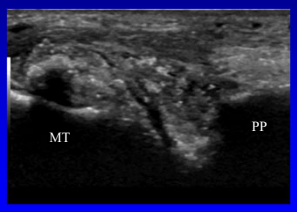
1st MTP Joint Ankle Joint

73

Tophi

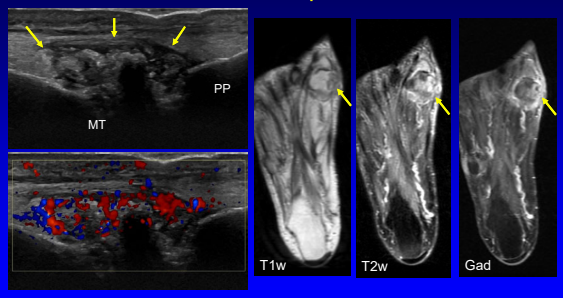
- Hyperechoic heterogeneous with hypoechoic rim
- Tiny internal speckles*
- "wet clump of sugar" appearance
- Variable shadowing: even without calcification

Fernandes et al. Skeletal Radiol 2011; 40:309



74

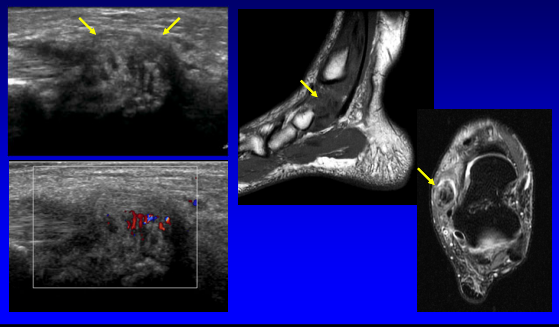
Gout: tophus



1st Metatarsophalangeal Joint

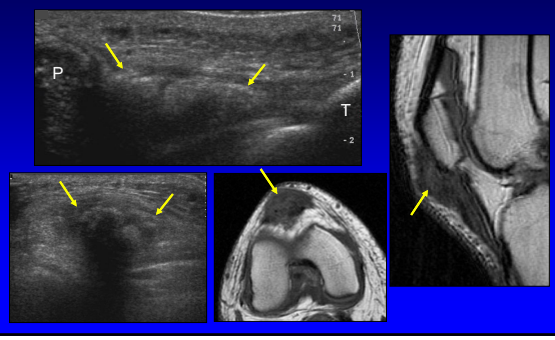
75

Gout: tibialis posterior tendon



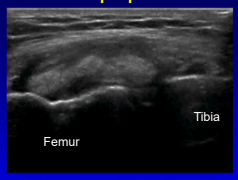
76

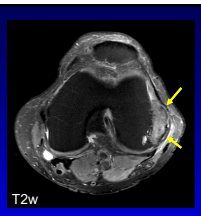
Gout: patellar tendon

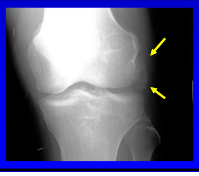


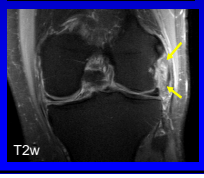
77

Gout: popliteus









78

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79

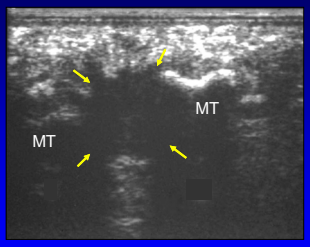
Morton Neuroma:

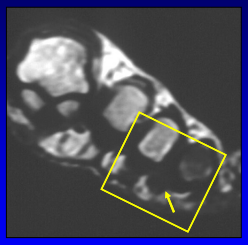
- Hypoechoic 5 mm mass
  - Sensitivity: 100% ; Specificity: 83%
- Digital nerve continuity*
  - Excludes other causes for mass
- Compression:
  - Produces symptoms
  - Bursa (compressible) vs. neuroma (not compressible)

Redd et al. Radiology 1989; 171:415
Quinn et al. AJR 2000; 174:1723

80

Morton Neuroma





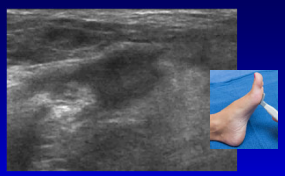
Transverse Coronal T1w

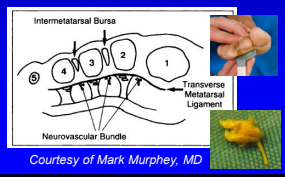
81

Dynamic Evaluation

- Compression
  - Between transducer and palpation
  - Bursae (dorsal) compress, neuromas (plantar) do not
- Sonographic Mulder Sign
  - Scan plantar: coronal plane
  - Neuroma displaces: plantar
  - Palpable click

Torriani M et al. AJR 2003; 180:1121
Zanetti M et al. Radiology 1997; 203:516

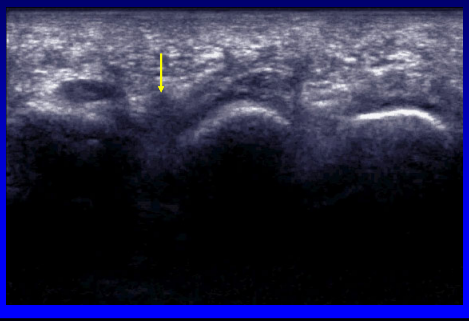




Courtesy of Mark Murphey, MD

82

Dynamic imaging: Mulder's Maneuver



83

Take Home Points

- Hip joint: screen for fluid anterior
- Trochanter pain syndrome: not bursitis!
- Iliopsoas snapping: dynamic evaluation
- Extensor mechanism (knee): not tendinitis
- Achilles and peroneals: dynamic imaging
- Gout: specific findings
- Morton neuroma: dynamic imaging

84

Thank you!

Syllabus on line and other educational material:
www.jacobsonmskus.com

Twitter handle: @jjacobsn

85