

Ultrasound of Common Ankle and Foot Pathology

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Disclosures

- Consultant: Bioclinica
- Advisor: Philips
- Book Royalties: Elsevier
- Not relevant to this lecture

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Fundamentals of Musculoskeletal Ultrasound are
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Outline:

- Tendon Pathology
- Ligament Pathology
- Inflammation
- Masses

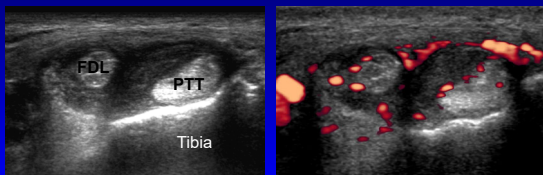
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Tenosynovitis: US

- Fluid distending tendon sheath
 - Anechoic or hypoechoic
 - May be heterogeneous, complex
- Synovial proliferation:
 - Hypoechoic
 - May be isoechoic to tendon
 - Variable flow on color Doppler imaging

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Tenosynovitis: ankylosing spondylitis



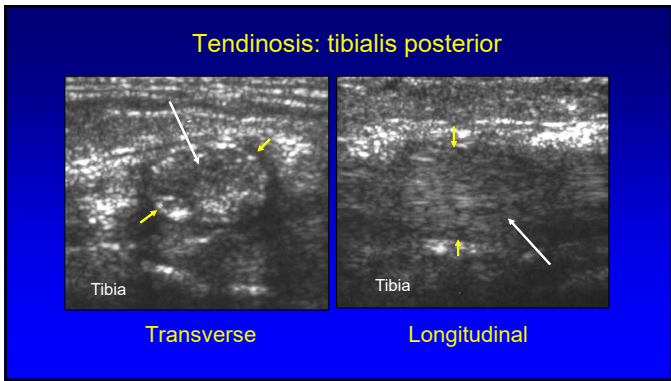
Short Axis

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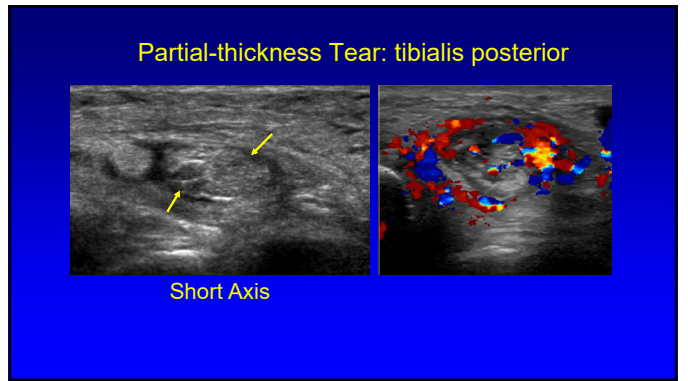
Tendinosis

- Tendon degeneration
- Not tendinitis: no acute inflammation
- Swollen, hypoechoic tendon
- Unlike tear:
 - Tendon fibers still continuous
 - No defined clefts

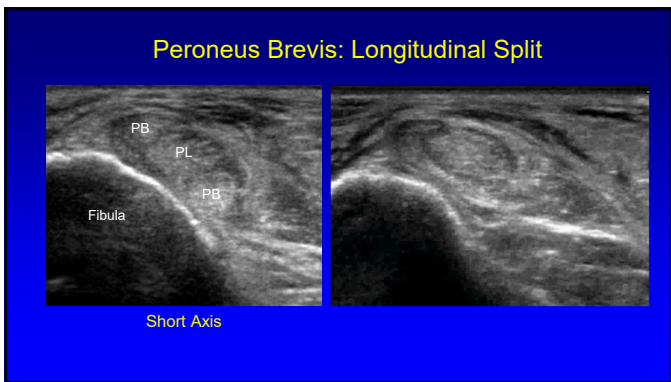
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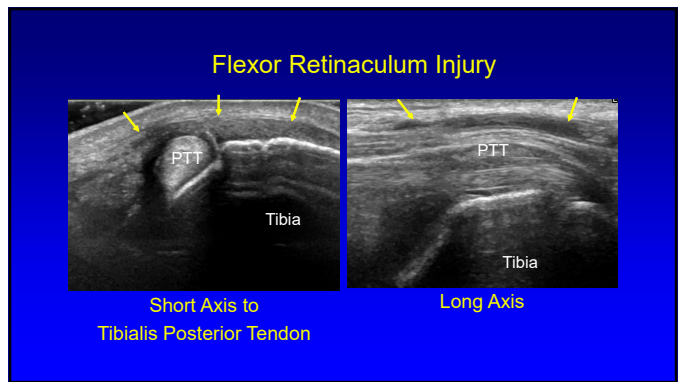
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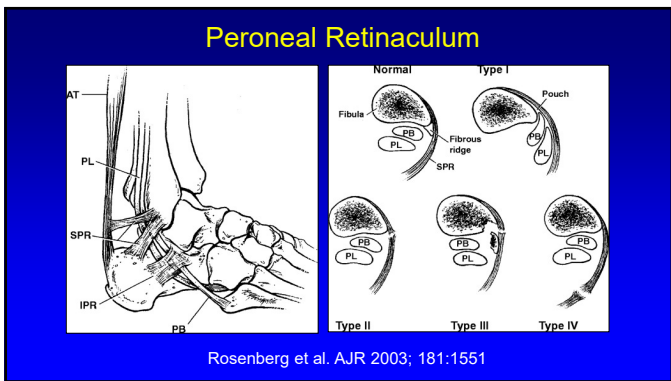
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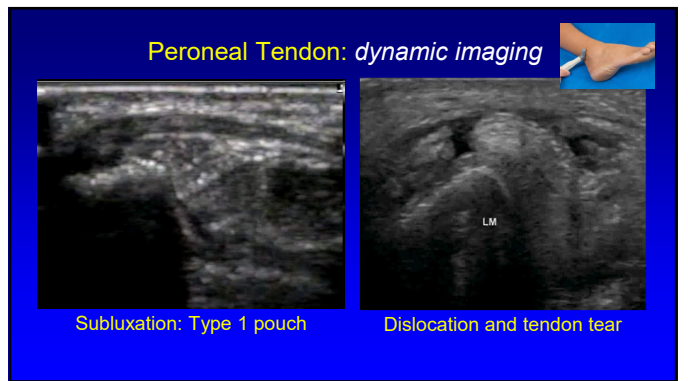
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Intrasheath Peroneal Subluxation

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



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

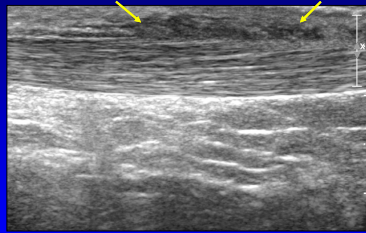
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Achilles Tendon:

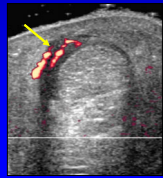
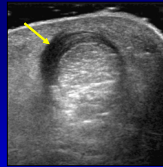
- 2 – 6 cm proximal to insertion
 - Tendinosis
 - Full-thickness tear
- Calcaneal attachment
 - Tendinosis, tear
 - Haglund Syndrome

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Paratenonitis: Achilles

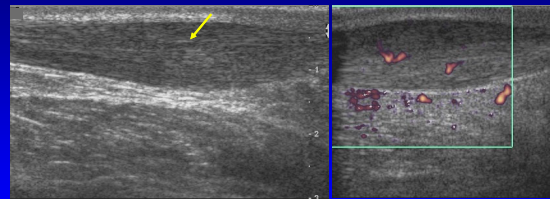


Long Axis



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Tendinosis: Achilles

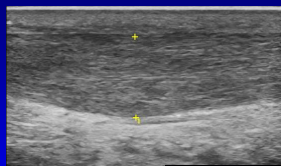


Long Axis

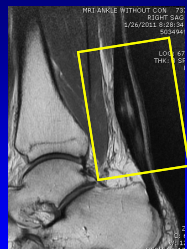
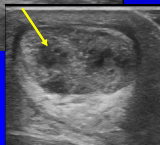
power Doppler

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Achilles Tendon: partial-thickness tear



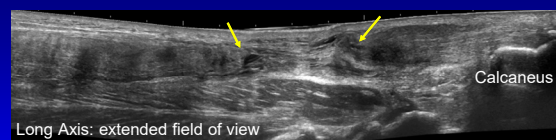
Long Axis



Courtesy of Jon Halperin,
San Diego

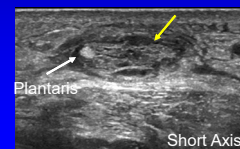
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Full-thickness Tear: Achilles



Long Axis: extended field of view

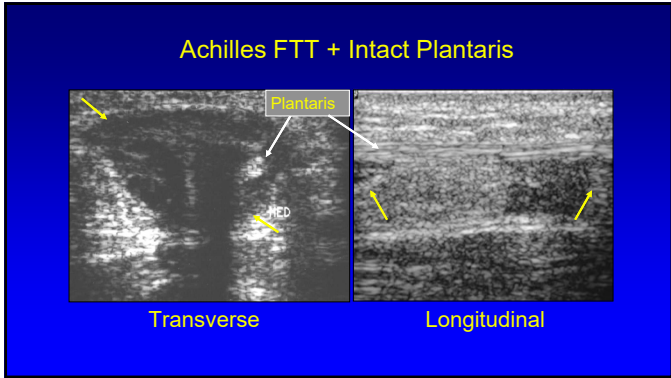
Calcaneus



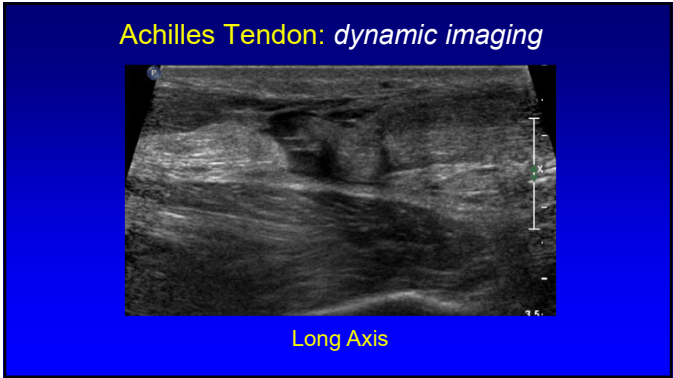
Plantaris

Short Axis

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Plantar Fascia

- Fasciopathy
 - Central cord, proximal
 - Degenerative, tendinosis-like, tear
- US:
 - Hypoechoic, thickened > 4 mm
 - Painful with transducer pressure

Cardinal, E. et al. Radiology 1996; 201:257

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Outline:

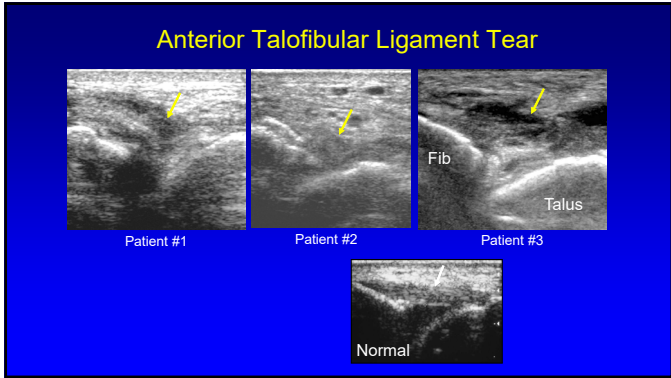
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- Masses

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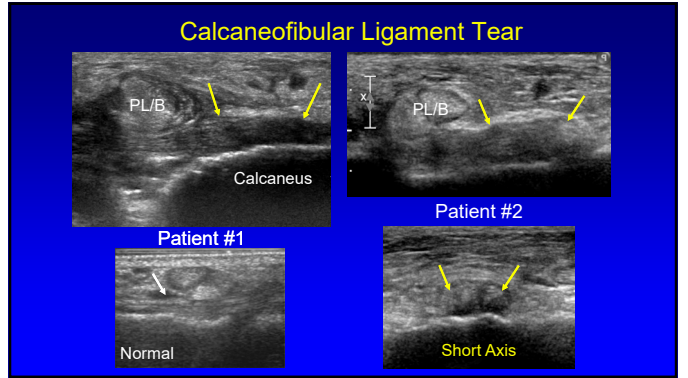
Ligament Tear:

- Hypoechoic & thickened
- Acute: anechoic fluid tracking through defect indicates full-thickness tear
- Cortical avulsion: hyperechoic

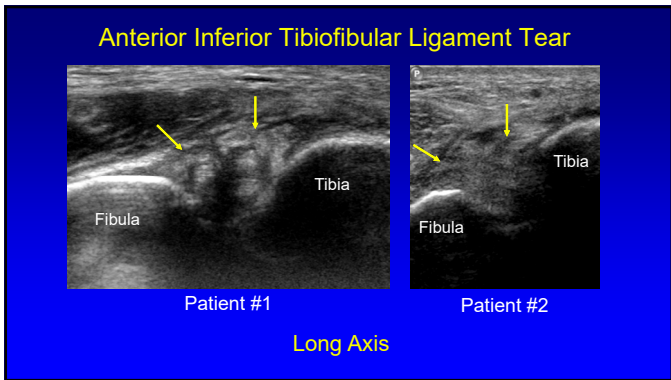
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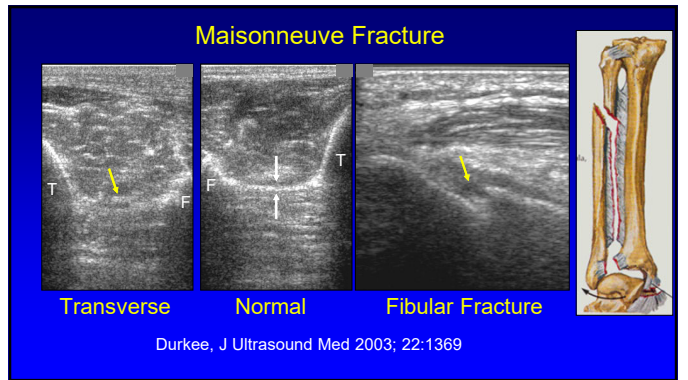
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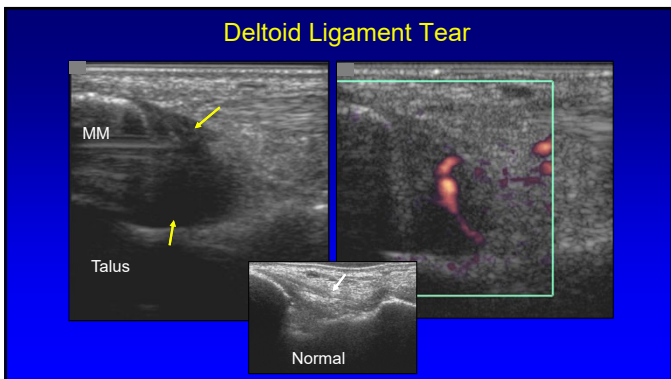
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Spring Ligament Complex

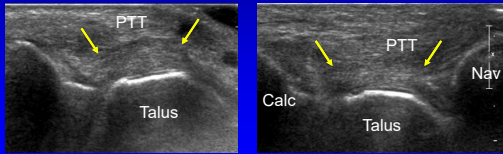
- Calcaneonavicular ligament
 - Superomedial
 - Perpendicular to distal PTT
 - Medioplantar oblique
 - Inferoplantar longitudinal

From: Radiology 2005; 237:242

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Spring Ligament Complex:

- Superomedial component
- Normal: hyperechoic, 2.8 – 3.4 mm thick

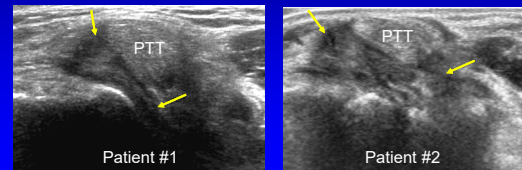


Harish, Skeletal Radiol 2007; 36:221

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Superomedial Calcaneonavicular Ligament

- Associated with PTT dysfunction
- Abnormal: hypoechoic, thick > 4 mm, thinned or disrupted



Harish, J Ultrasound Med 2008; 27:1145

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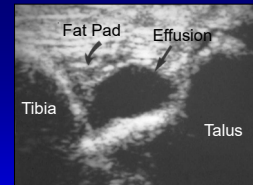
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Tibiotalar Joint: *effusion*

- Anterior evaluation most sensitive
- Plantar flexion
- Hyperechoic fat pad displaced by anechoic or hypoechoic fluid
- Sensitivity: MRI > US > PF



Jacobson, JA et al. AJR 1998; 170:1231

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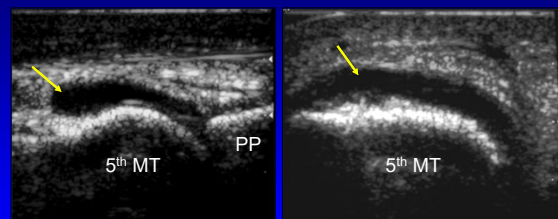
Septic Joint:

- Anechoic or hypoechoic distention of joint recesses
- May be hyperechoic if complicated
 - Possible synovitis
- US or color Doppler cannot distinguish between septic and aseptic effusion*

*Strouse et al. Radiology 1998; 206:731

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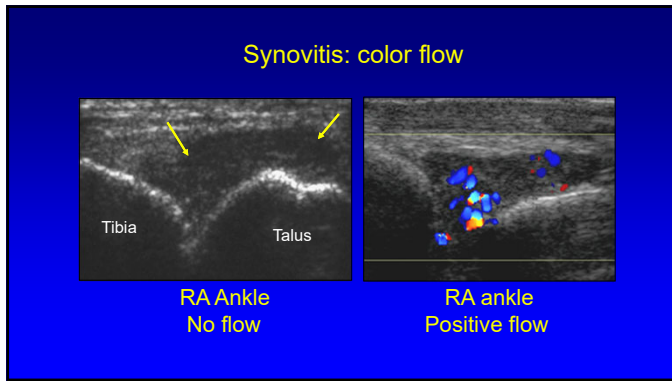
5th Metatarsal Phalangeal Joint: septic



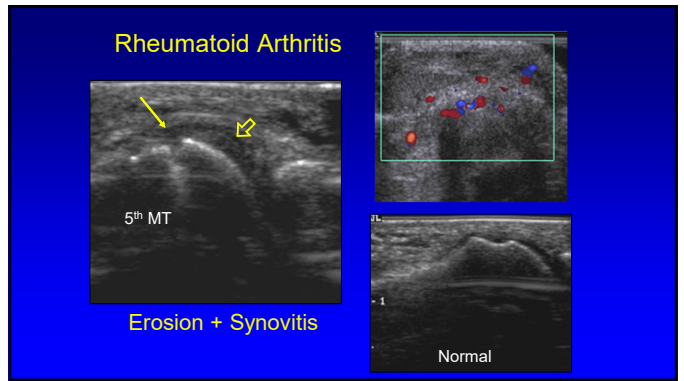
Sagittal

Coronal

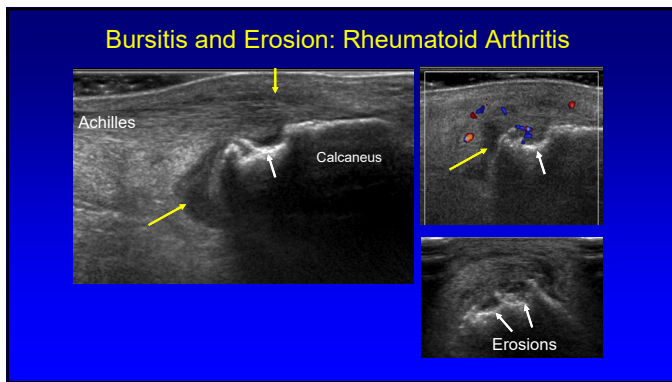
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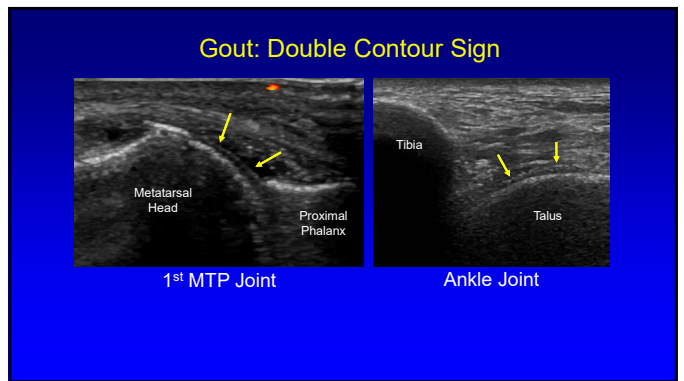
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- ### Gout:
- Joint effusion / synovial hypertrophy
 - Double contour sign:
 - Monosodium urate crystal icing on cartilage
 - Tophi:
 - Hyperechoic with hypoechoic rim
 - Erosions:
 - Adjacent to tophi
 - Medial 1st metatarsal head

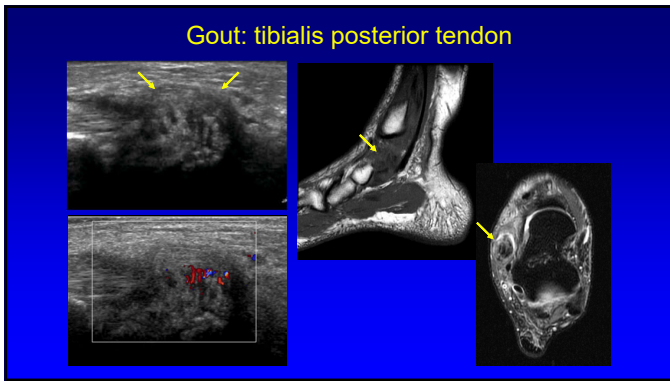
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- ### Tophi
-
- Hyperechoic heterogeneous with hypoechoic rim
 - Tiny internal speckles*
 - “wet clump of sugar” appearance
 - Variable shadowing: even without calcification
-
- MT PP
- Fernandes et al. Skeletal Radiol 2011; 40:309

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- **Masses**

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Plantar Fibromatosis

- Benign fibrous proliferation
- Multiple: 33%, bilateral: 20 – 50%
- Hypoechoic mass or masses
- Plantar aponeurosis
- Variable vascularity

Griffith JF et al. AJR 2002; 179:1167

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Intermetatarsal Neuroma:

- Interdigital nerve entrapment
- Edema, fibrosis, necrosis
- 3rd intermetatarsal space > 2nd
- Sharp, burning pain from metatarsal head to toes
- Females: pliable foot, high-heeled narrow-toed shoes

From: Martinoli, RadioGraphics 2000; 20:S199

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Anatomy

- At level of metatarsal heads:
 - Transverse metatarsal ligament
 - Attaches to plantar plates
 - Intermetatarsal bursa: dorsal
 - Neurovascular bundle: plantar

Zanetti M et al. Radiology 2014; 203:516

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Intermetatarsal Neuroma

Note: neuroma is at distal edge of intermetatarsal ligament
 White arrow: neuroma
 Arrowheads: interdigital nerve
 Curved arrow: intermetatarsal bursa
 Yellow arrow: intermetatarsal ligament

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Intermetatarsal Neuroma

- Hypoechoic 5 mm mass
 - Sensitivity: 100% ; Specificity: 83%
 - Accuracy equal to MRI
 - <5 mm: asymptomatic
- Intermetatarsal bursa
 - Associated with neuroma
 - “Neuroma-bursal complex”


Quinn T et al. AJR 2000; 174:1723
 Bignotti B et al. Eur Radiol 2015; 25:2254
 Cohen SL et al. J Ultrasound Med 2016; 25:3191

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Ultrasound Evaluation

- #1: plantar, short axis
 - With dorsal compression
- #2: plantar, long axis
 - With dorsal compression
- #3: Mulder maneuver
 - With side-to-side compression

*Neuroma of 5 mm or larger: 100% sensitivity, 83% specificity

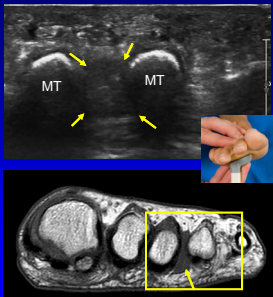


Redd et al. Radiology 1989; 171:415
 Quinn et al. AJR 2000; 174:1723

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Step #1

- Plantar, short axis
- Dorsal compression
- Neuroma: more plantar
- Bursa: dorsal, anechoic, compressible

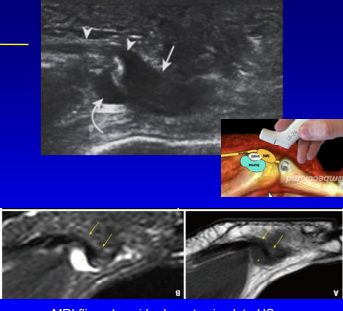


Note: coronal-oblique plane moving distal to metatarsal heads

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Step #2

- Plantar, long axis
 - Follow MT head curvature
- Dorsal compression
 - Move finger distal, proximal
 - See neuroma sliding over intermetatarsal ligament
- Neuroma: plantar, distal
- Bursa: curved arrow
 - Dorsal, proximal
 - Anechoic, compressible

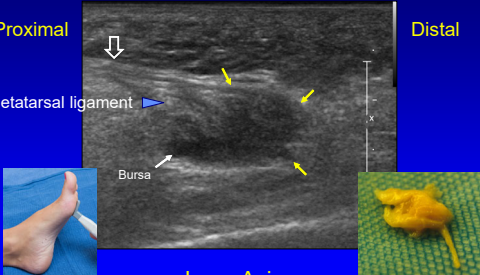


MRI flipped upside down to simulate US

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Neuroma: nerve continuity (white open arrow)

Proximal Distal



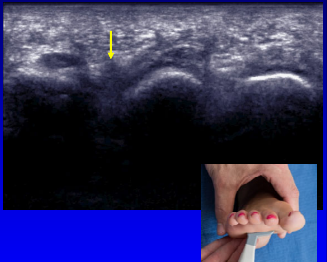
Long Axis

Courtesy of Mark Murphey, MD

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Step #3: Mulder's maneuver

- Transducer: plantar, short axis
- Squeeze foot side-to-side
- Neuroma moves plantar
 - Palpable click, elicits symptoms
 - Important to document
 - Improved accuracy, measurements
- Make sure to perform distal to intermetatarsal ligament
- Bursa: remains dorsal

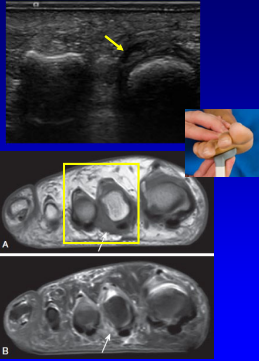


Torriani M et al. AJR 2003; 180:1121

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Differential Diagnosis

- Pericapsular fibrosis
- Associated with capsule injury
- Hypoechoic
- Eccentric
- Not truly intermetatarsal
- Negative Mulder's maneuver



Umans H et al. Skeletal Radiol 2014

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Take Home Points

- Tendons:
 - Tenosynovitis, tendinosis, partial tear, longitudinal split, complete tear
- If concern for infection: aspirate
- Gout: specific findings
- **Dynamic imaging**
 - Peroneal subluxation
 - Achilles tear
 - Interdigital neuroma

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Thank you!



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



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