

Advanced Musculoskeletal US: Dynamic Ultrasound

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Syllabus PDF

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Disclosures

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

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Fundamentals of Musculoskeletal Ultrasound are
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See www.jacobsonmuskus.com for syllabus other educational material

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Objectives:

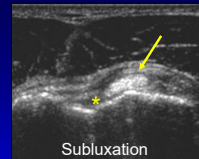
- To demonstrate musculoskeletal pathologies requiring:
 - Joint movement or positioning
 - Muscle contraction

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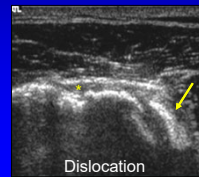
Shoulder: biceps tendon

- Subluxation
 - Partial medial displacement
- Dislocation
 - Complete out of groove
 - Possibly located within subscapularis or glenohumeral joint
- Evaluate dynamically

*Farin et al. Radiology 1995; 195:845



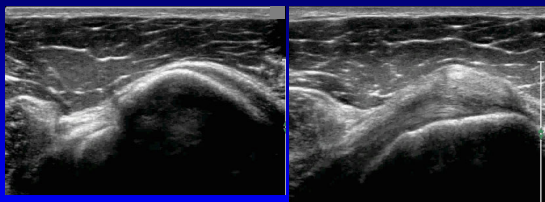
Subluxation



Dislocation

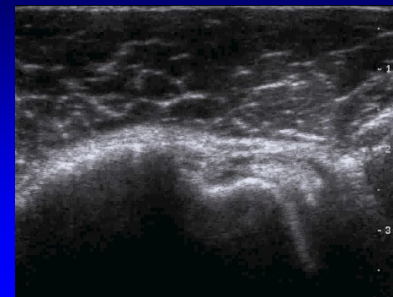
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Biceps Tendon Dislocation



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Biceps Tendon Dislocation



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Rotator Interval Tear

- Abnormal hypoechoogenicity, non-visualization
- Abnormal supraspinatus, superior glenohumeral ligament, subscapularis
- Biceps instability
 - “Chondral Print Sign”*
 - Intracapsular instability

Case #2: instability Case #3: remote tear

Yellow Arrow = coracohumeral ligament

*Zappia M et al. Skel Radiol 2016; 45:35

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Isolated Ulnar Nerve Dislocation

Ulnar Nerve Medial Epicondyle Apex

Okamoto, J Hand Surg 2000; 25B:85

*Asymptomatic finding in 20%

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Snapping Triceps Syndrome

- Ulnar nerve and medial triceps dislocate over apex of medial epicondyle
- Ulnar nerve and medial triceps remain in contact with each other
- Palpable snap felt through transducer

Jacobson JA et al. Radiology 2001; 220:601

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Synovial Fold Syndrome

- Normal capsular tissue
 - Hyperechoic, triangular
- Abnormal:
 - Thickened > 3 mm
 - Heterogeneous
 - Adjacent synovitis

Humerus Radius

Cerezal et al. AJR 2013; 201:W88

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Ulnar Collateral Ligament Tear

Long Axis Normal

T1w Coronal post-gadolinium T2w Coronal post-gadolinium

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Ulnar Collateral Ligament

- Valgus stress: 30 degrees elbow flexion
 - Unlock the olecranon
 - Stress: UCL anterior bundle
- Gravity stress is adequate, equal to Telos¹
- Ultrasound measurements:
 - Reliable and precise²

Ulnar Collateral Ligament: partial tear

¹Harada M et al. J Sho Elb Surg 2014; 23:561
²Bica D et al. J Ultrasound Med 2015; 34:371

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Ulnar Collateral Ligament: valgus stress

- >1 mm asymmetric gapping = 87% accuracy in diagnosis of UCL tear
 - MR arthrography accuracy = 88%
 - US + MR arthrography: accuracy = 98%
- Asymmetric joint space widening with stress:
 - Normal: 1.3 mm or less
 - Partial tear: 1.2 – 3.0 mm
 - Full thickness tear: 2.8 – 4.8 mm

Roedel JB et al. Radiology 2016

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Biceps Brachii Tendon: complete tear

Proximal biceps stump

Distal biceps stump

Longitudinal

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Biceps Brachii Tendon: complete tear

Radial Tuberosity

Radial Head

Longitudinal

Transverse

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Biceps Brachii Tendon: normal

Longitudinal: dynamic imaging

Eur Radiol Feb 2009

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Biceps Brachii Tendon: complete tear non-retracted

Longitudinal: dynamic imaging

Kalume Brigido M. Eur Radiol 2009 ; 19:1817

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Biceps Brachii Tendon: partial tear (short head)

Radius

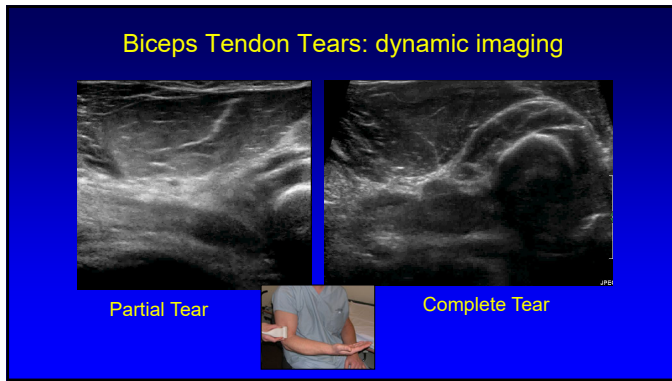
Shadowing

Longitudinal:

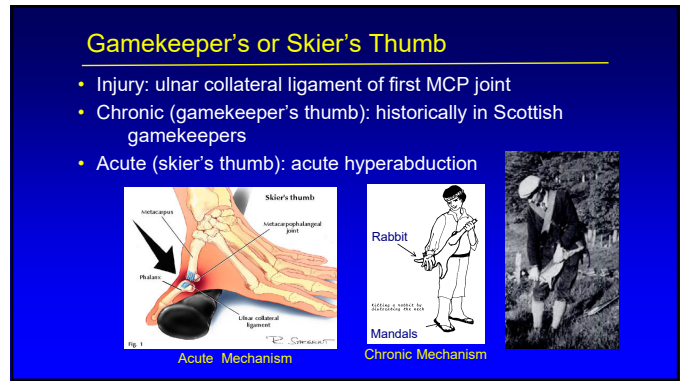
Retracted superficial short head (yellow arrows)

Hypoechoic but intact deep long head (white arrows)

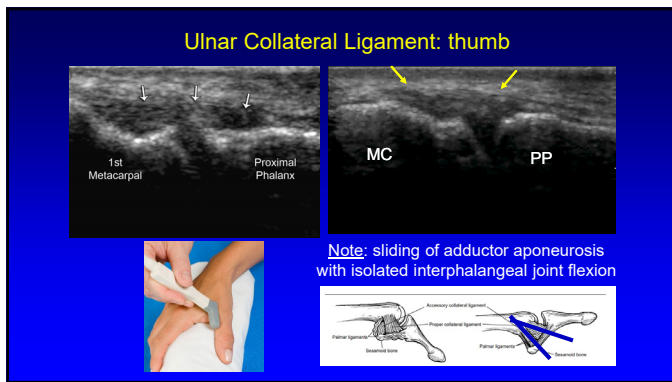
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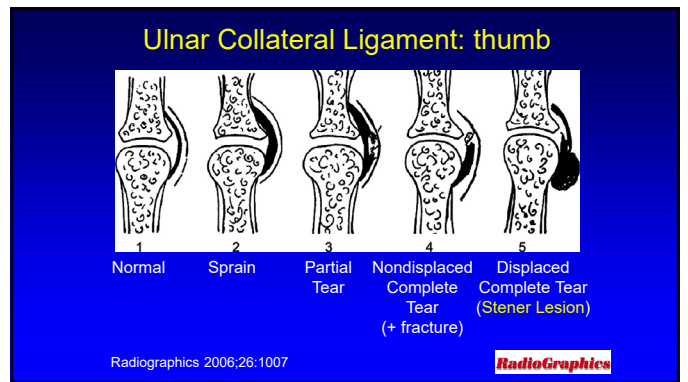
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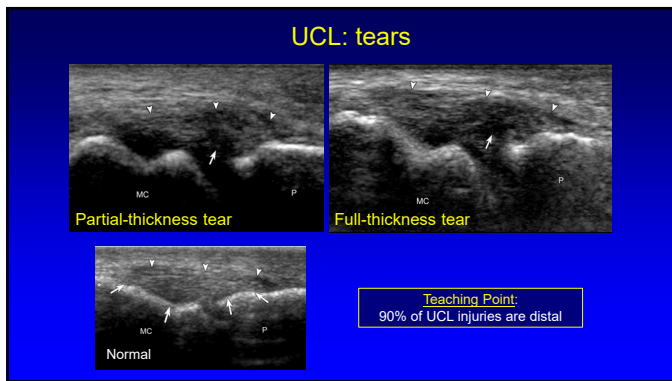
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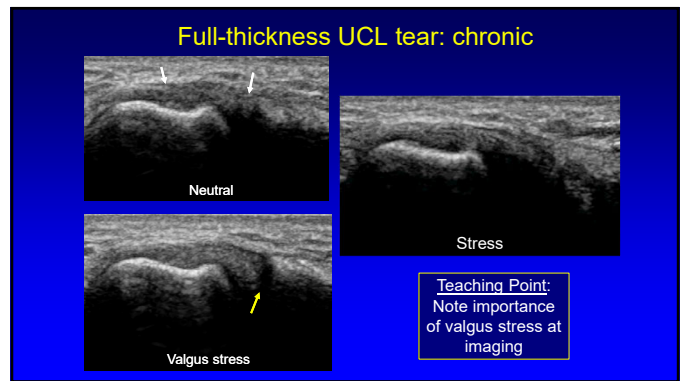
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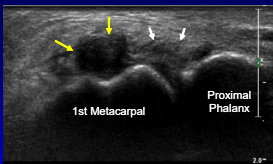
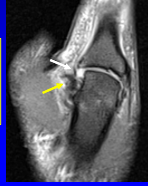


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Stener Lesion

- Displaced proximal stump of UCL
 - Hypoechoic & round
 - Proximal to MCP joint
 - At proximal edge of adductor pollicis aponeurosis
- No tissue spanning MCP joint
- "Yo-yo on a string" sign
- Ultrasound: 100% accuracy

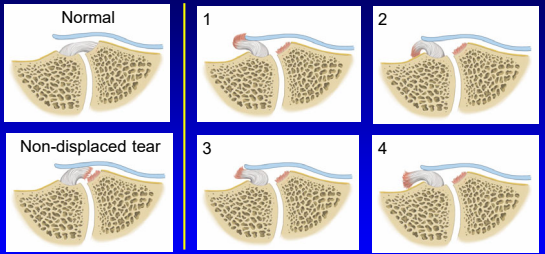
*Melville D. et al. Skeletal Radiology 2013; 42:667

Yellow arrows:
Stener
White arrows:
aponeurosis

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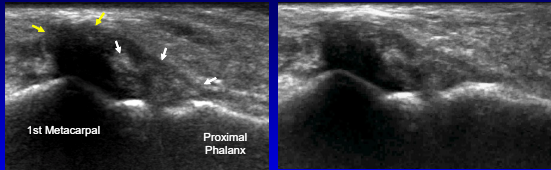
Stener Lesion: variations




Displaced Full-thickness Tears

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Stener Lesion: dynamic



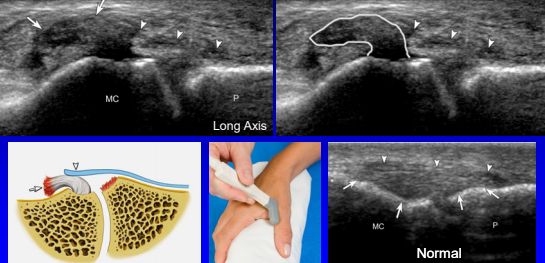
White arrows = adductor aponeurosis
Yellow arrows = Stener lesion



Teaching Point!
Note importance of active IP joint flexion at imaging showing aponeurosis

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Stener Lesion



From: Melville D. et al. Skeletal Radiology 2013; 42:667

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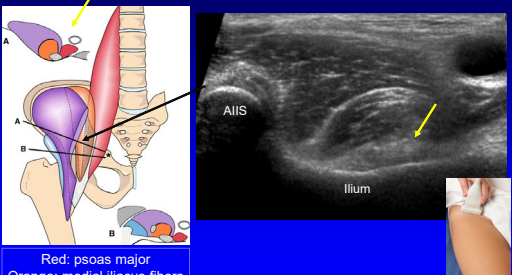
Stener Lesion



From: Melville D. et al. Skeletal Radiology 2013; 42:667

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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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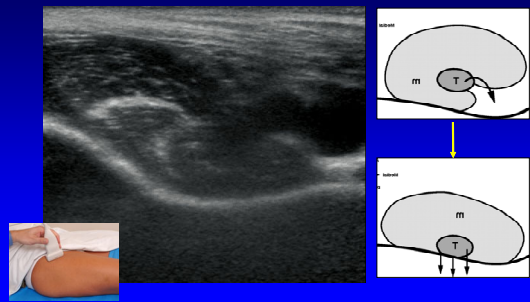
Snapping Hip Syndrome: iliopsoas

- 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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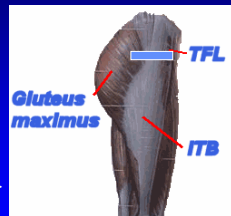
Snapping Hip Syndrome: iliopsoas



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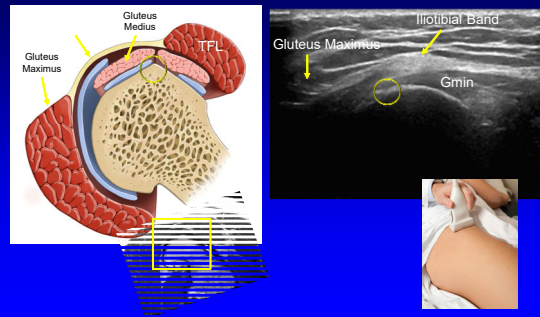
Snapping Hip: lateral

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



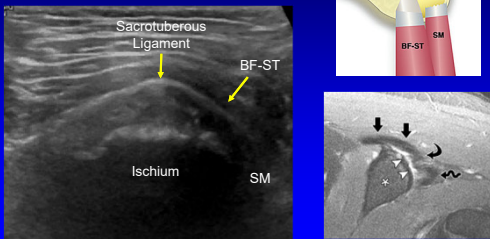
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Snapping Gluteus Maximus / Iliotibial Band



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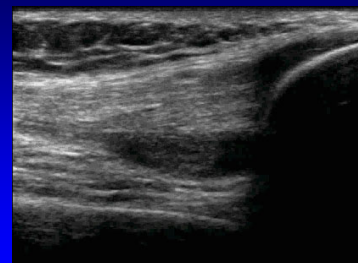
Snapping Conjoined Long Head Biceps Femoris, Semitendinosus + Sacrotuberous Ligament



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

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Intra-articular Body: loose



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Patellar Clunk Syndrome

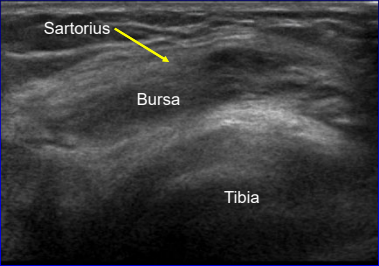
- After total knee arthroplasty
- 1% to 7.5% incidence
- Fibrous nodule: intercondylar notch
- Pain with flexion - extension



Okamoto T. et al. J Orthop Sci 2002; 7:590

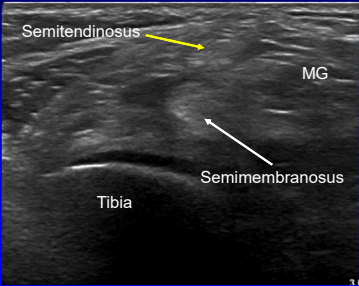
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Sartorius Snapping over Pes Anerinus Bursa



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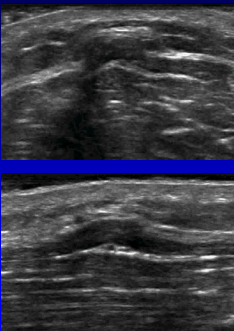
Semitendinosus Snapping over Semimembranosus



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Muscle Hernia

- Cause: trauma, activities, weak fascia
- Lower leg: especially anterior tibialis
- Swelling with muscle contraction
- US: muscle bulge, possible fascial defect
 - Site of perforating vessel





Beggs, AJR 2003; 180:395

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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

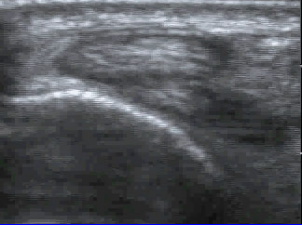



Neustadter et al. AJR 2004; 183:985

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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

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Achilles Tendon: complete tear

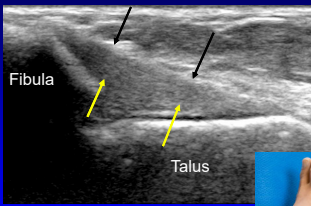
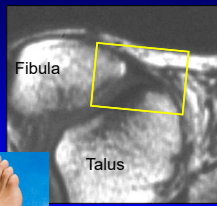

- Pitfall: misinterpretation of intact plantaris as Achilles fibers
- Dynamic imaging: look for
 - Widening of gap with passive dorsiflexion
 - Lack of tendon movement across tear
 - Determine if ends approximate



Long Axis

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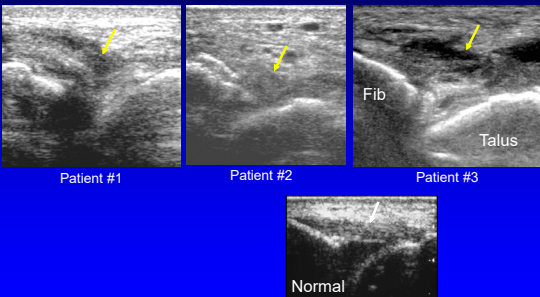
Anterior Talofibular Ligament

Long Axis

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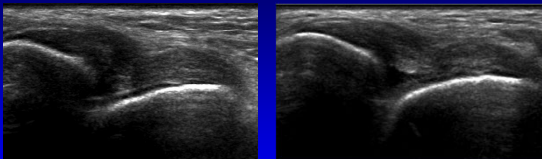
Anterior Talofibular Ligament Tear



Normal

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Anterior Talofibular Ligament: Partial Tear

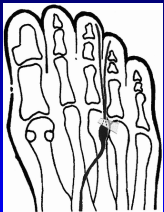


Long Axis: Dynamic Anterior Drawer Test

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Morton Neuroma:

- Digital 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

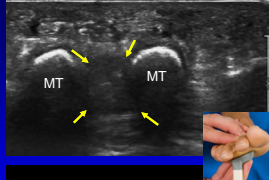
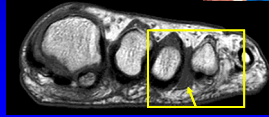


From: Martinoli, RadioGraphics 2000; 20:S199

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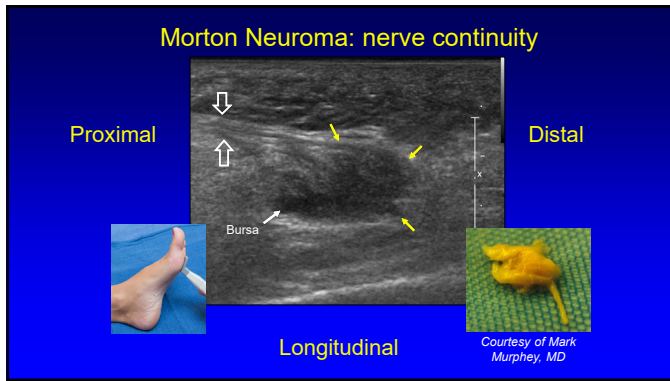
Morton Neuroma

- 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

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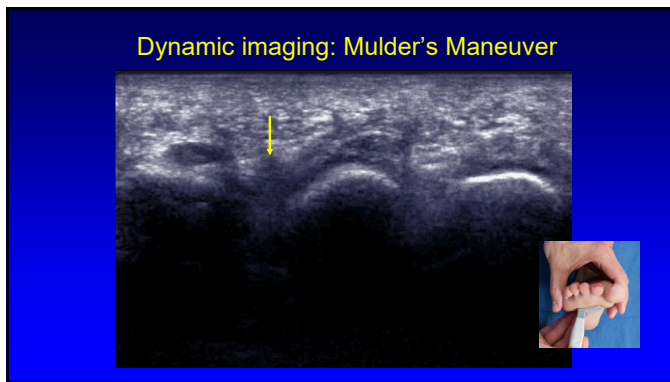
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Dynamic Evaluation

- 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

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Slipping Rib Syndrome

- Abnormal mobility of cartilaginous rib
- Slips over adjacent rib with muscle contraction or activity
- Visible with dynamic ultrasound

J Ultrasound Med 2002; 21:339

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Dynamic Imaging: summary

- Dynamic pathologic conditions
 - Limited number
 - Involve specific structures
- Consider ultrasound for any snapping or painful dynamic situation

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Thank you!

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

Twitter handle: @jjacobsn

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