Musculoskeletal Ultrasound: Dynamic Imaging

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

Dynamic Imaging:
- Shoulder
- Elbow
- Wrist and Hand
- Hip and Thigh
- Knee
- Ankle and Foot
- Soft Tissues

Biceps Brachii Tendon:
- Subluxation:
  - Partially perched on lesser tuberosity
- Dislocation:
  - Empty bicipital groove
  - Simulates biceps tendon tear
  - Associated subscapularis tears

Farin et al. Radiology 1995; 195:845

Note: all images from the textbook Fundamentals of Musculoskeletal Ultrasound are copyrighted by Elsevier Inc.
Biceps Tendon Dislocation

Impingement: bursal fluid
- Abnormal pooling of subacromial-subdeltoid bursal fluid
- Lateral acromion\(^1\):
  - Coronal plane, active arm elevation
  - Not visible in neutral position, no cuff tear
- At coracoid\(^2\):
  - Axial plane, active elevation internal rotation

\(^1\)Farin et al. Radiology 1990; 176:845
\(^2\)Stallenberg et al. AJR 2006; 187:894

Impingement Test

Impingement: supraspinatus

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Ulnar Nerve Dislocation
- Occurs in elbow flexion
- Reduces in extension
- Nerve irritation, predisposes to injury
- Found in 20% asymptomatic volunteers

Okamoto, J Hand Surg 2000; 25B:85
Isolated Ulnar Nerve Dislocation

Snapping Triceps Syndrome: dynamic imaging

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
  Roedl JB et al. Radiology 2016

Ulnar Collateral Ligament: laxity

Biceps Brachii Tendon: normal

Biceps Brachii Tendon: complete tear
Biceps Brachii Tendon: complete tear non-retracted

Biceps Brachii Tendon: partial tear (short head)

Biceps Tendon Tears: dynamic imaging

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Extensor Carpi Ulnaris:
- 6th extensor wrist compartment
- Asymptomatic subluxation
  - Supination
  - Up to 50% out of groove
  - No tear or tenosynovitis

Lee KS et al. AJR 2009; 193:651
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Snapping Hip Syndrome
- Painful snap with hip motion
- Intraarticular
- Extraarticular:
  - Anterior: iliopsoas tendon
  - Lateral: iliobibial tract or gluteus maximus

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

Snapping Hip Syndrome: lateral
- Transverse over greater trochanter
- Hip external rotation / flexion
- Abrupt motion of iliobibial tract or gluteus maximus over greater trochanter

Iliopsoas Complex
- Red: psoas major
- Orange: medial iliacus fibers
- Purple: lateral iliacus fibers


Deslandes et al. AJR 2008; 190:576
Snapping Gluteus Maximus / Iliotibial Band

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


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Peroneal Retinaculum

Rosenberg et al. AJR 2003; 181:1551
Dislocation: peroneus brevis & longus

Intrasheath Peroneal Subluxation: Type A

Achilles Tendon: Dynamic Imaging

- Increase accuracy for full-thickness tear:
  - Widening of gap with passive dorsiflexion
  - Lack of tendon movement across tear
- Determine if ends approximate
  - Conservative versus surgical treatment

Achilles Tendon: healing tear

Morton 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
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

Torlani 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


Syllabus on line and other educational material:
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