Musculoskeletal Ultrasound Applications in the ER

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Outline
• Infection
• Foreign body
• Trauma

Infection:
• Cellulitis
• Bursitis
• Abscess
• Tenosynovitis
• Septic joint
• Osteomyelitis

Infection: predicted by route
• Direct spread:
  – Ulceration (diabetic), penetrating injury
  – Soft tissue infection, osteomyelitis
• Hematogenous spread:
  – Children, intravenous drug abusers
  – Septic joint, osteomyelitis

Edema and Cellulitis
• Edema: increased interstitial fluid
• Cellulitis: subcutaneous skin infection
• Both appear similar at sonography
• Lower leg: consider Baker cyst rupture
Cellulitis: ultrasound

- Early (<3 days):
  - Thick subcutaneous tissues, increase echogenicity
- Advanced:
  - Distorted, anechoic channels
- Severe, advanced:
  - Fluctuating purulent fluid
  - Guided aspiration: efficacy similar to surgery
- Late: abscess formation

J Ultrasound Med 2000; 19:743

Acute Cellulitis: thigh

Normal Fat

Advanced Cellulitis: ankle

Bursa: normal appearance

- Thin hypoechoic layer: fluid / synovium
- Hyperechoic layers: bursa walls / fat
- Knowledge of common bursa:
  - Subacromial-subdeltoid, olecranon, trochanteric, prepatellar

Subacromial-subdeltoid Bursa: fluid

Coronal Coronal T2w

Subacromial-subdeltoid Bursitis

Infection Hemophilia
**Fluid versus Synovitis**

- Anechoic and compressible = simple fluid
- If not anechoic:
  - Compressible, no hyperemia = complex fluid
  - Non-compressible, hyperemia = synovitis

AJR 2000; 174: 1353

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**Infection: olecranon bursa**

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**Soft Tissue Abscess**

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

AJR 1996; 166:149

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**Abscess: shoulder**

Transverse  Longitudinal

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**Abscess: ultrasound**

- Anechoic
- Isoechoic
- Hyperechoic

- Dynamic compression
- Through-transmission

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**MRI Abscess: calf**

**Abscess**

- Transverse
- Longitudinal

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**Tenosynovitis (paratenonitis)**

- Anechoic: simple fluid
- Not anechoic:
  - Complicated fluid: compressible, swirling of contents
  - Synovitis: hyperemia*
  - Consider US guided aspiration

*AJR 1998; 206:731

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**Infected Tenosynovitis: extensor tendon**

- Proximal
- Distal
- Longitudinal

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**Septic Arthritis**

- Ultrasound:
  - Joint effusion:
    - Variable echogenicity
    - Anechoic to echogenic
  - Hyperemia:
    - Lack of flow does not exclude infection*
  - Synovial thickening
  - Guided aspiration

*AJR 1998; 206:731

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**Joint Recesses:**

- Shoulder: biceps, posterior
- Elbow: posterior
- Wrist: dorsal
- Hip: anterior femoral neck
- Knee: superior, medial, lateral to patella
- Ankle: anterior
- MCP, MTP: dorsal recesses
Septic Arthritis: sternoclavicular joint

Calcific Tendinosis

Joint Effusion: distal radioulnar joint

Synovitis: dorsal wrist

Suprapatellar Recess and Gutters

Joint Effusion: sagittal plane

Joint Effusion: transverse plane

Joint Effusion: knee extension

Effusion: tibiotalar joint

Synovitis Elbow Joint: Coccidiomycosis

Osteomyelitis:
- Direct spread:
  - Soft tissue cellulitis / abscess
  - Extension to bone
  - Cortical irregularity, destruction
- Hematogenous:
  - Periostitis: especially children
  - Bone destruction

Osteomyelitis: 5th metatarsal
Outline

• Infection
• Foreign body
• Trauma

Radiography:

• Non-radiopaque objects: wood, plastic
• Glass: opaque
  – Regardless of tint or color
  – Visualization requires optimized positioning and technique

Radiology 1998; 206:45

Soft Tissue Foreign Bodies:

• All are initially hyperechoic by US
• Surrounding hypoechoic foreign body response improves conspicuity
• Flat & smooth: reverberation
• Irregular & small radius: shadowing

Radiology 1998; 206:45
US: foreign body echogenicity

Wooden Toothpick Foreign Body: foot

Foreign Body: rose thorn

Wooden Foreign Body: wrist

Foreign Body: wood

Wooden Foreign Body: finger
Infected Tenosynovitis: finger

Metal Foreign Body: Brillo pad

Plastic Catheter: foot

Metal Foreign Body: needle

Foreign Body: seashell

No Foreign Body: gas

Case courtesy of T. Quinn, Toledo, Ohio
Outline

- Infection
- Foreign body
- Trauma

Trauma:

- Tendon tear
- Muscle tear
- Ligament tear:
  - Ankle
- Fracture: incidental

Extensor Pollicis Longus: tear

Long Axis

Short Axis

Pulley Tear

- A2 and A4 pulleys: most important
- Sagittal image
  - Bowstringing
  - Hypoechoic edema / hemorrhage
- Dynamic evaluation*

*Radiology 2002; 222:755
Radiology 1998; 208:339

A2 – 4 Pulley Injury

Normal

Normal

Quadriceps Tendon: Partial Tears

Radius Femoris Tear (1 layer)

Vasti Tear (2 layers)
Quadriceps Tendon: full-thickness tear

Medial Head of Gastrocnemius Tear

Baker Cyst: rupture

Soleus Hematoma

Tumor

Full-thickness Tear: Achilles

Metastasis: Renal Cell Carcinoma

Sarcoma: high grade

Calcaneus
Achilles Tendon: *dynamic imaging*

Triceps: long head tear

Long Axis

Longitudinal

Anterior Talofibular + Calcaneofibular Ligament Tears

Anterior Talofibular Ligament

Calcaneofibular Ligament

Lisfranc Ligament Disruption

Normal

Abnormal

Lisfranc Ligament Injury

Greater Tuberosity Fracture:

- Cortical step-off
- Point tenderness
- Differentiate from osteophyte
- Correlate with radiographs

Patten et al. Radiology 1992; 182:201
Fracture: greater tuberosity

Long Axis
Coronal T1w

Fracture: greater tuberosity

Long Axis
Short Axis

Take Home Points

• Infection:
  – Abscess: variable appearance
  – Septic joint: scan joint recesses
  – Specific anatomic location
• Foreign body:
  – Eliminate anisotropy
• Trauma:
  – Muscle hematoma: possible malignancy

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