Interventional Musculoskeletal Ultrasound: Common Applications

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Outline:
- Joint
- Tendon sheath
- Bursa
- Cyst
- Calcific tendinitis
- Miscellaneous

Joint Aspiration and Injection
- Aspiration:
  - Infection, crystal disease
- Injection:
  - Anesthetic: Lidocaine, Ropivacaine
  - Steroids
  - Therapeutic or diagnostic

Needle: trocar or no trocar?
- May help puncture through fascial planes, bursal wall, joint capsule
- Avoids taking cores of tissue
- Avoids plugging needle with tissue
- Disadvantage: must set transducer down to remove trocar, connect syringe, air

Corticosteroids
- Steroids in subcutaneous fat:
  - Depigmentation
  - Atrophy
- Flush needle after injection with lidocaine or saline to avoid complication
Joint Aspiration and Injection

• Know which joint recesses become distended and which are accessible
• For joint access:
  – Aim for joint fluid seen at ultrasound
  – Aim for specific joint recess
  – If no recess, aim for joint space

Glenohumeral Joint

• Posterior joint recess
  – In plane
  – Transducer: axial
  – Lateral to medial
  – Most reliable site*

Acromioclavicular Joint

• In plane
• Transducer: coronal
• Lateral to medial

Elbow Joint

• Olecranon recess
• Elbow flexed
• In plane
• Lateral to medial

Wrist Joints

• Dorsal recesses
• In plane
• Transducer: axial
• Medial or lateral

MCP Joints

• Dorsal recesses
• In plane
• Parasagittal or transverse
• Sterile gel stand off
MCP Joints
- Dorsal recesses
- Out of plane
- Transducer: sagittal
- Needle: parasagittal
- Medial or lateral direction

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

Joint injection
- Anterior recess
- In plane
- Transducer:
  - Parallel to femoral neck
  - Consider curvilinear
- Needle: distal to proximal
- 97% accuracy1

Joint Injection
- Femoral neck target
- Preferred over head
- High volumes
- Less extra-articular contrast

Knee Joint: effusion

Knee Joint
- Suprapatellar recess or medial/lateral recesses
- In plane
- Transducer: axial
- Needle: lateral to medial
**Ankle Joint**
- Anterior joint recess
- In plane
- Transducer: sagittal
- Needle: inferior to superior

**Posterior Subtalar Joint**
- Lateral joint recess
- Out of plane
- Transducer: coronal
- Place roll: varus
- Avoid: peroneal tendons

**MTP Joints**
- Dorsal recesses
- In plane
- Parasagittal or transverse
- Sterile gel stand off

**Synovial Biopsy**
- Synovial mass: benign
- Synovial hypertrophy:
  - Infection*: atypical, TB, fungal
  - Rheumatoid arthritis and others
- Synovial proliferation:
  - Pigmented villonodular synovitis*
  - Synovial chondromatosis

* = Common indications for biopsy

**Synovitis: ultrasound appearance**
- Synovial hypertrophy: hypoechoic
- Non-displaceable or poorly compressible
- + / - color or power Doppler flow
- May simulate complex fluid
  - Fluid: compressible, displaces, swirls with transducer pressure or joint movement

Bruyn G et al. J Rheumatol 2019; 46:1388
**Synovitis and Fluid**

- Ankle: anterior recess
- Trochanteric Bursa

**Synovial Biopsy**

- Synovium within joint recess
- Soft tissue core
  - 18 – 22 gauge
  - 1 cm throw
  - Consider introducer
  - 3 – 5 cores

**Pigmented Villonodular Synovitis**

- Sagittal
- Transverse
- Tibia
- Talus

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**Tendon Sheath**

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  - Steroids
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**Tendon Sheath**

- Axial versus longitudinal to tendon
- Aspiration: look for fluid collection
- Injection with steroids:
  - Do not inject steroids into tendon
  - Risk of tendon rupture
  - Test needle location with Lidocaine first
Biceps Brachii: sheath injection

- Ultrasound-guided: highest accuracy
  - Statistically significant difference in pain relief compared with blind injection at 33 weeks
- In plane, lateral to medial:
  - Deep to tendon: avoid SA-SD bursa
  - Avoid anterior circumflex humeral artery
- Glenohumeral joint extension: if 5 ml injected

1 Hashiuchi et al. J Sho Elb Surg 2011; 20:1069
3 Nwawka et al. AJR 2016; 206:337

De Quervain Tenosynovitis

- Inject short axis: dorsal
- Between EPB & radius
- Possible septation
- Inject around abnormal tendons
- Avoid superficial branch of radial nerve


Tendon Sheath: injection

- Short axis to tendon
- Anterior or posterior
- Deep to tendon:
  - Decreased risk of depigmentation, fat atrophy
- 100% accurate


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Bursa

- Aspiration:
  - Infection, crystal disease
- Injection:
  - Corticosteroids
  - Therapeutic
Subacromial-subdeltoid Bursa
- In plane
- Posterior to anterior or lateral to medial
- Patient supine
- Test inject
- Avoid rotator cuff

Olecranon Bursa
- Arm extended
- Axial plane
- Lateral to medial
- Avoid cubital tunnel

Iliopsoas Bursa
- Oblique-axial plane:
  - Superior to femoral head
  - Lateral to medial
  - Inject between tendon, ilium
- Pain relief = successful iliopectineal release

Infection: olecranon bursa
Float the transducer to avoid compression

Iliopsoas Injection

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1 Dauffenbach J et al. A Ultrasound Med 2014; 33:405
2 Blankenbaker DG. Skeletal Radiol 2006; 36: 559
Greater Trochanter

**Trochanteric Region Bursae**
- Trochanteric: deep to gluteus maximus
- Subgluteus medius
- Subgluteus minimus
- Axial or coronal plane

**Baker Cyst**
- Aspiration
  - Inferior to superior
  - Medial to lateral
- Aspirate joint effusion first if present
- Steroid injection
  - Baker cyst injection works better than intra-articular injection


Prepatellar Bursa
- Leg extended
- Axial plane
- Sagittal plane

Isoechoic Bursal Fluid: dynamic imaging
Semimembranosus-Tibial Collateral Ligament Bursa
- Between SM and TCL
- Does not communicate with knee joint

Pes Anserinus
- Pes anserinus: “goose foot”
  - Sartorius
  - Gracilis
  - Semitendinosus
- Bursa:
  - Deep to tendons
  - Superficial to MCL

Retrocalcaneal Bursa
- Injection
- Medial to lateral
- Short axis to Achilles
- Needle perpendicular to ultrasound beam

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Cyst Aspiration
- Ganglion cyst:
  - Multilocular, non-compressible
  - Large bore needle
  - Fenestrate neck
- Other cysts:
  - Paralabral cysts: shoulder and hip labrum
  - Parameniscal cysts

Ganglion Cyst: dorsal + aspiration
Ganglion Cyst (elbow): aspiration

Paralabral cyst
• Usually with labral tear
• Aspiration
  – Axial plane
  – Lateral to medial

Paralabral Cyst
• Ultrasound-guided aspiration
• 18 – 20 gauge spinal needle
• Steroid injection

Medial Meniscus: tear and parameniscal cyst

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Tendon Calcification
• Degenerative:
  – Thin, linear
  – Background of tendinosis
• Calcific tendinosis / tendinitis:
  – Globular
  – Tendon metaplasia
  – Lavage and aspiration

Degenerative Calcification

Calcific Tendinosis
- Hydroxyapatite deposition: metaplasia
  - Usually do not have cuff tear
- Appearance:
  - 79% hyperechoic & shadowing
  - No shadow: 7%
- Two phases:
  - Formative
  - Resorptive: painful

Farin et al. Skeletal Radiol 1996; 25:551

Calcific Tendinosis
- Formative
  - Defined, shadow
- Resorptive
  - Amorphous, little shadow

Calcific Tendinosis: aspiration
- Percutaneous lavage and aspiration
  - Best: rounded amorphous calcification
  - Correlate with radiography
- 3-10 cc syringes: Lidocaine
- 20 – 22 gauge needle
- Position patient: syringe is dependent

Calcific Tendinosis: aspiration
- Inject Lidocaine, then aspirate
  - Dilute calcification
  - Syringe dependent
  - Calcification will flow into needle
  - Repeat until calcification decreases
- Inject steroids into adjacent bursa

Calcific Tendinosis: lavage/aspiration
Calcific Tendinosis: lavage/aspiration

Patient #1

Patient #2

Calcific Tendinosis: results

- Calcium decrease correlates with symptom improvement
- Improvement: 91% at 1 year*
  - Transitory recurrence at 15 weeks: 44%
  - Improved symptoms at 1 year
- No difference at 5, 10 years**

*del Crura, AJR 2007; 189:W128
**Serafini G, Radiology 2009; 252:157

Calcific Tendinosis

- Ultrasound-guided lavage and aspiration
- 20 gauge spinal needle

Morton Neuroma

- Steroid injection¹
  - 3 month: pain relief
- Alcohol injection²
  - Symptoms return at 5 yrs
- Radiofrequency ablation³
  - 85% effective at 6 months

¹Thomson CE JBJS 2014; 96A:334
²Gurdezi S Foot Ank Int 2013; 34:1064
³Chuter GSJ Skeletal Radiol 2013; 42:107

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**Carpal Tunnel Injection**
- Axial plane: ulnar to radial
- Sterile gel stand-off
- Begin over ulnar nerve and stay superficial
- Inject adjacent to median nerve
- Cross-sectional area may decrease within 1 week after steroid injection


**Take Home Points:**
- **Joint:**
  - Aim for recess
- **Bursa:**
  - Know anatomic locations
- **Cyst:**
  - Large bore needle
- **Calcific tendinitis:**
  - One puncture, lavage and aspiration

**Audience Response Question #1**
What target is ideal for injecting or aspiration the hip joint using ultrasound guidance?
- a) Anterior recess of femoral neck
- b) Iliopsoas bursa
- c) Posterior recess
- d) Joint space between femoral head and acetabulum


**Audience Response Question #2**
Concerning synovitis, which of the following is true?
- a) Complex joint fluid and synovitis may appear similar at ultrasound
- b) Synovitis always shows increased flow on color or power Doppler imaging
- c) Synovitis is displaceable and fully compressible with transducer pressure
- d) Synovitis is specific for a rheumatologic disorder

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Audience Response Question #2
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Audience Response Question #3
What are some concerns when injecting the first extensor wrist compartment tendon sheath for de Quervain disease?

a) The extensor pollicis brevis and abductor pollicis longus tendon sheaths may not communicate
b) The superficial branch of the radial nerve crosses superficial to the first extensor wrist compartment
c) The radial artery courses deep to the first extensor wrist compartment
d) All of the above