Joint Injection Workshop
ACP Scientific Meeting
February 28, 2015

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Michael J. Battistone, MD
<table>
<thead>
<tr>
<th>Time</th>
<th>Session Description</th>
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<tbody>
<tr>
<td>1:00-1:15</td>
<td>A Practical Approach to the Shoulder Exam</td>
</tr>
<tr>
<td>1:15-1:40</td>
<td>Arthrocentesis and Steroid Injections of the Knee and Shoulder</td>
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<tr>
<td>1:40-1:45</td>
<td>Transition</td>
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<tr>
<td>1:45-2:05</td>
<td>Hands-on Session I*</td>
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<tr>
<td></td>
<td>Shoulder Exams</td>
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<td>Knee Injections</td>
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<td>2:05-2:25</td>
<td>Hands-on Session II*</td>
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<tr>
<td></td>
<td>Shoulder Exams</td>
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<tr>
<td></td>
<td>Knee Injections</td>
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</tbody>
</table>

* Joint Injection simulators are available during this time
Introduction to Musculoskeletal Physical Examination:

SHOULDER
<table>
<thead>
<tr>
<th>Examination</th>
<th>Performed</th>
<th>Technique Adequate</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FROM BEHIND</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Observation</td>
<td>Adequate exposure</td>
<td>Observe as they disrobe for degree of discomfort</td>
</tr>
<tr>
<td></td>
<td>General</td>
<td>Symmetry, scars, skin lesions, erythema, edema, atrophy</td>
</tr>
<tr>
<td></td>
<td>Scapular winging</td>
<td>Patient raises arms bilaterally</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wall press</td>
</tr>
<tr>
<td><strong>PALPATION</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Bilateral</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sternoclavicular joint</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Acromioclavicular joint</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Biceps tendon</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Laternal shoulder</td>
<td>Inferior to acromion</td>
</tr>
<tr>
<td><strong>FACING PATIENT</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Range of Motion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Motor Function of Rotator Cuff</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bilateral</td>
<td></td>
</tr>
<tr>
<td>Supraspinatus</td>
<td>ROM Active forward elevation in scapular plane</td>
<td>Scapular plane</td>
</tr>
<tr>
<td></td>
<td>Painful arc (&gt;90')</td>
<td>Neutral rotation (thumbs to ceiling)</td>
</tr>
<tr>
<td></td>
<td>Drop arm test</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Motor: Empty Can Test</td>
<td>Scapular plane</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Full pronation (thumbs to floor)</td>
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<tr>
<td></td>
<td></td>
<td>Resisted forward elevation</td>
</tr>
<tr>
<td>Infraspinatus</td>
<td>ROM Active external rotation</td>
<td>Elbows at side</td>
</tr>
<tr>
<td></td>
<td>Motor: Active external rotation against resistance</td>
<td>Elbows at side</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Start with hands near midline</td>
</tr>
<tr>
<td><strong>UNILATERAL</strong></td>
<td></td>
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</tr>
<tr>
<td>Supraspinatus</td>
<td>Motor: Belly Press Test</td>
<td>Hand on abdomen</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Elbow anterior to midline</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Examiner pulls at forearm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Watch for elbow to drop</td>
</tr>
<tr>
<td></td>
<td>ROM Active internal rotation along spine</td>
<td>Observe patient from behind</td>
</tr>
<tr>
<td></td>
<td>Motor: Lift Off Test</td>
<td>Hand at lumbar spine</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Actively lifts off back against resistance</td>
</tr>
<tr>
<td>Teres Minor</td>
<td>ROM Active external rotation with 90' shoulder abduction and 90' elbow flexion</td>
<td>90' shoulder abduction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>90' elbow flexion</td>
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<tr>
<td></td>
<td></td>
<td>Thumb points posterior</td>
</tr>
<tr>
<td></td>
<td>Motor: Hornblower's Test</td>
<td>External rotation as above against resistance</td>
</tr>
</tbody>
</table>

*Note: check passive range of motion if active is limited.*

*This will identify mechanical block of motion versus shoulder weakness.*
Anatomy

- Clavicle
- Acromion
- Glenoid
- Scapula
- Humerus
- Head of the humerus
- Coracoid process
Acromioclavicular joint
Acromion
Subacromial bursa
Supraspinatus tendon
Glenohumeral joint
Greater tubercle
Lesser tubercle
Bicipital tendon sheath
Bicipital tendon
Subscapularis tendon
Subscapularis muscle
Biceps muscle (long head)
Coracoid process
Clavicle
Sternoclavicular joint
Scapula
Sternum
5 Components of Shoulder Exam

1. Observation
2. Palpation
3. Range of Motion
4. Motor Function of the Rotator Cuff
5. Provocative Testing

ADEQUATE EXPOSURE!!!
1. Observation

- Symmetry
- Skin lesions/scars
- Erythema
- Scapular winging
- Atrophy
2. Palpation

- Bilateral palpation from behind patient

- SC joint
- AC joint
- Biceps tendon (long head)
- Subacromial space (lateral and posterolateral)

Note locations of tenderness to help guide examination
3. Range of Motion

4. Motor Function of Rotator Cuff

<table>
<thead>
<tr>
<th></th>
<th>Range of Motion Motor Function of Rotator Cuff</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bilateral</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| **Supraspinatus** | ROM: Active forward elevation in scapular plane | Scapular plane  
| | Painful arc (>90°) | Neutral rotation (thumbs to ceiling)  
| | Drop arm test | |
| | Motor: Empty Can Test | Scapular plane  
| | | Full pronation (thumbs to floor)  
| | | Resisted forward elevation  
| **Infraspinatus** | ROM: Active external rotation | Elbows at side |
| | Motor: Active external rotation against resistance | Elbows at side  
| | | Start with hands near midline |
| **Unilateral** | | |
| **Subscapularis** | Motor: Bally Press Test | Hand on abdomen  
| | | Elbow anterior to midline  
| | | Examiner pulls at forearm  
| | | Watch for elbow to drop  
| | ROM: Active internal rotation along spine | Observe patient from behind  
| | Motor: Lift Off Test | Hand at lumbar spine  
| | | Actively lifts off back against resistance  
| **Teres Minor** | ROM: Active external rotation with 90° shoulder abduction and 90° elbow flexion | 90° shoulder abduction  
| | | 90° elbow flexion  
| | | Thumb points posterior  
| | Motor: Hornblower’s Test | External rotation as above against resistance |

*Note: check passive range of motion if active is limited.  
This will identify mechanical block of motion versus shoulder weakness*
3. Range of Motion
   - Start with active ROM and perform passive ROM if active is limited

4. Motor Function of Rotator Cuff
   - Monitor each maneuver for pain as well as strength
     - Pain but normal strength: tendonitis or partial-thickness tear
     - Pain with weakness: concern for full-thickness tear
   - Compare strength with unaffected side
Supraspinatus

Abduction
Forward elevation

✓ **ROM:** Active forward elevation in scapular plane
  • Bilateral
  • Elbows extended
  • Thumbs to ceiling
• Painful Arc (pain >90° ABD)
• Drop Arm Test
Supraspinatus

Abduction
Forward elevation

✔ Motor: Empty Can Test
  • Bilateral
  • Internal rotation (thumbs toward floor)
  • Elbows extended
  • Downward pressure by examiner
  • 90° or lower
Infraspinatus

- **ROM**: External rotation
  - Bilateral
  - Elbows at side, 90 degrees of flexion
  - Examine for symmetry
Infraspinatus
External rotation

✓ **Motor**: external rotation test
  – Bilateral
  – Elbows at side, 90 degrees of flexion
  – Hands near midline
  – Examiner resists ER
Subscapularis
Internal rotation

✓ Motor: Belly Press Test
  • Unilateral
  • Elbow anterior to midline
  • Examiner attempts pull arm off abdomen at the wrist
Subscapularis
Internal rotation

✓ **ROM**: Internal rotation along spine
  • Unilateral
  • Repeat on unaffected side for comparison
Subscapularis
Internal rotation

Motor: Lift-off Test
- Unilateral
- Dorsum of hand against lumbar spine
- Patient attempts to lift hand off back against resistance
- Resistance applied at wrist
Teres Minor
External rotation

✓ ROM: External rotation in abduction
  • Unilateral
  • 90 degrees shoulder abduction
  • 90 degrees elbow flexion
  • Thumb toward ceiling
  • Patient attempts ER “hitchhiking”
Teres Minor
External rotation

- Motor: Hornblower’s Test
  - Unilateral
  - 90 degrees shoulder abduction
  - 90 degrees elbow flexion
  - End position of ROM test
  - Examiner resists ER
## 5. Provocative Testing

<table>
<thead>
<tr>
<th>5</th>
<th>Provocative Testing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Impingement Testing</strong></td>
<td></td>
</tr>
</tbody>
</table>
| Hawkin’s Test | Shoulder 90’ abduction  
Scapular plane  
90’ elbow flexion  
Internal rotation + horizontal  
adduction |
| Neer’s Test | Elbow extended  
Full pronation  
Maximal passive forward  
elevation of shoulder with  
scapular stabilization |
| **Biceps Testing** | |
| Speed’s Test | 60’ forward elevation  
Hand in supination  
20-30’ elbow flexion  
Apply downward pressure to  
forearm |
| Yergeson’s Test | Elbow at side, 90’ flexion  
Palm in supination  
Resisted supination |
| **AC Joint Testing** | |
| Cross-arm Test | Active horizontal adduction |
Subacromial Impingement

- Area between humeral head and acromion
- Narrowed space
  - Bony changes
    - Acromion type
    - AC spurs
    - Cuff arthropathy
  - Soft tissue swelling
    - Bursa
    - Rotator cuff
Subacromial Impingement Testing

• Hawkin’s Test
  – Passive
  – 90° abduction, 90° elbow flexion
  – Scapular plane
  – Maximal internal rotation

• Neer’s Test
  – Passive
  – Elbow extended
  – Pronation
  – Sagittal plane
  – “Near to the ear”
Biceps Tendinopathy Testing

• Speed’s Test
  – 60° forward elevation
  – 20-30° elbow flexion
  – Downward pressure at forearm

• Yergason’s Test
  – Elbow at side, 90° flexion
  – Palm in supination
  – Examiner attempts to pronate
Acromioclavicular Joint Testing

• Cross-arm Test
  – 90° forward elevation
  – Maximal horizontal adduction

Pain must be localized to AC joint for test to be positive
Neurologic Testing

- Spurling’s Test
  - Slight neck extension
  - Rotation toward affected shoulder
  - Axial load

<table>
<thead>
<tr>
<th>Neurologic Testing</th>
<th>Motor</th>
<th>Reflexes</th>
<th>Sensation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Shoulder abduction, forearm supination (C5)</td>
<td>Biceps (C5, C6)</td>
<td>Deltoid (C5)</td>
</tr>
<tr>
<td></td>
<td>Elbow flexion, wrist extension (C6)</td>
<td>Brachioradialis (C6)</td>
<td>Radial aspect of arm/hand, thumb (C6)</td>
</tr>
<tr>
<td></td>
<td>Elbow extension/wrist flexion/finger extension (C7)</td>
<td>Triceps (C7, C8)</td>
<td>3rd digit (C7)</td>
</tr>
<tr>
<td></td>
<td>Finger flexion/thumb abduction (C8)</td>
<td></td>
<td>Ulnar aspect of arm/hand and 5th digit (C8)</td>
</tr>
</tbody>
</table>

Note: Schematic demarcation of dermatomes (according to Keegan and Garrett) shown as distinct segments. There is actually considerable overlap between adjacent dermatomes. An alternative dermatome map is provided online.
Arthrocentesis and Corticosteroid Injections of the Knee and Shoulder
Am I Ready?

• Do I have a good indication?
• Do the risks outweigh the benefits?
• What size needle and syringe will I use?
• What medications do I want to use?
• Will I anesthetize the skin?
• Which approach is most reliable and least painful?
• What will be considered a successful outcome?
• What can I tell the patient to expect during & after?
Overview

• Contraindications/risks to corticosteroid (CS) injections
• Preparation prior to procedure
• Intra-articular (IA) knee injection
  – Indications
  – Approach
  – Patient positioning + procedure
• Subacromial (SA) injection of the shoulder
  – Indications
  – Approach
  – Patient positioning + procedure
Contraindications/Cautions

• Prosthetic joint
• Recent surgical procedure involving the joint
• Joint surgery anticipated in the next 3 months
• Overlying cellulitis
• Supratherapeutic anticoagulation
• Medication allergies
• Suboptimal response to prior injection
• *If concern for septic arthritis, contact orthopedics or rheumatology*
Do Risks Outweigh Benefits?

• Significant Risks and Complications
  – Infection\(^1\)
  – Post-injection flare
  – Bleeding
  – Increase in blood glucose
  – Lack of response/no improvement\(^2\)

• Things to Consider
  – Tendon rupture
  – Skin atrophy/hypopigmentation
  – Suppression of the hypothalamic-pituitary axis
Pre-Procedural Procedure Checklist

1. Informed consent
2. Documentation plan
3. Supplies prepared
KEY: Be consistent with needle gauge and syringe size

This produces consistent resistance during injections; increased resistance suggests injection of medications into soft tissue/tendon
21 Gauge 1.5 Inch Needle + 10cc Syringe

- Recommended for SA and IA injections
- Fast delivery, can still feel resistance
- Can be used for aspiration

- 18 gauge needle + 20-30cc syringe
  - Aspiration of large effusion or hemorrhhosis
Use single-dose vials when possible³,⁴
Anesthetics: Lidocaine + Bupivacaine

- Mix in syringe with CS
  - Dilution and dispersion of steroid
    - Decrease risk post-injection flare, local atrophy
- Fast-onset with lidocaine (1-2cc total)
  - Facilitates diagnosis
- Long duration with bupivacaine (1-2cc total)
  - Bridges gap with onset of CS
Should I Anesthetize the Skin?

• Local anesthetic not necessary or recommended
  – More painful
  – Limits feedback on accuracy of needle placement

• Ethyl chloride spray not recommended
Which Corticosteroid Should be Used?

• No large RCTs comparing various preparations

• American College of Rheumatology Survey\(^5\)
  – Triamcinolone acetonide (Kenalog) in the West
  – Methylprednisolone (Depo-Medrol) in the East

• Both agents comparable for SA shoulder injection\(^6\)

• Both may have less chance of post-injection flare
<table>
<thead>
<tr>
<th>Body Area</th>
<th>Specific Location</th>
<th>Corticosteroid Dosing Recommendation (Methylprednisolone equivalent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shoulder</td>
<td>Subacromial</td>
<td>40mg</td>
</tr>
<tr>
<td></td>
<td>Glenohumeral joint</td>
<td>40-80mg</td>
</tr>
<tr>
<td></td>
<td>Acromioclavicular joint</td>
<td>20mg</td>
</tr>
<tr>
<td>Knee</td>
<td>Intra-articular</td>
<td>40-80mg</td>
</tr>
<tr>
<td></td>
<td>Pre-patellar bursa</td>
<td>20-40mg</td>
</tr>
<tr>
<td></td>
<td>Pes anserine bursa</td>
<td>20mg</td>
</tr>
<tr>
<td>Hip</td>
<td>Greater trochanteric bursa/area</td>
<td>20-40mg</td>
</tr>
</tbody>
</table>

General rule for methylprednisolone equivalent:
- 120mg in 1 day
- 160mg in 4 weeks
Process of Drawing up Medication

- Open 10cc syringe and attach 18 gauge needle
- Open medication vials and wipe tops with chlorhexidine
- Draw medication into syringe; start with multi-dose
- Cap 18 gauge needle but don’t remove from syringe
- Open gauze and bandage, set near patient
Ready For Procedure...

✓ Pre-procedure checklist
  ✓ iMed Consent
  ✓ Out of OR Time Out Note
  ✓ Supplies prepared and near patient

Marking injection site
Sterile prep
“No-touch” technique
Marking the Site

• Retractable pen
Sterile Prep

- Chlorhexidine over iodine
- Must be mechanical scrub
- 2 swabs, 30 seconds each
- Silver dollar area
“No-Touch” Technique

• Use final prep to confirm location & hand placement
• Non-sterile gloves
• Indentation remains
Intra-articular Knee Injection

Indications
Approach
Patient Positioning
Procedure Checklist
Do I Have a Good Indication for a Knee Aspiration and/or Injection?

- OA
  - ACR conditionally recommends\(^8\)
  - AAOS inconclusive\(^9\)
- Degenerative meniscus tear
- Known inflammatory disease with exacerbation
- Question of inflammatory disease – needing confirmation of crystals

- Avoid in younger patients/those with normal cartilage
Approach to Knee Injection

**Flexed Knee**
- Anteromedial joint line
- Anterolateral joint line

**Extended Knee**
- Lateral midpatellar
- Superolateral patellar
Accuracy Review\textsuperscript{10-12}

**Flexed Knee**
- Anterolateral joint line
  - 67-71%
- Anteromedial joint line
  - 72-75%

**Extended Knee**
- Lateral midpatellar
  - 85-93%
- Superolateral patellar
  - 87-91%

- Improved accuracy
  - Effusion present
  - Provider experience
- Recommend when starting out to pick one technique and use the same approach every time
Recommendations

• **1st choice**
  Superolateral patellar or lateral midpatellar
  – Improved accuracy
  – Potentially less painful

• **Alternate**
  Anterolateral or anteromedial joint line
  – When body habitus limits landmarks in extension
  – Severe PF OA with large lateral patellar osteophytes
• Supine
• Bridge from pelvis to ankle
• Maximal tolerated hyperextension*
• Point toes and patella to ceiling
• Keep quadriceps relaxed (may require additional person to stabilize the foot)
• Elevate patient to place entry site at eye level
Procedure

1. Identify the upper 1/3 of patella
2. Displace and tilt lateral edge of patella
3. Find entry point: soft indentation just posterior to lateral patellar edge
4. Needle entry:
   1. Perpendicular to femur
   2. Parallel to ground
1. Identify the upper 1/3 of patella

2. Displace patella lateral and tilt lateral edge up

3. ID entry point: soft indentation just posterior to lateral patellar edge

4. Needle entry: Perpendicular to femur + parallel to ground

5. Insert needle quickly through skin, then slowly advance through synovium (0.5 to 1 in)
# Knee Injection Summary:
Superolateral or lateral midpatellar approach

<table>
<thead>
<tr>
<th>Positioning</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximal hyperextension</td>
<td>Upper 1/3 of patella</td>
</tr>
<tr>
<td>Toes to ceiling</td>
<td>Displace and tilt</td>
</tr>
<tr>
<td>Relax quads</td>
<td>Perpendicular to femur</td>
</tr>
<tr>
<td>Eye level</td>
<td>Parallel to ground</td>
</tr>
</tbody>
</table>
Subacromial Shoulder Injection

Indications
Approach
Patient Positioning
Procedure Checklist
Do I Have a Good Indication for Subacromial Injection of the Shoulder?

- Impingement Syndrome/SA bursitis
- Rotator cuff tendinitis/partial-thickness tear
  - Failed conservative management
- Inoperable full-thickness rotator cuff tear
- Rotator cuff arthropathy
  - Get both SA and GH areas
- Not indicated for primary GH OA
  - No connection unless full-thickness tear
Subacromial Injections

- Inflamed tendon
- Bursa filled with fluid
- Hooked acromion
Approach

Posterior

Lateral
Patient Positioning

- Patient seated
- Arm hanging at side, relaxed
- Provider stands behind patient
- Injection site at eye level
Procedure

1. Identify anterior and posterior acromion
2. Note angle of acromion
3. Find entry point:
   – 1 cm inferior and medial to posterior corner
4. Needle entry:
   – Parallel to acromion angle
   – Sagittal plane
5. Insert needle 1-1.5 in.
   – Tip under mid to anterior acromion
Troubleshooting

• Always aspirate before injecting

• If resistance encountered:
  – First, rotate needle 180 degrees
  – Next, withdraw few millimeters
  – Finally, withdraw a few more millimeters and redirect slope of needle by 5-10 degrees
Documentation Requirements

• See handout
Synovial Fluid Analysis

- Purple-top tube
  - Cell count and differential
  - Crystal analysis
- Original syringe with cap
  - Gram stain and culture
- Label each tube
  - Patient name
  - SSN
  - Date/time collected
  - Location ("Right knee")
  - Order number
Summary Recommendations

- 21 gauge 1.5 inch needle with 10cc syringe
- Medications (can be used for both procedures):
  - 1cc = 40mg methylprednisolone or equivalent
  - 2cc 0.1% lidocaine
  - 2cc 0.5% bupivacaine
- Do not anesthetize the skin
- Prep skin with chlorhexidine
- Use the “no-touch” technique
- Position patient with entry site at eye level
- Use same approach for each procedure