Musculoskeletal Injections: Joint and Soft Tissue Injections

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James McNabb, MD, FAAFP

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Dr. McNabb maintains a solo private practice as a “simple country doctor” in Mooresville, NC. The office is an NCQA Level 3 PCMH and is a member of Piedmont HealthCare - a multisite, multispecialty group. “We strive to create positive, therapeutic, and lasting physician-patient relationships,” says Dr. McNabb. He actively teaches for National Procedures Institute, the North Carolina Academy of Family Physicians, and other medical organizations. Dr. McNabb divides his professional time between patient care, teaching, and writing. He has presented at FMX every year since 1999. His specialty topics include musculoskeletal injections, osteoarthritis of the knee, and dermatologic procedures. He says that use of visco-supplements for treatment of osteoarthritis of the knee and musculoskeletal ultrasound are important trends in his field of expertise.
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Dr. Watkins has been teaching and writing about a wide range of topics, including PCMH, quality improvement, motivational interviewing, joint injections, and natural medicine, for more than a two decades. Dr. Watkins and his team received the Kate B. Reynolds Foundation’s National 2014 Innovations in Rural Health Award for his role in developing a program that placed undergraduate students in community medical practices to help them achieve NCQA recognized PCMH status and implement quality improvement processes.
Learning Objectives

1. Compare musculoskeletal injections by joint site, steroid agent and dose, and potential side effects that may occur.
2. Evaluate whether joint injections are for patients’ pain relief, to reduce inflammation or mobility improvement.
3. Perform joint injections on models.
Musculoskeletal disorders are commonly encountered in practice by family physicians. Nonpharmacologic options including injections are needed to treat these conditions.
Acetaminophen Toxicity

• The 2014 Annual Report of the American Association of Poison Control Centers' National Poison Data System:
  • 50,396 single exposures to acetaminophen alone
  • 22,951 single exposures to acetaminophen combos
  • Acetaminophen exposure alone resulted in 65 deaths
  • Acetaminophen combinations resulted in 42 deaths.


• CDC estimates 1,600 cases of acute liver failure each year. Acetaminophen-related was the most common.

FDA Safety Announcement

• On Jan. 13, 2011, the U.S. Food and Drug Administration asked manufacturers to limit acetaminophen in prescription drug products to 325 mg per dosage unit (tablet/capsule).

• A Boxed Warning highlighting the potential for severe liver injury and a Warning highlighting the potential for allergic reactions (e.g., swelling of the face, mouth, and throat, difficulty breathing, itching, or rash) was added to the label of all acetaminophen prescription drug products.
FDA Safety Announcement

• On Jan. 14, 2014, the U.S. FDA asked health care professionals to discontinue prescribing combination drug products with > 325 mg acetaminophen per dosage unit.

• No available data shows that > 325 mg of acetaminophen per unit provides additional benefit that outweighs the added risks.

• Limiting the amount will reduce the risk of severe liver injury.

Paracetamol: Not as safe as we thought?

- Systematic lit. rev of 1888 studies, 8 met inclusion criteria.
- 2 studies reported all cause mortality - increased relative rate from 0.95 to 1.63.
- 4 studies reported cardiovascular AEs - all showed a dose response with 1 reporting an increased risk ratio from 1.19 to 1.68.
- 1 study of GI AEs or bleeds reported a dose response with increased RR from 1.11 to 1.49.
- 3 studies of renal AEs reported a dose response with 1 reporting an increased OR of ≥30% decrease in eGFR from 1.40 to 2.19.

Risk of acute myocardial infarction with NSAIDs in real world use: Bayesian meta-analysis of individual patient data

- Meta-analysis of 4 studies
- The pooled data comprised 61,460 cases and 385,303 controls for a total number of 446,763 individuals.
- All NSAIDs, including naproxen, were found to be associated with an increased risk of acute myocardial infarction. Risk of myocardial infarction with celecoxib was comparable to that of traditional NSAIDS and was lower than for rofecoxib. Risk was greatest during the first month of NSAID use and with higher doses.

BMJ 2017;357:j1909 http://dx.doi.org/10.1136/bmj.j1909 Accepted: 10 April 2017
NSAIDS and Atrial Fibrillation

- Two large European population-based studies show that traditional NSAIDs and COX-2 inhibitors increase the incidence of AF.
- This is especially noted with recent use within 30 days of onset of AF.
- Since NSAIDS inhibit cyclooxygenase enzymes in the kidneys, it is thought that this mechanism causes fluid retention, increases blood pressure, and leads to enlargement in both end-diastolic and end-systolic dimensions of the heart.

NSAIDS and Venous Thromboembolism

- 6 European studies (from 2007 - 2013) with 21,401 pts.
- The pooled risk ratio of VTE in NSAID users was 1.8.
- The pooled risk ratio of VTE in COX-2 inhibitor users was 1.99.
- Inhibition of the COX-2 enzyme:
  - Inhibits synthesis of prostacyclin → plt activation
  - Stimulates release of thromboxane → plt aggregation

FDA Alert

Prescription NSAID labels revised to reflect the following information:

• The risk of heart attack or stroke can occur as early as the first weeks of using an NSAID. The risk may increase with longer use of the NSAID.
• The risk appears greater at higher doses.
• It was previously thought that all NSAIDs may have a similar risk. Newer information makes it less clear that the risk for heart attack or stroke is similar for all NSAIDs; however, this newer information is not sufficient for us to determine that the risk of any particular NSAID is definitely higher or lower than that of any other particular NSAID.
• NSAIDs can increase the risk of heart attack or stroke in patients with or without heart disease or risk factors for heart disease. A large number of studies support this finding, with varying estimates of how much the risk is increased, depending on the drugs and the doses studied.
• In general, patients with heart disease or risk factors for it have a greater likelihood of heart attack or stroke following NSAID use than patients without these risk factors because they have a higher risk at baseline.
• Patients treated with NSAIDs following a first heart attack were more likely to die in the first year after the heart attack compared to patients who were not treated with NSAIDs after their first heart attack.
• There is an increased risk of heart failure with NSAID use.

https://www.fda.gov/ForConsumers/ConsumerUpdates/ucm453610.htm Posted 07/09/2015, Last updated 09/28/2016
Other treatment alternatives

- Physical therapy/devices/thermal
- Pain modulating medications
- Injection management
  - Corticosteroids
  - Devices such as hyalanuronic viscosupplements
  - Botulinum toxin
  - Platelet-rich plasma
  - Prolotherapy
  - Others
Indications

• **Diagnostic**
  – Synovial fluid for analysis
  – Local anesthetic for exam

• **Therapeutic**
  – Fluid removal
  – Pain relief
Corticosteroid Injections

• Effective for **short-term** treatment
• Should be used with other treatments:
  – Thermal modalities - ice, heat, ultrasound
  – Compression
  – Splinting
  – Activity modification
  – Physical therapy
  – Orthotics


Joint Conditions

- Effusion of unknown origin
- Crystalloid arthropathies
- Synovitis
- Inflammatory arthritis
- Osteoarthritis/Osteoarthrosis
Soft Tissue Conditions

- Bursitis
- Tendonitis/Tendinosis
- Fasciitis
- Entrapment syndromes
- Trigger points
- Ganglions
- Neuromas
Contraindications

- Critical tendons
  - Achilles, Patellar, Quadriceps
- Allergy to injected medications
  - including methylparaben which is commonly used as a preservative in multi-dose vials.
- Uncooperative patient
Safety

• Define anatomic landmarks
• Use universal precautions
• Follow sterile procedure
• Utilize aseptic “no-touch” technique
Local Anesthetic

- Dilutes the corticosteroid
- Provides short term pain relief
- Allows patient feedback
Local Anesthetic

- Lidocaine - 1% plain
- Bupivacaine 0.25%
  (Optional)
Corticosteroids

• Mechanism of action
  – Anti-inflammatory

• Selection of steroid
  – Triamcinolone acetonide
  – Methylprednisolone acetate
  – Betamethasone acetate & sodium phosphate
  – Dexamethasone
# Corticosteroids

<table>
<thead>
<tr>
<th>Corticosteroid Preparation</th>
<th>Equivalent Dose/Volume</th>
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<tbody>
<tr>
<td>Triamcinolone acetonide</td>
<td>40 mg/mL</td>
</tr>
<tr>
<td>Methylprednisolone acetate</td>
<td>40 mg/mL</td>
</tr>
<tr>
<td>Betamethasone Na&lt;sub&gt;3&lt;/sub&gt;PO&lt;sub&gt;4&lt;/sub&gt;</td>
<td>8 mg/mL</td>
</tr>
<tr>
<td>Dexamethasone mixture</td>
<td>8 mg/mL</td>
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</table>
Viscosupplements

- High molecular weight derivatives of Hyaluronan
- Synthetically derived from rooster combs or bacterial fermentation

Mechanisms of action:
- Physical cushioning of knee joint
- Anti-inflammatory action
- Stimulation of production of endogenous hyaluronan by synoviocytes
Viscosupplements

FDA approval for the treatment of pain in knee osteoarthritis in patients who have failed to respond adequately to conservative nonpharmacologic therapy and to simple analgesics, e.g., acetaminophen
Equipment

- Syringes: 3, 5, 10, 20 & 60 mL
- Needles:
  - #20 gauge - 1 inch blunt tip fill needles for drawing medications
  - #18 gauge - 1½ inch - for aspirations
  - #25 gauge – ½, 1, 1½, & 2 inch - for injections
- Alcohol, 10% Povidone-iodine, Gauze pads, Adhesive bandages
- Exam gloves - nonsterile
- Vapocoolant spray
- Lidocaine: 1% plain
- Steroid of choice – Triamcinolone acetonide 40 mg/mL
- Viscosupplement of choice (if indicated and desired)
Complications - Systemic

- Vasovagal reaction
- Lidocaine allergy
- Lidocaine toxicity
  - Cardiac arrhythmias
  - Seizures
Complications - Systemic

- Flushing
- Increased blood sugar with diabetes
- Impaired immune response
- Psychological disturbance
- Adrenal suppression
- Irregular menses
- Osteoporosis

Complications - Local

- Bleeding – rare
- Infection – rare with aseptic technique
- Steroid flare - or reaction to preservative?
- Tendon rupture
- Subcutaneous atrophy
- Skin depigmentation
- Joint space loss at the knee joint – does NOT occur following multiple corticosteroid injections in osteoarthritis

Total joint arthroplasty following intra-articular steroid injection

- Meta-analysis of 12 studies with 2,068 participants
- Steroid injection prior to total joint replacement was found to confer no increased risk of deep or superficial prosthetic infection (CI = 95%).
- Safe procedure when conducted with aseptic precautions.

Chondrotoxicity

• Reported with amide local anesthetics - lidocaine, bupivacaine and ropivacaine in in-vitro studies.
  

• Confirmed with in-vivo trials.
  
Chondrotoxicity

• Greater risk for chondrolysis with longer exposure to a high concentration of local anesthetic, such as with the use of a continuous infusion of anesthetic via a pain pump following orthopedic surgery.


• The preservatives and the pH of the local anesthetic solution may also play a role in chondrotoxicity.

Chondrotoxicity

The consequences of a single intra-articular injection of local anesthetics and corticosteroids in humans remains unclear and requires further investigation.
Corticosteroids have a time- and dose-dependent effect on articular cartilage, with beneficial effects occurring at low doses and durations and detrimental effects at high doses and durations. Clinically, beneficial effects are supported for intra-articular administration, but the lowest efficacious dose should be used.

Effect of Intra-articular Triamcinolone vs Saline on Knee Cartilage Volume and Pain in Knee OA

• 2-year, double-blind RCT of intra-articular triamcinolone vs saline for symptomatic knee osteoarthritis with ultrasonic features of synovitis in 140 patients.
• Triamcinolone 40 mg vs. Saline every 12 weeks x 2 years.
• A mean change in index compartment cartilage thickness of −0.21 mm vs −0.10 mm measured using MRI scans.
• No significant difference in pain (−1.2 vs −1.9)

INFORMED CONSENT
EVIDENCE BASED MEDICINE
What’s New & Exciting?
Musculoskeletal Ultrasound

- Diagnosis
- Treatment

Aid needle placement for Injections & Aspirations
Others for Treatment of Lateral Epicondylitis and Plantar Fasciitis

- Botulinum Toxin A
- Autologous blood
- Platelet-rich plasma
- Glucose - Prolotherapy

These are not FDA-approved
Workshop
Rotator Cuff
Tendinitis
Subacromial Space Injections

• Corticosteroid injections in the subacromial space are effective in the short to medium term treatment of rotator cuff disorders.

• and for the treatment of adhesive capsulitis.
Subacromial Space Injections

- Safety - Use in patients with subacromial impingement does not result in an increase in rotator cuff tears.
Subacromial Space

Acromion

Acromial Clavicular Joint

Corocoid Process

Glenoid Fossa
Landmarks

- Target Site
- Lateral Border of Acromion
- Entry Site

Posterior Border of Acromion
Subacromial Space Injection

3 mL syringe

#25 ga, 2 inch needle

1 mL Lidocaine

1 mL Steroid
Glenohumeral Joint Arthritis Adhesive Capsulitis
Glenohumeral Joint Injection

3 mL syringe

#25 ga, 1 inch needle

1 mL Lidocaine

1 mL Steroid
AC Joint Arthritis
Acromioclavicular Joint Injection

3 mL syringe

#25 ga, ½ inch needle

0.5 mL Lidocaine

0.5 mL Steroid
Lateral Epicondylitis
Lateral Epicondylitis

3 mL syringe
#25 gauge, 1 inch needle

1 mL Lidocaine
1 mL Steroid
Lateral Epicondylitis
Pinch Technique
Medial Epicondylitis
Medial Epicondyle

Injection Site

Ulnar Nerve
Medial Epicondylitis

3 mL syringe
#25 gauge, 1 inch needle

1mL Lidocaine
1 mL Steroid
Olecranon Bursitis
Olecranon Bursae
Olecranon Bursitis

Aspiration

• 10 or 20 mL syringe
• #18 gauge, 1 ½ inch needle
• No steroid
Olecranon Bursitis
Carpal Tunnel Syndrome
Carpal Tunnel Syndrome
Local corticosteroid injection is effective for the short-term treatment of CTS.

Local corticosteroid injection is a common non-surgical treatment for CTS. This systematic review confirmed the effectiveness of local corticosteroid injection for relief of symptoms for severe carpal tunnel syndrome up to one month after injection. Local corticosteroid injection provides significantly greater clinical improvement compared to oral steroid up to three months after treatment. Two injections of local corticosteroid do not provide significant further clinical improvement of symptoms. Further research is required to determine length of benefit of local corticosteroid injection and benefit for mild and moderate carpal tunnel syndrome.

http://onlinelibrary.wiley.com/o/cochrane/clsysrev/articles/CD001554/frame.html
Carpal Tunnel

- From radial to ulnar
- Flexor carpi radialis
- Flexor pollicis longus
- Median nerve
- Flexor digitorum superficialis
- Flexor digitorum profundus
- Overlying flexor retinaculum
Flexor Carpi Radialis Approach

- Highest accuracy rate, and is also the safest injection site.

- Higher risk of ulnar artery and median nerve injury when using the traditional approach.
Right Wrist - distal radioulnar joint

- Structures from left to right (radial to ulnar)
  - Abductor pollicis longus
  - Extensor pollicis brevis
  - Flexor carpi radialis
  - Flexor pollicis longus
  - Median nerve
  - Palmaris longus
  - Flexor digitorum superficialis
  - Ulnar artery and nerve
  - Flexor carpi ulnaris
Position the needle and syringe at a 30 to 45 degree angle to the skin with the needle tip directed in an ulnar and distal direction toward the hypothenar eminence.
Carpal Tunnel: Flexor Carpi Radialis Approach

- 3 mL syringe
- #25 gauge, 1 inch needle
- 1mL Lidocaine
- 1 mL Steroid
- 30 to 45 degree angle of introduction
Carpal Tunnel Corticosteroid Injection

- A single local injection of corticosteroid results in long-lasting improvement in approximately half of treated patients.


- A second corticosteroid injection appears at least as effective as the first.
Ganglion Cyst
Ganglion Cyst

• Local anesthesia
• 10 mL syringe
• #18 gauge, 1 1/2 inch needle
• No steroid
Thumb CMC Joint Arthritis
Thick
Carpometacarpal
Joint

Trapezium

1st metacarpal
Thumb CMC Joint

Distal Aspect of Anatomic Snuff Box
Thumb CMC Joint Injection

- 3 mL syringe
- #25 ga, ½ inch needle
- 0.5 mL Lidocaine
- 0.5 mL Steroid
Trigger Finger
Trigger Finger

• Injection of corticosteroid is a useful first-line treatment for trigger finger.

• 66% success rate.
Trigger Finger

3 mL syringe
#25 gauge, 1 inch needle
0.5 mL Lidocaine
0.5 mL Steroid
Trochanteric Bursitis
Trochanteric bursa of gluteus muscles
Trochanteric Bursitis Injection

- 5 mL syringe
- #25 gauge, 1 ½ or 2 inch needle
- 3 mL Lidocaine
- 1 mL Steroid

Consider fanning
Prepatellar Bursitis
Prepatellar Bursa Aspiration

- 10 or 20 mL syringe
- #18 gauge
  1 ½” needle
- No steroid
Knee Joint Arthritis
Intra-articular Corticosteroids for Knee Osteoarthritis

- 27 trials (13 new studies) with 1767 participants
- Most trials were small and hampered by low methodological quality.
- Intra-articular corticosteroids appeared to be more beneficial in pain reduction and functional improvement than control interventions.
- When stratifying results after end of treatment, benefits were:
  - moderate at 1 to 2 weeks
  - small to moderate at 4 to 6 weeks
  - small at 13 weeks
  - no evidence of an effect at 26 weeks

Knee Joint
The Most Common Knee Joint Injection Approaches

Lateral Suprapatellar Approach (supine)
Lateral Midpatellar Approach (supine)
Anterior Lateral Approach (seated)
Anterior Medial Approach (seated)
What is the most accurate approach?

- Literature review through July 2010, 9 studies

<table>
<thead>
<tr>
<th>Approach</th>
<th>Accuracy</th>
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<tbody>
<tr>
<td>Lateral suprapatellar</td>
<td>91% (95% CI 84-99%)</td>
</tr>
<tr>
<td>Lateral midpatellar</td>
<td>85% (95% CI 68-100%)</td>
</tr>
<tr>
<td>Anteromedial</td>
<td>72% (95% CI 65-78%)</td>
</tr>
<tr>
<td>Anterolateral</td>
<td>67% (95% CI 43-91%)</td>
</tr>
</tbody>
</table>

Knee Joint Injection (without aspiration)

- Good topical vapocoolant spray:
- Insert a #25 gauge, 1 ½ - 2 inch needle
- 3 mL syringe
  - 1 mL Lidocaine
  - 1 mL Steroid
Knee Joint Aspiration

Local Anesthesia:
- Good topical vapocoolant spray
- Insert a #25 gauge 1 ½ - 2 inch needle
- Inject 5 mL of 1% Lidocaine - infiltrating skin and synovial capsule

Aspiration:
- 10, 20 or 60 mL syringe
- #18 gauge, 1 ½ inch needle
Knee Joint Injection

• Following Anesthesia & Aspiration:
• Inject through the #18 gauge needle
• 3 mL syringe
  – 1 mL Lidocaine
  – 1 mL Steroid
VIDEO of Knee Joint Injection
Viscosupplementation is effective for the treatment of osteoarthritis of the knee

Hyaluronan (HA) products provide opportunity to treat osteoarthritis (OA) in individual knee joints. The analyses, support the contention that the HA class of products is superior to placebo. There is considerable between-product, between-variable and time-dependent variability in the clinical response. The clinical effect for some products against placebo on some variables at some time points is in the moderate to large effect size range. No major safety issues were detected. The analyses suggest that viscosupplements are comparable in efficacy to systemic forms of active intervention, with more local reactions but fewer systemic adverse events, and that HA products have more prolonged effects than IA corticosteroids. Overall, the analyses support the use of the HA class of products in the treatment of knee OA.

MSK Ultrasound

• Diagnostic

• Therapeutic
  – Assist accurate needle placement
  – Especially important when injecting viscosupplement

• Does imaging improve injection accuracy?
  – Systematic literature review
  – Knee (99% vs 79%)

Quadriceps muscle

Prefemoral fat pad

18 gauge needle

Anterior aspect of femur
Plantar Fasciitis
Plantar Fasciitis

- 3 mL syringe
- #25 gauge, 1 ½ inch needle
- 1 mL Lidocaine
- 1 mL Steroid
Coding

• CPT Code
  – Describes the procedure performed

• J Code
  – Used to account for the injected corticosteroid or viscosupplementation product
  – (Not local anesthetic)

• E&M Code
  – May be used only if medical necessity documented
CPT 2017

- **20600** Arthrocentesis, aspiration and/or injection _small_ joint or bursa
- **20605** Arthrocentesis, aspiration and/or injection _intermediate_ joint or bursa
- **20610** Arthrocentesis, aspiration and/or injection _major_ joint or bursa
CPT 2017

- **20612** Aspiration or injection of *ganglion cyst(s)*
- **20526** Injection, carpal tunnel
- **20550** Injection, tendon sheath, ligament, aponeurosis (plantar fasciitis)
- **20551** Injection, tendon origin/insertion
Pearls

• Review and mark anatomy before aspirating or injecting.

• Always use the no-touch technique.

• Injections:
  – use a ½, 1, 1½, or 2 inch #25 ga. needle

• Aspirations:
  – use a 1½ inch #18 ga. needle.
Practice Recommendations

- Consider injections and aspirations, as well as other nonpharmacologic treatment modalities instead of simply prescribing NSAIDS for patients with joint and soft tissue musculoskeletal conditions.
- Begin performing simple injections such as trochanteric bursitis, lateral epicondylitis, medial epicondylitis, olecranon bursitis and prepatellar bursitis.
- Then progress to more challenging and useful injections such as those accessing the subacromial space, knee joint and carpal tunnel.
Contact

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