Musculoskeletal Injections

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Acknowledgements

• Ryan Petering, MD
• Andrea Herzka, MD
Injections Objectives

• Describe possible locations for injections
• Review types of injectables
• Describe role for ultrasound-guidance
Location

- Tendon sheath
  - lateral/medial epicondyle, external rotators of hip, achilles
- Intraarticular (IA)
  - Small, medium, large
  - Point of care Ultrasound (US): Hip
- Bursa
  - subacromial/subdeltoid, iliopsoas, greater tuberosity, prepatella
- Nerve
  - lateral femoral cutaneous nerve, carpal tunnel
- Calcific tendonitis
  - Needling
Common Injectables

- Corticosteroids
- Hyaluronic acid (viscosupplementation)
- Autologous Blood (whole blood)
- Platelet-rich plasma (PRP)
- Anesthetic
  - Diagnosis
  - Needling: tenotomy or calcific tendonitis
Corticosteroids

- Anti-inflammatory
- Regional treatments
- Many aspects of outcome/use is related to the location of injection (bursa vs joint/cartilage vs tendon)
- Typically provide weeks-months of pain reduction and symptom improvement
- Triamcinolone, methylprednisolone, dexamethasone
Corticosteroids

- Cochrane Review
- Twenty-eight trials (1973 participants)
- Short-term benefit of IA corticosteroids in treatment of knee OA is well established
- Few side effects have been reported.
- Overall supports the use of the IA corticosteroids in the treatment of OA knee.
- “The response to HA products appears more durable.”

Cochrane Database of Systematic Reviews 2006, Issue 2.
**Corticosteroid Injections for Common Musculoskeletal Conditions**

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**SORT: KEY RECOMMENDATIONS FOR PRACTICE**

<table>
<thead>
<tr>
<th>Clinical recommendation</th>
<th>Evidence rating</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corticosteroid injections in the shoulder have only short-term benefits in adhesive capsulitis and subacromial impingement syndrome.</td>
<td>B</td>
<td>5, 7-9, 12, 14, 19</td>
</tr>
<tr>
<td>Corticosteroid injections for lateral and medial epicondylitis lead to short-term improvement but have a high rate of recurrence and are no better than other options in the long term.</td>
<td>B</td>
<td>21, 26-30</td>
</tr>
<tr>
<td>Corticosteroid injections can be considered for patients with carpal tunnel syndrome who wish to avoid or delay surgical treatment.</td>
<td>B</td>
<td>35, 36, 40</td>
</tr>
<tr>
<td>Corticosteroid injections for de Quervain tenosynovitis and trigger finger are effective early in therapy.</td>
<td>B</td>
<td>44, 46, 48, 50</td>
</tr>
<tr>
<td>Corticosteroid injections provide short-term relief from symptoms of knee and hip osteoarthritis in patients who wish to delay surgery.</td>
<td>B</td>
<td>57, 60-63</td>
</tr>
</tbody>
</table>

*A = consistent, good-quality patient-oriented evidence; B = inconsistent or limited-quality patient-oriented evidence; C = consensus, disease-oriented evidence, usual practice, expert opinion, or case series. For information about the SORT evidence rating system, go to http://www.aafp.org/afpsort.*
<table>
<thead>
<tr>
<th>Condition</th>
<th>Short-term relief</th>
<th>Long-term relief</th>
<th>Strength of evidence</th>
<th>Success of therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adhesive capsulitis</td>
<td>++ to +++</td>
<td>++ to +++</td>
<td>++</td>
<td>Faster pain relief and improved range of motion and function in short term; equivalent to other options in long term</td>
</tr>
<tr>
<td>Carpal tunnel syndrome</td>
<td>+++</td>
<td>+</td>
<td>+</td>
<td>Short-term improvements in pain and function, with up to one-half of patients having a recurrence in the long term; reduces need for surgery in some patients</td>
</tr>
<tr>
<td>De Quervain tenosynovitis</td>
<td>++</td>
<td>NA</td>
<td>+</td>
<td>Short-term improvements in pain and function compared with placebo</td>
</tr>
<tr>
<td>Greater trochanteric bursitis</td>
<td>+++</td>
<td>+ to ++</td>
<td>++</td>
<td>Short-term pain relief, although no better than usual care in the long term</td>
</tr>
<tr>
<td>Hip osteoarthritis</td>
<td>++ to +++</td>
<td>+ to ++</td>
<td>++</td>
<td>Injections challenging to administer in office settings</td>
</tr>
<tr>
<td>Knee osteoarthritis</td>
<td>++ to +++</td>
<td>+</td>
<td>++</td>
<td>One to two weeks of pain relief after injection</td>
</tr>
<tr>
<td>Lateral epicondylitis</td>
<td>++ to +++</td>
<td>+</td>
<td>+</td>
<td>Short-term pain relief with significant risk of symptom rebound in long term</td>
</tr>
<tr>
<td>Medial epicondylitis</td>
<td>++</td>
<td>+</td>
<td>+</td>
<td>Short-term pain relief, although no long-term difference compared with placebo</td>
</tr>
<tr>
<td>Morton neuroma</td>
<td>NA</td>
<td>NA</td>
<td>+</td>
<td>Success of therapy is unknown because of poor-quality studies</td>
</tr>
<tr>
<td>Subacromial impingement syndrome</td>
<td>+</td>
<td>+</td>
<td>++ to +++</td>
<td>Short-term pain relief equal to systemic corticosteroids; similar long-term outcomes as other treatments</td>
</tr>
<tr>
<td>Trigger finger</td>
<td>++ to +++</td>
<td>++</td>
<td>+</td>
<td>Cure rates range from 54% to 86%</td>
</tr>
<tr>
<td>Wrist and hand osteoarthritis</td>
<td>NA</td>
<td>NA</td>
<td>+</td>
<td>No strong recommendation from the American College of Rheumatology</td>
</tr>
</tbody>
</table>

NA = not available; + = weak or conflicting evidence or poor success; ++ = fair evidence or success; +++ = good evidence or success.
How many shots can you get?

• Depends on the location/target
• Common quoted range is 3-4 per year IA
• Theoretical risk of cartilage damage
  – Data sparse: no RCT showing harm in humans; most of studies are lab based
• Theoretical risk of tendon damage
  – Ex. achilles rupture if injection near – there is growing evidence that risk is low
  – Ex. Weakening of tissue; future surgery
Hyaluronic acid (HA)

• HA is a non-sulfated, naturally occurring glycosaminoglycan
• Approved for osteoarthritis of the knee only (FDA)
• Series of injections typically
• HA exists naturally in various animal tissues
  – Rooster combs (the largest content of HA), shark skin, bovine eyeballs and nasal cartilage, rabbit brain and heart
  – Human tissues: umbilical cord, synovial fluid, vitreous body, dermis, epidermis, thoracic lymph, urine, and serum.

Drugs R D 2011; 11 (1): 13-27
Hyaluronic acid

- Orthovisc, Synvisc, Euflexxa, Suparttz
- Stimulates cell migration, differentiation, and proliferation, and regulates extra-cellular matrix organization and metabolism.
- Chondroprotective effects
- Exact mechanism unclear.
- Second (last) line injections for knee OA

Drugs R D 2011; 11 (1): 13-27
• Conclusions:
• Meta-analysis of only the double-blinded, sham-controlled trials with at least sixty patients did not show clinically important differences of HA treatment over placebo.
• The overall effect was greater but was biased toward stronger treatment effects because of the influence of nonblinded or improperly blinded trials.

Network meta-analysis

Individual patients had 15% or 11% greater chance achieving functional benefits (IAS/IAP)

Recommends the use of HA for the appropriate patients with knee OA.

Limited armamentarium of non-op treatments
Autologous Blood

• Whole blood
• Taken from patient at time of procedure
• Creating a bruise
• Assist tendon healing (growth factors, fibroblast growth factors)
• Induce healing cascade
• US healing of tendon
• Costs: same as procedure to do steroid injection
Platelet Rich Plasma (PRP)

- Autologous Conditioned Plasma (ACP)
- Patient blood spun in centrifuge to concentrate the platelets
- Platelets are 3-10x higher than normal serum
- +/- leukocytes (WBC)
- Cash pay – typically not covered by insurance ($350 to 500+ per shot)
- Many times recommended as a series (3-5 shots spaced out 3-4 weeks apart)
Table 1
Growth factors identified within platelet-rich plasma and their biological functions

<table>
<thead>
<tr>
<th>Name</th>
<th>Abbreviation</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Platelet-derived growth factor</td>
<td>PDGF</td>
<td>Stimulation of fibroblast production, chemotaxis, TGF-β1, collagen production; upregulation of proteoglycan synthesis of fibroblasts, smooth muscle cells, chondrocytes, osteoblasts and mesenchymal stem cells</td>
</tr>
<tr>
<td>Insulin-like growth factor-1</td>
<td>IGF-1</td>
<td>Promotion of cell growth, differentiation, recruitment in bone, blood vessel, skin, other tissues; upregulation of collagen synthesis with PDGF of fibroblasts</td>
</tr>
<tr>
<td>Transforming growth factor-beta 1</td>
<td>TGF-β1</td>
<td>Promotion of fibroblast proliferation, extracellular matrix formation, cell viability, production of collagen from fibroblasts; suppressed interleukin 1-mediated effects on proteoglycan synthesis in cartilage</td>
</tr>
<tr>
<td>Vascular endothelial growth factor</td>
<td>VEGF</td>
<td>Promotion of cell growth, migration, new blood vessel growth and antiapoptosis (anti-cell death) of blood vessel cells</td>
</tr>
<tr>
<td>Basic fibroblastic growth factor</td>
<td>bFGF</td>
<td>Stimulation of collagen production, angiogenesis and myoblast proliferation</td>
</tr>
<tr>
<td>Epidermal growth factor</td>
<td>EGF</td>
<td>Promotion of cell recruitment, proliferation, differentiation, angiogenesis, cytokine secretion by mesenchymal and epithelial cells</td>
</tr>
<tr>
<td>Connective tissue growth factor</td>
<td>CTGF</td>
<td>Promotion of angiogenesis, cartilage regeneration, fibrosis, platelet adhesion</td>
</tr>
</tbody>
</table>
Chronic Hamstring Tendonopathy

- Compare US guided: platelet-rich plasma (PRP) and whole blood (WB) injections to proximal hamstring tendon
- Prospective double-blind randomized controlled trial
- Pain/Function: 2, 6, and 12 weeks and 6 months after injection.
- Diagnostic ultrasound compare pre-injection and 6-month

Results:
- WB group: showed greater improvements in pain and function before 12 weeks; decreased pain with 15-minute sitting
- PRP group: significant improvements in ADLs

Conclusions: Both groups significant improvement at 6 months; PRP group improved ADLs, WB improvement with sitting.

PRP

“There is not substantial scientific evidence available in the form of randomized, double-blind clinical studies that document the reliability and effectiveness of PRP therapy in various injuries”

- PRP uses: heart bypass surgery, plastic surgery, maxillofacial surgery, dermatology, and orthopedic surgery.
- PRP MSK uses: tendinopathies (lateral epicondylitis, achilles, patellar, hamstring), acute muscle tears, medial collateral ligament tears, anterior cruciate ligament tears, osteoarthritis, and ankle sprains.

Med Clin N Am 100 (2016) 199–217
PRP Future

- Platelet concentrations
- Pre and Post – injection protocols
- Rehabilitation protocols
- Efficacy/application
- Cost
Ultrasound Guided

- Accuracy:
  Visualize target
  Visualize Adjacent Hazards
- All landmark based injections
- Makes other injections possible in clinic
- Lack Radiation
- Cost Effective
- Patient Education
Carpal Tunnel Injection
Obesity
Hematoma Aspiration
Needling/Tenotomy

Ultrasound-Guided Fenestration of Tendons About the Hip and Pelvis

Clinical Outcomes

Jon A. Jacobson, MD, Joshua Rubin, MD, Corrie M. Yablon, MD, Sung Moon Kim, MD, Monica Kalume-Brigido, MD, Aishwarya Parameswaran, MS

Conclusions—Clinical follow-up after ultrasound-guided fenestration of the gluteus medius, gluteus minimus, proximal hamstring, and tensor fascia latae tendons showed that 82% of patients had improvement in their symptoms.
Needling/tenotomy
Diagnostic Injection

• Anesthetic only
• Ultrasound guidance
• Clinical setting pre and post injection assessment
• Pain scale
• Attempt provocative maneuvers if pain only occurs with certain exercise
Intraarticular Hip
Ultrasound vrs Landmark

- Accuracy
- Efficacy
- Patient comfort
- Viscosupplementation
- Diagnostic information
- Cost effectiveness
- Patient Education
What patients benefit?

• *Unable to participate or advance in physical therapy*
• Pain disrupting sleep, ADLs, work
• Prior steroid injection
  – Landmarks: may try ultrasound guided
  – Consider autologous or PRP injection
• Diagnostic: Confirming location as source of pain
• Patient would like to avoid surgery
  – Preference
  – Medical comorbidities
References

• J Ultrasound Med 2015; 34:2029–2035
• Drugs R D 2011; 11 (1): 13-27
• Med Clin N Am 100 (2016) 199–217
• Drugs R D 2011; 11 (1): 13-27