Injectable and Topical Corticosteroids in Athletes

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Objectives

- Understand the basics of injectable and topical corticosteroids
- Learn how to choose & use the appropriate corticosteroid for common conditions
- Learn how to counsel a patient prior to performing a corticosteroid injection
- Understand the risks and potential complications of corticosteroid use
Background: Types of Corticosteroids & Indications
Background

• Corticosteroids are hormones synthesized predominantly in the adrenal cortex which have Glucocorticoid (GC), cortisol-like, and/or Mineralocorticoid (MC), aldosterone-like, activities.

• In clinical practice, we often use the term “corticosteroids” to refer to synthetic and natural Glucocorticoid compounds that vary in potency, duration of action, and degree of GC (measured by antiinflammatory activity) vs MC (measured by sodium retention) properties.

• Corticosteroids can be an effective remedy for numerous ailments d/t their anti-inflammatory and immunosuppressive effects.
Background

• Hydrocortisone (HC) is most similar to cortisol
  - one of the original injectable corticosteroids, the standard by which synthetics corticosteroids are often compared to.
  - less often used in injections these days and more commonly used as a topical -> has both GC and MC properties, is very short acting, so not as effective as intermediate acting injectables.

• We often say “cortisone injection” in laymams terms when referring to the synthetic corticosteroids that are used in joint and soft tissue injections.
## Intra-Articular Corticosteroid Solutions

<table>
<thead>
<tr>
<th>Corticosteroid</th>
<th>Brand name</th>
<th>Equivalent dose</th>
<th>Duration of action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrocortisone</td>
<td>Hydrocortisone</td>
<td>200mg (soluble)</td>
<td>Short-acting</td>
</tr>
<tr>
<td>Triamcinolone hexacetonide</td>
<td>Aristopan</td>
<td>40mg (insoluble)</td>
<td>Intermediate</td>
</tr>
<tr>
<td>Triamcinolone acetonide</td>
<td>Kenalog</td>
<td>40mg (insoluble)</td>
<td>Intermediate</td>
</tr>
<tr>
<td>Methylprednisolone acetate</td>
<td>Depo-Medrol</td>
<td>40mg (insoluble)</td>
<td>Intermediate</td>
</tr>
<tr>
<td>Dexamethasone acetate</td>
<td>Decadron-LA</td>
<td>8mg (insoluble)</td>
<td>Long-acting</td>
</tr>
<tr>
<td>Dexamethasone sodium phosphate</td>
<td>Decadron, Solurex</td>
<td>4mg (soluble)</td>
<td>Short-acting</td>
</tr>
<tr>
<td>Betamethasone sodium phosphate, or acetate</td>
<td>Celestone, Soluspan</td>
<td>8mg (soluble, insoluble)</td>
<td>Short-acting</td>
</tr>
</tbody>
</table>

The less soluble, the longer the duration of action.
Indications for Corticosteroid Injections

- Can be therapeutic or diagnostic
- Therapeutic: pain relief and anti-inflammatory
- Therapeutic effect can be transient vs long-lasting, often unpredictable
- Even if transient relief can help pt comply w/ PT, reduce pain as a condition undergoes natural time course, & help patient stay active
- Can be diagnostic: if relieves the pain helps confirm etiology
Common Indications

- **Osteoarthritis**: knee, hip, shoulder, ankle, elbow, 1st CMC
- **Bursitis**: subacromial, pes anserine, olecranon
- **Tendinitis, tendinosis, or tenosynovitis**: rotator cuff, glut medius, common extensor of elbow, long head biceps, trigger finger, de Quervains
- **Overuse issues**: impingement, epicondylitis, AC joint, carpal tunnel syndrome
- **Others**: adhesive capsulitis, morton’s neuroma, sinus tarsi syndrome, various ganglion cysts
- **Crystalloid arthropathies**: gout, pseudogout
- **Inflammatory arthritis**: RA, etc
- **Other cases of synovitis**
Knee OA and Corticosteroid Injections

• Intra-articular corticosteroid is more effective than placebo for: pain reduction, increased function, and global assessment in knee OA
• Can increase mobility in knee OA
• Should be done in conjunction w/ rest, PT, NSAIDs, to maximize positive outcomes
• Effectiveness can start as early as 1 week
• Provides pain relief for: 2-4 wks, some relief up to 6wks, some limited data shows effectiveness up to 16-24 wks.

Corticosteroid Injections: Potential Side Effects and Contraindications
Potential Side Effects

- Bleeding, bruising, rare hemarthrosis
- Atrophy of skin, subcutaneous tissue, fat tissue: more common in soft tissue & superficial injections (1%)
- Hypopigmentation: more common in superficial injections
- Risk for infection: low if using sterile technique
- Local reaction, increased pain, cortisone flair (2-10%)
- Tendon rupture if injected into tendon
- Facial flushing: transient, typically onset within 24hrs, lasts 6-96hrs, more common in women (<1 to 12%)
Potential Side Effects, contd.

• Elevated blood pressure: transient
• Anxiety, insomnia: transient, can be very unpleasant
• Menstrual irregularity: rare
• Hyperglycemia in diabetics: can last days, but transient
• HPA (hypothalamic pituitary adrenal) axis disruption: rare but possible, can last 1-4wks; dependent on dose, injection frequency, & co-existing meds/med issues
Use Sterile Technique to Reduce Risk of Infection

- Risk for joint infection in literature varies but is fairly low: 1:10,000 -> 6:100,000
- Avoid high risk patients and use sterile technique
- Use gloves & don’t touch injection site once you’ve sterilized it, if need to touch it then should use sterile gloves
- Sterilize with: betadine, etoh swabs, or chlorhexadine
Post-Injection Pain

• Post-injection pain is common 24-48hrs independent of contents injected
  - advise rest 1 day to minimize risk

• “Cortisone flare” refers to a specific post-injection inflammatory reaction (2-10%)
  - precipitation of steroid crystals into a less soluble paste causing transient microcrystalline-induced inflammatory synovitis
  - warmth, effusion, significant acute pain, sterile leukocytosis of synovial fluid
Cortisone Flare

- Develops 6-36hr post-injection, resolves within 48-72hrs after injection.
- Self-limiting: ice, rest
- Methylprednisolone (aka Dep-medrol) and Triamcinolone acetonide (Kenalog) cause less post-injection flare than other long acting agents
- Diluting the steroid w/ local anesthetic decreases tendency of steroid precipitation (also mixing the solution)
- Try to use lowest effective dose
Do corticosteroid injections accelerate chondral loss in OA?

- Hard thing to test clinically in vivo since cartilage in OA naturally degenerates w/ time
- Studies’ overall results are mixed and inconclusive
- Many in vitro studies (animal based as well as human chondrocyte) suggest there may be a dose dependent and time dependent effect: lower doses being beneficial (more synovial fluid, less cartilage degradation), while higher doses may be harmful
  - The best clinical study to date (RCT of 68pts) showed no increased loss of joint space after injecting arthritic knees q3mos for 2yrs w/ corticosteroid vs placebo (saline)
  - In RA there is some data to show protective effect
- Bottom line: limiting to no more than q3mos prn per joint appears to be safe

Dragoo, 2011; Wernicke, 2015
Reynauld JP, 2002
Contraindications to injection

- Cellulitis, local infection at/adjacent to injection site
- Rash
- Broken skin at injection site
- Joint infection
- Major recent trauma such as fracture
- Impending joint surgery
- Joint prosthesis/hardware
- Severely deformed joint
- Systemic infection, bacteremia
- H/o allergic or other type of severe reaction to contents to be injected
Potential Contraindications

• Systemically immunocompromised state can increase risk of infection:
  - chemo, transplant meds, inflam arthritis meds, serious medical issues, ongoing infection

• CBC thresholds: leukopenia, neutropenia, thrombocytopenia (platelets <50,000)

• Severe coagulopathy
Anti-Coagulated Patients

• Lack of clear data for patients on warfarin but general consensus is to be within therapeutic INR, not over it
  - aim for \( \leq 2.5 \) INR (though some say INR might be safe up to 3 or 3.5)

• Unclear data on other anticoagulants (Xarelto, Eliquis, Pradaxa, etc), but so far data shows equivalent or possibly even lower risk of serious local bleeding compared to warfarin

• Hold/compress immediately following injection to reduce risk
• Best to avoid injection or hold anticoagulant in high risk injection sites such as hip joint
• Consent properly regarding increased bleeding risk

Anti-Platelet Agents

- Plavix, ASA, NSAIDs
- Relative low risk of serious bleeding or hemarthrosis, but can vary between patients, other meds, co-morbidities, and site of injection
- Can increase bleeding -> hold/compress
- Consent/educate properly
Special considerations

- Tendons: Avoid injecting most tendons, particularly tendons at high risk of rupture such as achilles tendon & patellar tendon
  - Less risk: common extensor elbow, glut medius (troch bursa), long head biceps
- Ligaments: do NOT inject
- Poorly controlled Diabetes: best to avoid
- Case reports have shown that HIV patients on Protease Inhibitors (PI) are at increased risk of getting adrenal suppression & Cushings syndrome w/ corticosteroid injections
  - avoid if can, use lowest effective dose if absolutely needed
  - consent/educate properly
  - avoid multiple injections close together
  - consider holding the PI if appropriate
Combining Corticosteroids with Local Anesthetics
Local Anesthetics

- Diluting with local anesthetic helps:
  - provide immediate relief before corticosteroid onset
  - reduces risk of soft tissue atrophy and discoloration
  - reduces risk of steroid precipitation
  - increases volume which might help distribute contents into the joint/bursa space

- Too much anesthetic can have systemic risks
  - potential chondrotoxicity
Local Anesthetics

- Stephens, Mark et al. AFP, 2008.

<table>
<thead>
<tr>
<th>MEDICATION</th>
<th>ONSET OF ACTION (MINUTES)</th>
<th>DURATION OF ACTION (HOURS)</th>
<th>MAX VOLUME OF INJECTION*</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.25% Bupivacaine</td>
<td>30</td>
<td>8</td>
<td>60 mL</td>
</tr>
<tr>
<td>(Marcaine)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.5% Bupivacaine</td>
<td>30</td>
<td>8</td>
<td>30 mL</td>
</tr>
<tr>
<td>1% lidocaine (Xylocaine)</td>
<td>1 to 2</td>
<td>1</td>
<td>20 mL</td>
</tr>
<tr>
<td>2% lidocaine</td>
<td>1 to 2</td>
<td>1</td>
<td>10 mL</td>
</tr>
</tbody>
</table>

* - Increased risk of cardiac toxicity or arrhythmia above these dosages.

Higher doses may have risk of systemic effects such as arrhythmia.
Guidelines for Corticosteroid Injections

- Avoid injecting the same site more than every 3 months prn (aka 3-4x/yr per joint).
- No lifetime combined limit.
- There is no evidence for repeating injection prophylactically, do only as needed.
- Needle used:
  - 22g 1.5 inch to inject large & medium joints
  - 18g to aspirate
  - Small joints could use 25g.
- Syringe: usually a bit larger than the total volume injected (10cc for large joints, 5cc for medium joints, 3cc for small).
## Suggested volumes & doses (can vary)

<table>
<thead>
<tr>
<th>Injection Site</th>
<th>Dose of corticosteroid (Triamcinolone or Methylprednisolone)</th>
<th>Volume of Anesthetic (ex. 1% Lidocaine)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knee joint</td>
<td>40mg</td>
<td>5-6 cc</td>
</tr>
<tr>
<td>Pes anserine bursa</td>
<td>40mg</td>
<td>3cc</td>
</tr>
<tr>
<td>Shoulder joint (GH)</td>
<td>40mg</td>
<td>5-6cc</td>
</tr>
<tr>
<td>Subacromial bursa</td>
<td>40mg</td>
<td>5-6cc</td>
</tr>
<tr>
<td>Lateral epicondylitis</td>
<td>40mg</td>
<td>2-3cc</td>
</tr>
<tr>
<td>Elbow joint</td>
<td>40mg</td>
<td>2-3cc</td>
</tr>
<tr>
<td>AC joint</td>
<td>20mg</td>
<td>1cc</td>
</tr>
<tr>
<td>Tibiotalar joint</td>
<td>40mg</td>
<td>3-4cc</td>
</tr>
<tr>
<td>Greater trochanteric bursa</td>
<td>40mg</td>
<td>5-6cc</td>
</tr>
</tbody>
</table>
Proper Consent and Documentation

• Informed consent involves discussion of benefits, alternatives, and risks…and patient providing consent

• The discussion needs to include:
  - Indications and potential benefits
  - Potential risks/complications & side effects (include most common & also most serious)
  - Possible Alternatives
  - Potential outcomes
  - Opportunity for patient to ask questions

• Documentation in the chart that above was done, and the patient provided consent

• Document steroid dose & quantity, anesthetic dose & quantity, joint/space injected, approach, sterilization technique
Post-procedure instructions

• Rest 24-48hrs
• Keep injection site clean
• Look for signs of infection and what to do if develop worsening pain, swelling, warmth (go to ER, call our office ASAP)
• Inform pt it can take at least 1-2 weeks to start having an effect
DERMATOLOGY:
Topical Corticosteroids
Topical Corticosteroids

• Helpful for skin conditions that require anti-inflammatory and/or immunosuppressive agent
• No single agent has been proven to have best benefit to risk ratio
• Vary in potency, delivery vehicle, side effect severity
• Can exacerbate an infection, so may need to rule out infection in appropriate situations
### Choosing Topical Corticosteroids

**High-potency steroids (groups I to III)**

- Alopecia areata
- Atopic dermatitis (resistant)
- Discoid lupus
- Hyperkeratotic eczema
- Lichen planus
- Lichen sclerosus (skin)
- Lichen simplex chronicus
- Nummular eczema
- Poison ivy (severe)
- Psoriasis
- Severe hand eczema

**Medium-potency steroids (groups IV and V)**

- Anal inflammation (severe)
- Asteatotic eczema
- Atopic dermatitis
- Lichen sclerosus (vulva)
- Nummular eczema
- Scabies (after scabicide)
- Seborrhoeic dermatitis
- Severe dermatitis
- Severe intertrigo (short-term)
- Stasis dermatitis

**Low-potency steroids (groups VI and VII)**

- Dermatitis (diaper)
- Dermatitis (eyelids)
- Dermatitis (face)
- Intertrigo
- Perianal inflammation

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### Potency Ranges

Potency ranges from Ultra High (I) to Least Potent (VII).

**C = cream**

**F = foam**

**G = gel**

**L = lotion**

**O = ointment**

**Sh = shampoo**

**So = solution**

**T = tape**

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**Ference JD & Last AR, Am Fam Physician, 2009**
Steroid Vehicles

- Potency can be influenced by the *vehicle* in which a steroid is formulated.
- **Ointments** are very lubricating, occlusive, high absorption. Useful in thick hyperkeratotic lesions. Avoid in hairy areas or intertriginous (groin, gluteal cleft, axilla).
- **Creams** are lubricating, cosmetically appealing, less potent than ointments of the same medication; contain preservatives that can be irritating. Useful in acute exudative inflammation b/c has drying effect.
- **Lotions and gels** are least occlusive/least greasy, contains ethoh. Useful drying effect on oozing lesions & exudative inflammation like poison ivy, good in hairy areas like scalp.
- **Foams, mousses, shampoos**: useful in scalp.
Using Topical Steroids Properly

• **Low potency steroids** are the safest especially for more longterm use, on large surface areas, on face, and body regions w/ thinner skin, and in children

• **More potent agents** are helpful for treating more severe diseases and on body regions w/ thicker skin (palms and bottom of feet)

• **High and ultra-potency steroids** should NOT be used on: face, groin, axilla, & under occlusion… except rare instances and short duration

• Usually used 1-2x/d, higher frequency is not beneficial

• Chronic steroid use can lead to tolerance & diminished effectiveness, if long durations then may need to taper to avoid rebound, consider 1wk break
Key Recommendations

• Ultra-high potency topical steroids should not be used more than 3 weeks

• Low to high potency topical steroids should not be used longer than 3 months; typically most conditions don’t need more than 2-3 weeks.

• Use least potent one you can for shortest timeframe

Ference JD & Last AR, Am Fam Physician, 2009
Side Effects of Topical Steroids

- Skin atrophy (face, back of hand, intertriginous areas)
- Telangiectasis and striae
- Easy bruising
- Increased skin fragility
- Ulceration
- Hypopigmentation
- Delayed wound healing
- Contact dermatitis
- Rosacea on the face from rebound steroid
- Secondary infection, or worsening of an underlying infection
- Systemic side effects if long duration of high & ultra high potency
References

References

• Sherman et al. In vitro toxicity of local anesthetics and corticosteroids on chondrocyte and synoviocyte viability and metabolism. Cartilage. 2015; 6(4)233-240.
• UpToDate.com search “corticosteroid injections” (accessed on 11/2016)
The End

Natalie Voskanian, MD