Joint and Soft Tissue Injection

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Injection techniques are helpful for diagnosis and therapy in a wide variety of musculoskeletal conditions. Diagnostic indications include the aspiration of fluid for analysis and the assessment of pain relief and increased range of motion as a diagnostic tool. Therapeutic indications include the delivery of local anesthetics for pain relief and the delivery of corticosteroids for suppression of inflammation. Side effects are few, but may include tendon rupture, infection, steroid flare, hypopigmentation, and soft tissue atrophy. Injection technique requires knowledge of anatomy of the targeted area and a thorough understanding of the agents used. In this overview, the indications, contraindications, potential side effects, timing, proper technique, necessary materials, pharmaceuticals used and their actions, and post-procedure care of patients are presented. (Am Fam Physician 2002;66:283-8,290. Copyright© 2002 American Academy of Family Physicians.)

A patient information handout about joint and soft tissue injection, written by the authors of this article, is provided on page 290.

This article is one in a series of "Office Procedures" articles coordinated by Dennis A. Cardone, D.O., C.A.Q.S.M., associate professor, and Alfred F. Tallia, M.D., M.P.H., associate professor, Department of Family Medicine, UMDNJ–Robert Wood Johnson Medical School, New Brunswick, New Jersey.

Injection of joints, bursae, tendon sheaths, and soft tissues of the human body is a useful diagnostic and therapeutic skill for family physicians. With training, physicians can incorporate joint and soft tissue injection into daily practice, yielding many benefits. For example, a lidocaine (Xylocaine) injection into the subacromial space can help in the diagnosis of shoulder impingement syndromes, and the injection of corticosteroids into the subacromial space can be a useful therapeutic technique for subacromial impingement syndromes and rotator cuff tendinopathies. Evidence-based reviews of joint and soft tissue injection procedures have found few studies that support or refute the efficacy of common joint interventions in medical practice.[1-3] However, substantial practice-based experience supports the effectiveness of joint and soft tissue injection for many common problems.

These injections are most useful in instances of joint or tissue injury and inflammation. History of pain, local and referred, will provide important clues to the underlying pathology. Physical examination is extremely helpful in ascertaining the diagnosis. Knowledge of the anatomy of the area to be injected is essential. Intratendinous injection should be avoided because of the likelihood of weakening the tendon. Corticosteroid injections also should be avoided in cases of Achilles or patella tendinopathies.

Joint and soft tissue injection is most useful in instances of joint and tissue injury and in inflammatory conditions.

Therapeutic responses to corticosteroid injections are variable.[4] The patient's response to previous injection is important in deciding whether and when to proceed with reinjection. Most patients, if they are going to respond, will respond after the first injection. If the patient has achieved significant benefit after the first injection, an argument can be made to give a second injection if symptoms recur. However, patients who have gained no symptom relief or functional improvement after two injections should probably not have any additional injections, because a subsequent positive outcome is low.

If therapeutic effect is achieved, a maximum of four injections per year is recommended. There is some concern that corticosteroid preparations, with repeated use, may accelerate normal, aging-related articular cartilage atrophy or may weaken tendons or ligaments. When symptoms are resistant, or when there is a history of trauma, a radiograph or other imaging study should be performed to help assist in the diagnosis.

Patients who have not gained any symptom relief after two steroid injections should probably not have any additional injections.

Indications

The indications for joint or soft tissue aspiration and injection fall into two categories: diagnostic and therapeutic. A common diagnostic indication for placing a needle in a joint is the aspiration of synovial fluid for evaluation. Synovial fluid evaluation can differentiate among various joint disease etiologies including infection, inflammation, and trauma. A second diagnostic indication involves the injection of a local anesthetic to confirm the presumptive diagnosis through symptom relief of the affected body part.

Therapeutic indications for joint or soft tissue aspiration and injection include decreased mobility and pain, and the injection of medication as a therapeutic adjunct to other forms of treatment.[5] Caution must be exercised when removing fluid for pain relief because of the possibility of introducing infection and precipitating further or new bleeding into the joint. Also, early reaccumulation of fluid can occur in many cases.

Therapeutic injection with corticosteroids should always be viewed as adjuvant therapy.[6] The improper or indiscriminate use of corticosteroids is likely to have a bad outcome. These injections should never be undertaken without diagnostic definition and a specific treatment plan in place. Physicians should resist external pressure for a quick return of athletes to playing sports by the use of joint or soft tissue injections. *Table 1* lists soft tissue and joint condition indications for diagnostic and therapeutic injections.

TABLE 1
Indications for Diagnostic and Therapeutic Injection

Soft tissue conditions
Bursitis
Tendonitis or tendinosis
Trigger points
Ganglion cysts
Neuromas
Entrapment syndromes
Fasciitis
Joint conditions
Effusion of unknown origin or suspected infection (only diagnostic)
Crystalloid arthropathies
Synovitis
Inflammatory arthritis
Advanced osteoarthritis

Contraindications

As with any invasive diagnostic or therapeutic injection procedure, there are absolute and relative contraindications *(Table 2)*.[7] Drug allergies, infection, fracture, and tendinous sites at high risk of rupture are absolute contraindications to joint and soft tissue injection. Relative contraindications are less well defined and should be considered on a case-by-case basis. Physicians should be aware that the contraindications listed are for therapeutic injection and do not apply for diagnostic aspiration of joints or soft tissue areas. For instance, suspected septic arthritis is a contraindication for therapeutic injection, but an indication for joint aspiration.

Timing of Injections

Appropriate timing can minimize complications and allow a clear diagnosis or therapeutic response. For diagnostic injections, the procedure should be performed when acute or chronic symptoms are present, when the diagnosis is unclear or needs to be confirmed, when consideration has been given to other diagnostic modalities, and when septic arthritis has been ruled out (by aspiration and fluid analysis). For therapeutic injections, the procedure should be performed when acute or chronic symptoms are present, after the diag-

nosis and therapeutic plan have been made, and after consideration has been given to obtaining radiographs. Therapeutic injection should be performed only with or after the initiation of other therapeutic modalities (e.g., physical therapy). In the absence of an underlying chronic inflammatory arthritis, any joint with an effusion should be radiographed to rule out a fracture or other intra-articular pathologic process.

Corticosteroids

MECHANISM OF ACTION

After intra-articular injection, corticosteroids function to suppress inflammation and decrease erythema, swelling, heat, and tenderness of the inflamed joint. These effects are believed to result from several mechanisms, including alterations in neutrophil chemotaxis and function, increases in viscosity of synovial fluid, stabilization of cellular lysosomal membranes, alterations in hyaluronic acid synthesis, transient decreases in synovial fluid complements, alterations in synovial permeability, and changes in synovial fluid leukocyte count and activity.[8] Whether this is exactly the same mechanism of action that occurs with orally or parenterally administered corticosteroids is uncertain.[4]

SELECTION OF CORTICOSTEROID

Many corticosteroid preparations are available for joint and soft tissue injection. The agents differ according to potency *(Table 3)*, solubility, and crystalline structure. Potency is generally measured against hydrocortisone, and ranges from low-potency, short-acting agents such as cortisone, to high-potency, long-acting agents such as betamethasone (Celestone).

Few studies have investigated the efficacy or duration of action of the various agents in joints or soft tissue sites. The duration of effect is inversely related to the solubility of the preparation: the less soluble an agent, the longer it remains in the joint and the more prolonged the effect. Consequently, suspensions are longer acting. A short-acting solution, such as dexamethasone sodium phosphate (Decadron), is less irritating and less likely to cause a postinjection flare than a long-acting dexamethasone suspension. Many clinicians use injectables that combine short-acting compounds with long-acting suspensions (e.g., betamethasone sodium phosphate and acetate suspension),

TABLE 2
Absolute and Relative Contraindications to Therapeutic Joint and Soft Tissue Injection

Absolute contraindications	Relative contraindications
Local cellulitis	Minimal relief after two previous corticosteroid injections
Septic arthritis	Underlying coagulopathy
Acute fracture	Anticoagulation therapy
Bacteremia	Evidence of surrounding joint osteoporosis
Joint prosthesis	Anatomically inaccessible joints
Achilles or patella tendinopathies	Uncontrolled diabetes mellitus
History of allergy or anaphylaxis to injectable pharmaceuticals or constituents	

TABLE 3
Corticosteroid Agents by Relative Potencies, Duration, and Dose

Agent	*Potency*	*Duration*	*Dose/site*
Hydrocortisone acetate (Hydrocortone)	Low	Short	10 to 25 mg for soft tissue and small joints 50 mg for large joints
Methylprednisolone acetate (Depo-Medrol) or triamcinolone acetonide (Aristocort)	Intermediate	Intermediate	2 to 10 mg for soft tissue and small joints 10 to 80 mg for large joints
Dexamethasone sodium phosphate (Decadron)	High	Long	0.5 to 3 mg for soft tissue and small joints 2 to 4 mg for large joints
Betamethasone sodium phosphate and acetate (Celestone Soluspan)	High	Long	1 to 3 mg for soft tissue and small joints 2 to 6 mg for large joints

Low-solubility corticosteroid agents should not be used for soft tissue injection because of the increased risk of surrounding tissue atrophy.

thereby obtaining the beneficial effects of both types of preparations. Mixing the corticosteroid preparation with a local anesthetic is a common practice for avoiding the injection of a highly concentrated suspension into a single area. The anesthetic provides early relief of symptoms and helps confirm the diagnosis.

Low-solubility agents, favored for joint injection, should not be used for soft tissue injection because of the increased risk of surrounding tissue atrophy. Methylprednisolone (Depo-Medrol) is often the agent selected for soft tissue injection.

PRECAUTIONS

Several precautions should be taken when using steroid injections. Care should be taken to avoid direct injection of tendons because of the danger of rupture. Avoid injection into adjacent nerves of the target area (e.g., ulnar nerve when injecting for medial epicondylitis). Allow adequate time between injections, generally a minimum of four to six weeks. Pay attention to the depth of needle insertion to avoid needle trauma to articular cartilage. Finally, avoid injecting several large joints simultaneously because of the increased risk of hypothalamic-pituitary-adrenal suppression and other adverse effects.[9]

DOSAGE

Dosing is site dependent. As a rule, larger joints require more corticosteroid. *Table 3* lists general corticosteroid dosing guidelines.

Local Anesthetics

Before injection of a joint or soft tissue, a small quantity of 1 percent lidocaine or 0.25 to 0.5 percent bupivacaine (Sensorcaine) can be injected subcutaneously with a 25- to 30-gauge needle to provide local anesthesia. For the actual joint or soft tissue injection, most physicians mix an anesthetic with the corticosteroid preparation. This provides temporary analgesia, confirms the delivery of medication to the appropriate target, and dilutes the crystalline suspension so that it is better diffused within the injected region. Manufacturers advise against mixing corticosteroid preparations with lidocaine because of the risk of clumping and precipitation of steroid crystals. However, the authors have never experienced this as a major problem.

For most injections, 1 percent lidocaine or 0.25 to 0.5 percent bupivacaine is mixed with a corticosteroid preparation. The dose of anesthetic varies from 0.25 mL for a flexor tendon sheath (trigger finger) to 5 to 8 mL for larger joints. On rare occasions, patients exhibit signs of anesthetic toxicity, including flushing, hives, chest or abdominal discomfort, and nausea. It can take as long as 20 to 30 minutes following the injection for these symptoms to present. For this reason, and to monitor for allergic reactions, patients should be observed in the office for at least 30 minutes following the injection.

Potential Complications

A number of potential complications can arise from use of joint and soft tissue proce-

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dures.[10] Local infection is always possible, but it can be avoided by following the proper technique. Joint injections should always be performed using sterile procedure to prevent iatrogenic septic arthritis. Local reactions at the injection site may include swelling, tenderness, and warmth, all of which may develop a few hours after injection and can last up to two days. A postinjection steroid flare, thought to be a crystal-induced synovitis caused by preservatives in the injectable suspension, may occur within the first 24 to 36 hours after injection.[11] This is self-limited and responds to application of ice packs for no longer than 15-minute intervals.

Soft tissue (fat) atrophy and local depigmentation are possible with any steroid injection into soft tissue, particularly at superficial sites (e.g., lateral epicondyle). Periarticular calcifications are described in the literature, but they are rare. Tendon rupture can be avoided by not injecting directly into the tendon itself.

Systemic effects are possible (especially after triamcinolone acetonide [Aristocort] injection or injection into a vein or artery), and patients should always be acutely monitored for reactions. Alterations in taste have been reported for one to two days after steroid injection. Hyperglycemia is possible in patients who have diabetes.

To avoid direct needle injury to articular cartilage or local nerves, attention should be paid to anatomic landmarks and depth of injection. Other rare, but possible, complications include pneumothorax (when injecting thoracic trigger points), perilymphatic depigmentation, steroid arthropathy, adrenal suppression, and abnormal uterine bleeding.

Informed Consent

Informed consent should always be obtained for any invasive procedure. Discussion with the patient should include indications, potential risks, complications and side effects, alternatives, and potential outcomes from the injection procedure. Patients should sign documentation that informed consent for the procedure was given and understood. A third party should witness the patient's signing. Documentation is kept as part of the patient's record.

Necessary Equipment

All joint and soft tissue injection or aspiration techniques should be performed wearing gloves. When injecting or aspirating a joint space, sterile technique should be used. Nonsterile gloves can be used when injecting or aspirating soft tissue regions. Necessary equipment for joint and soft tissue injection or aspiration is listed in *Table 4.*

Site Preparation

The entry point for injection or aspiration should be identified. The point of entry can be marked with an impression from a thumbnail, a needle cap, or an indelible ink pen. The important goal is to minimize risk of infection at the site. Prepare the area with an alcohol or povidone-iodine (Betadine) wipe. For all

TABLE 4
Equipment Tray Contents for Joint or Soft Tissue Injection or Aspiration

Alcohol wipes
Povidone-iodine (Betadine) wipes
Sterile and nonsterile gloves
Sterile drapes
25- to 30-gauge 0.5- to 1.0-inch needle for local skin anesthesia
18- to 20-gauge 1.5-inch needle for aspirations
22- to 25-gauge 1.0- to 1.5-inch needle for injections
1 mL- to 10 mL-syringe for injections
3 mL- to 60 mL-syringe for aspirations
Local anesthetic
Corticosteroid preparation
Laboratory tubes for culture or other studies (aspiration)
Hemostat (if joint is to be aspirated and then injected using the same needle)
Adhesive bandage or other adhesive dressing

intra-articular injections, sterile technique should be used.

Steps for Injection and Joint Aspiration

When possible, the patient should be placed in the supine position. This will help prevent or mitigate the effects of a vasovagal or syncopal episode. Palpate the soft tissue or bony landmarks. Follow the steps for site preparation. For soft tissue injections, the following modalities may be used for short-term partial anesthesia: applying ice to the skin for five to 10 minutes; applying topical vapo-coolant spray; or firmly pinching the skin for three to four seconds at the injecting site.[12] Once the skin is anesthetized, the needle should be inserted through the skin to the site of injection. To prevent complications, adhere to sterile technique for all joint injections; know the location of the needle and underlying anatomy; avoid neuromuscular bundles; avoid injecting corticosteroids into the skin and subcutaneous fat; and always aspirate before injecting to prevent intravascular injection.

The injection should flow easily and should not be uncomfortable to the patient. Most pain is the result of tissue stretching and can be mitigated by injecting slowly. If there is strong resistance while injecting, the needle may be intramuscular, intratendinous, or up against bone or cartilage, and it should be repositioned.

Postinjection Instructions and Care

An adhesive dressing should be applied to the injection site. To minimize pain and inflammation after leaving the office, the patient should be advised to apply ice to the injection site (for no longer than 15 minutes at a time, once or twice per hour), and nonsteroidal anti-inflammatory agents may be used, especially for the first 24 to 48 hours. The affected area should be rested from strenuous activity for several days after the injection because of the small possibility of local tissue tears secondary to temporarily high concentrations of steroid. This risk lessens as the steroid dissipates. Patients should be educated to look for signs of infection including erythema, warmth, or swelling at the site of injection, or systemic signs including fever and chills. The patient should keep the injection site clean and may bathe.

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