Injection Therapy in the Management of Musculoskeletal Injuries: Hand and Wrist

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Injections are valuable diagnostic and therapeutic nonoperative treatments for a myriad of painful conditions affecting the hand and wrist. Corticosteroid and analgesic preparations are frequently injected for the treatment of carpal tunnel syndrome, stenosing tenosynovitis, tendinopathy, and ganglion cysts, as well as for radiocarpal and basilar joint arthrosis. Although upper extremity surgeons frequently perform injections as part of their daily practice, other clinicians may not be as familiar with the appropriate indications and proper techniques required for injection therapy in the hand and wrist.

The purpose of this review is to briefly describe the clinical presentation and evaluation of common hand and wrist conditions most frequently amenable to injection therapy. Appropriate indications for injections will be presented along with a detailed description of proper injection technique.

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Carpal Tunnel Syndrome (CPT: 20526, ICD-9: 354.0)

Carpal tunnel syndrome (CTS) is caused by compression of the median nerve at the wrist. It is the most commonly diagnosed site of nerve compression of the upper extremity, and it has been found to affect 3% of the adult population of the United States. It is 3 times more common in women than in men.1

Anatomically, the carpal tunnel is a fibro-osseous canal bounded dorsally by the carpal bones and palmarly by the flexor retinaculum. The ulnar border of the canal is formed by the triquetrum, the hook of the hamate, and the pisiform. Its radial border is formed by the trapezium, scaphoid, and the fascial septum of the flexor carpi radialis. The contents of the carpal tunnel include the 4 sublimis tendons, the 4 profundus tendons, the tendon of the flexor pollicis longus, and the median nerve. CTS results from compression of the median nerve within the carpal tunnel. This compression can be caused directly from the flexor retinaculum itself or from increased pressure within the canal, such as that caused by a space-occupying lesion.2 CTS can also be triggered or exacerbated by aberrant carpal tunnel anatomy, infection, inflammatory diseases, and metabolic disorders.3

Diagnosis

CTS must be differentiated from compression of the median nerve or its branches in the forearm or elbow as seen in pronator teres syndrome and anterior interosseous nerve syndrome. Cervical root compression of C6 and C7 may also produce symptoms similar to that seen in CTS.

Patients with CTS present with pain, numbness, and paresthesias of the palmar-radial aspect of the hand in the median nerve distribution. This includes the thumb, index, middle finger, and radial side of the ring finger, although patients may describe symptoms in all fingers of the hand. Symptoms are often worse at night and awaken patients from sleep. Patients with CTS may describe the need to shake their wrists on waking to relieve symptoms. In severe cases, weakness in grip and loss of dexterity may be seen.

On physical examination, patients with CTS may have a clinically normal-appearing hand. However, in cases of advanced nerve compression, weakness and atrophy of the thenar musculature may be seen. Sensory changes may be examined by evaluating 2-point discrimination, vibration, and monofilament testing. Motor changes may be elicited by testing thumb abduction.

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Provocative maneuvers include the Durkan compression test, Phalen test, and Tinel sign. Durkan test is positive when compression of the carpal tunnel by the thumb of the examiner causes median nerve distribution paresthesias of the hand within 30 seconds. A positive Phalen test is seen when wrist flexion to 90° elicits median nerve symptoms after 1 minute. A positive Tinel sign of the carpal tunnel is seen when repetitive percussion of the carpal tunnel elicits median nerve symptoms.

A diagnosis of CTS may be made based on history, physical examination, and nerve conduction studies. For nerve conduction studies, distal sensory latencies of $>3.5\text{ ms}$ and distal motor latencies of $>4.5\text{ ms}$ are generally considered abnormal. A difference of motor conduction of $>1\text{ ms}$ and a sensory difference of $>0.5\text{ ms}$ between the affected and unaffected hand are also generally considered abnormal.

**Indications for Treatment**

Nonoperative treatment of CTS is reserved for patients without signs of objective motor or sensory deficits and includes wrist splints in the neutral wrist position worn primarily at night, non-steroidal anti-inflammatory medications (NSAIDs), and corticosteroid injection into the carpal tunnel. When nonoperative measures are not effective, operative treatment involves surgical decompression of the median nerve at the wrist.

A combination of corticosteroid and local anesthetic injections for CTS can be diagnostic as well, as patients who obtain symptomatic relief from steroid injection may have a higher probability of responding to surgical management. Several systematic reviews of randomized control trials have concluded that at 1 month, local steroid injections result in greater clinical improvement of symptoms compared with placebo and are most effective in patients who have had symptoms for $<1\text{ year}$ and demonstrate normal 2-point discrimination with only intermittent numbness and no motor deficits.

**Extensor Carpi Ulnaris Tenosynovitis, Tendinosis, and Instability (CPT Code: 20551, ICD-9 727.05)**

Extensor carpi ulnaris (ECU) pathology is a well-recognized cause of ulnar-sided wrist pain. The ECU tendon lies in the sixth and ulnar-most dorsal compartment of the wrist. Disorders of the tendon include subluxation, dislocation, tendinosis, tenosynovitis, and rupture. Although ECU tendinosis is pathology of the tendon without histologic evidence of acute or chronic inflammatory cells, ECU tenosynovitis is associated with histologic evidence of inflammatory cells along the tendon sheath.

ECU tendonitis is frequently seen in athletes, particularly those involved in rowing and racquet sports. It is common in the nondominant wrist of tennis players because of the 2-handed backhand swing. Occasionally, patients will relate it to a specific low-energy traumatic event, such as a twisting injury.

**Technique—Corticosteroid Injection**

A solution of 40 mg (1 mL) of methylprednisolone and 0.5 mL of 1% lidocaine is prepared. Before giving the injection, patients are told to expect a feeling of fullness in the palm as the fluid is injected, but that they should verbalize any paresthesias experienced in the digits. The palmaris tendon is identified by instructing the patient to pinch the thumb and small finger while slightly flexing the wrist. A 25-gauge needle is inserted at the distal wrist flexion crease just ulnar to the palmaris longus and angled 45° distally (Fig. 1). The needle can be inserted slightly ulnar to the midline in line with the ring finger if a palmaris longus tendon is not present or cannot be identified. The needle is advanced until it touches the floor of the canal. The needle is immediately withdrawn completely and redirected if median nerve paresthesias are elicited with placement. If no median nerve symptoms are elicited, the previously prepared solution is injected.
The differential diagnoses of ECU pathology include other conditions that frequently cause ulnar-sided wrist pain, such as flexor carpi ulnaris (FCU) tenosynovitis, pisotriquetral arthritis, triangular fibrocartilage complex lesions, ulnar impaction, and lunotriquetral instability. ECU tendinitis can often present in conjunction with these conditions, and thus concomitant pathology should be excluded before commencing treatment for the ECU in isolation.

The diagnosis of ECU tendonitis is traditionally clinical. However, although not specific for tendon instability, magnetic resonance imaging (MRI) is often useful for the diagnosis of ECU tendinopathy, tenosynovitis, and rupture. MRI of ECU tendinopathy is notable for tendon thickening and increased signal on both T1- and T2-weighted images. In cases of tenosynovitis, increased fluid is observed within the tendon sheath.

### Indications for Treatment

Initial treatment for ECU tenosynovitis is nonoperative. Symptomatic relief is often achieved with ice, extension splinting or casting, and NSAIDs, followed by corticosteroid injection if these treatments fail. Futami and Itoman reported that 40 of 43 patients recovered in 1 to 9 months treated nonoperatively. Recalcitrant ECU tenosynovitis may require surgical release or reconstruction of the retinacular subsheath of the ECU tendon.

Injection may be diagnostic, as transient but complete relief after infiltration of the ECU subsheath with local anesthetic confirms ECU pathology and differentiates it from intra-articular pathology.

### Technique: Corticosteroid Injection

A solution of 40 mg (1 mL) of methylprednisolone and 0.5 mL of 1% lidocaine is prepared. With the examiner seated across from the patient, the elbow is flexed to >90° and placed down on a hard surface, with the forearm in neutral rotation, and the fingers pointed directly up to the ceiling, thus the ulnar wrist is facing the examiner. The ulnar styloid is palpated as well as the distal ECU tendon as it proceeds toward its insertion on the dorsal base of the fifth metacarpal. A 25-gauge needle is used to give the injection into the sixth dorsal wrist compartment 0.5– to 1 cm distal to the ulnar styloid tip where the tendon is most readily palpated (Fig. 2).

### Flexor Carpi Ulnaris Tendinopathy  
(CPT: 20551, ICD-9: 727.05)

Tendinopathy of the FCU tendon includes calcific tendinitis and noncalcific tendinosis. The FCU tendon does not have a synovial sheath. As such, it cannot develop stenosing tenosynovitis, which is the most common etiology of tendinopathy of other tendons about the wrist.

Calcific tendinitis of the FCU tendon is an acute intensely painful synovitis of unknown origin that accompanies peri-tendinous release of calcium salts. Noncalcific tendinosis of the FCU tendon is noninflammatory intratendinous collagen degeneration characterized histologically by angiofibrous hyperplasia. The etiology of FCU tendinosis may be related to repetitive or overuse activities.

### Diagnosis

The onset of FCU tendinosis is insidious. Patients often present with aching ulnar-sided pain on the flexor side of the wrist. They may also complain of associated ulnar nerve symptoms, such as pain, numbness, or paresthesias.

On physical examination, patients with calcific tendinosis present with tenderness near the insertion of the FCU tendon on the pisiform in the wrist, whereas those with noncalcific tendinopathy often present with tenderness 1 to 2 cm proximal to the pisiform within the substance of the tendon. Provocative maneuvers include resisted wrist flexion and ulnar deviation, which typically produce pain. A careful neurovascular examination is critical, including a bilateral Allen test for asymmetry in ulnar flow and ulnar sensory and motor testing.

FCU tendinopathy may be mistaken for pisotriquetral arthritis, which can be visualized on a true lateral radiograph of the pisotriquetral joint. The differential diagnoses may also include other conditions that frequently cause ulnar-sided wrist pain, including ECU tendinitis, triangular fibrocartilage complex lesions, ulnar impaction, lunotriquetral instability, ganglia within Guyon’s canal, and ulnar artery aneurysm.

The diagnosis of FCU tendonitis is traditionally clinical. However, sonography and MRI may be notable for active enthesopathy of the FCU tendon, pisiform osteoproliferative alterations, hyperemia of the peritendinous soft tissue, mass lesions of the neurovasculature, or cystic fluid collections of the pisotriquetral joint.

### Indications for Treatment

Initial treatment for extensor FCU tendinosis is nonoperative. Symptomatic relief is often achieved with rest, ice, immobilization, and NSAIDs. Corticosteroid injection is considered when antiinflammatory medications have failed.
Operative treatment is reserved for FCU tendinosis that does not respond to nonoperative treatment. It involves Z-plasty lengthening of the tendon proximal to its insertion on the pisiform and debridement of any degenerative tendinosis. Excision of the pisiform may be necessary.13

**Technique: Corticosteroid Injection**

Injection for FCU tenosynovitis consists of a combination of local anesthetic and corticosteroid. A solution of 40 mg (1 mL) of methylprednisolone and 0.5 mL of 1% lidocaine is prepared with a 25-gauge needle. The needle is directed to the flexor side of the ulnar aspect of the wrist, and the FCU tendon is infiltrated (Fig. 3). Special care should be taken to ensure needle placement at the FCU and not in the adjacent ulnar neurovascular bundle. The FCU should be a more taught structure that becomes pronounced on resisted wrist flexion, and should also be directly in line with the pisiform, easily palpable in almost all patients. Aspiration before injection can help confirm that the needle is not intravascular. Patients should be alerted to voice any feelings of ulnar nerve paresthesias during the injection.

**Stenosing Tenosynovitis (Trigger Finger)**

(CTP 20550, ICD-9 727.03)

Stenosing tenosynovitis refers to entrapment tendinopathy of the flexor tendons of the hand secondary to narrowing of the flexor tendon retinacular sheath. The condition is a frequent cause of pain and disability, as patients frequently will complain of painful “catching” of the involved flexor tendon during active motion of the digits. The condition occurs 2 to 6 times more frequently in women. The ring finger is most commonly affected, and multidigit involvement is not uncommon.13 Patients with diabetes and other inflammatory tendinopathies exhibit a predilection toward developing trigger digits.14

The condition occurs as the digital flexor tendon impinges most commonly as it passes through a narrowed first annular pulley (A1). Histologic evaluations have documented inflammatory and cellular changes as well as derangements in collagen composition within the tissue of the A1 pulley of patients with trigger digits.14

**Diagnosis**

The principle complaint is insidious onset of painful catching of the involved digit, as the patient attempts to actively flex and extend the digit; occasionally, the digit will be “locked” in a flexed position. Patients frequently report the need to pull the affected digit into extension using the contralateral hand. Physical examination typically demonstrates tenderness volarly over the flexor tendon at the level of the A1 pulley near the metacarpal head, and locking may be demonstrated during attempts at active digital flexion. In severe and chronic cases, flexion contractures of the proximal interphalangeal may develop as patients exhibit reluctance to normally extend their digits because of the discomfort caused by their trigger digits.

The diagnosis of stenosing tenosynovitis is typically made based on the history and physical examination findings and imaging is not typically indicated. The condition may be mistaken for other ailments, including proximal interphalangeal dislocation, Dupuytren’s contracture, or a neoplasm of the tendon sheath (ie, giant cell tumor).

**Indications for Treatment**

Most cases will respond favorably to corticosteroid injection of the flexor tendon sheath, although results are poorer for patients with diabetes or rheumatoid arthritis.13,16 Most practitioners will attempt 2 or more trials of corticosteroid injections in patients with stenosing tenosynovitis before proceeding with surgery. Patients with diabetes, however, who experience refractory symptoms following an initial injection will usually be counseled against pursuing a subsequent injection, as several investigations have reported limited efficacy of multiple injections for trigger digits in patients with diabetes.17 In refractory cases, open surgical release of the A1 pulley is typically offered.

**Technique: Corticosteroid Injection**

Several techniques may be performed when administering corticosteroid injections for trigger fingers; in our practice, we typically prefer a volar approach centered over the MCP flexion crease of the digit for the index through small fingers, and for the thumb, the accessory crease just distal to the MCP crease (Fig. 4). A solution of 40 mg (1 mL) methylprednisolone and 0.5 mL of 1% lidocaine is prepared with a 25-gauge needle. The needle is directed perpendicular to the skin at the flexion crease, as described earlier in the text, and inserted all the way until the firm resistance of the periosteum is encountered. The landmarks described earlier will place the needle at the level of the middle of the proximal phalanx where there is no risk of intra-articular injection. The needle is gently withdrawn off periosteum 1 to 2 mm, and the
plunger is then depressed, administering the solution throughout the flexor tendon sheath. This injection should have only minimal resistance. If significant resistance is encountered, it is likely that the needle tip is either still within the periosteum or within the tendon substance, and that the needle should be advanced or withdrawn until there is minimal resistance. A fluid wave will be palpated along the entire digit if the flexor sheath is correctly injected with the steroid solution.

**De Quervain’s Syndrome**

**(CPT 20550, ICD-9 727.04)**

De Quervain syndrome refers to entrapment tendinopathy of the extensor tendons of the first dorsal compartment of the wrist. It is a frequent cause of radial-sided wrist pain, especially with repetitive activities involving thumb abduction and ulnar deviation of the wrist. The condition most commonly affects women in the fifth to sixth decades of life, and it is common in pregnant and lactating females.18

The condition occurs as the tendons of the abductor pollicis longus (APL) and extensor pollicis brevis (EPB) pass through an osteoligamentous tunnel over the radial styloid. The floor of the tunnel is formed by a shallow groove of the radial styloid; the roof is formed by thickened transverse fibers of the retinacular sheath. During repetitive thumb abduction and wrist ulnar deviation, the tendons produce friction at the rigid retinacular sheath, with resultant narrowing of the osteoligamentous tunnel.

**Diagnosis**

The principle complaint is radial-sided wrist pain, which is exacerbated by active abduction of the thumb. Physical examination will typically demonstrate tenderness to palpation most pronounced at the radial styloid as well as 1-2 cm proximal and distal to it. Finkelstein test is frequently performed in an effort to provoke symptoms by having the patient oppose the thumb into the palm and then force the wrist into ulnar deviation.

De Quervain’s syndrome must be differentiated clinically from intersection syndrome (discussed elsewhere in this chapter), and radiographs of the wrist and hand should be carefully scrutinized for scaphoid or scapholunate ligament pathology, or concomitant degenerative joint disease, particularly at the thumb carpometacarpal (CMC) joint or the wrist.

**Indications for Treatment**

Removable thumb spica splints can be effective in mild De Quervain’s syndrome; although corticosteroid injection of the first dorsal compartment sheath is especially effective in acute and more severe cases as well as in pregnant or lactating females. The use of injections in patients with diabetes has been reported to be less effective.18

When nonoperative treatment fails to resolve symptoms, surgical release of the rigid retinacular sheath overlying the first dorsal compartment may be indicated, particularly in patients who experienced even temporary relief after an injection within the tendon sheath. The procedure should be performed by a surgeon who is well aware of the variations of first dorsal compartment anatomy and local nerve anatomy to ensure a complete release and avoid nerve injury and recurrence.

**Technique: Corticosteroid Injection**

A solution of 40 mg (1 mL) methylprednisolone and 0.5 mL of 1% lidocaine is prepared with a 25-gauge needle. The patient is instructed to abduct and extend the thumb to identify the tendons of the first dorsal compartment, which are most easily palpable just distal to the radial styloid. The hand is positioned with the ulnar surface down on a hard surface and the wrist in gentle ulnar deviation to put the tendons on some stretch, making them more easily palpable. The injection is then performed by introducing the needle into the tendon sheath (Fig. 5), 1 cm distal to the radial styloid where the tendons are most palpable. One can usually feel the needle “bounce” off the tendons like a trampoline. Resistance may be felt as the injection is attempted; this usually signifies that the needle tip is intratendinous. When this occurs, the needle is slowly withdrawn into the tendon sheath, and the injection should be reattempted. A fluid wave is often observed proximal and distal to the injection site, as the first half of the injectant is given. In approximately 40% of patients, the EPB and APL will pass within separate compartments, and thus we routinely redirect the needle several times, including dorsoulnarly, and provide the remainder of the injectant in an attempt to maximize the likelihood of corticosteroid accessing both the APL and EPB.19
Intersection Syndrome
(CPT: 20610, ICD-9: 727.05)

Although its etiology is controversial, intersection syndrome is a condition believed to be caused by stenosing tenosynovitis of the radial wrist extensors, also known as the second dorsal compartment.

Anatomically, inflammatory changes are observed on the dorsal aspect of the wrist where the contents of the second dorsal extensor tendon compartment (the extensor carpi radialis longus and the extensor carpi radialis brevis) pass beneath the contents of the first dorsal extensor tendon compartment 4-6 cm proximal to the radiocarpal joint.

**Diagnosis**

Patients with intersection syndrome present with dorsoradial wrist discomfort associated with pain and swelling of the muscle bellies of the APL and EPB. The discomfort is often exacerbated by repetitive wrist flexion and extension movements. Patients frequently describe popping at that region.

On physical examination, patients are tender on the dorsoradial aspect of the wrist, 4 cm proximal to the wrist joint at the point of intersection. Active flexion and extension of the wrist may produce audible and palpable crepitus.

The differential diagnoses of intersection syndrome include other conditions that frequently cause radial-sided wrist pain. It is often mistaken for de Quervain’s tenosynovitis (discussed earlier in this chapter) and Wartenberg syndrome, or radial sensory nerve entrapment as the nerve exits from beneath the brachioradialis tendon. Radial tunnel syndrome or impingement of the radial nerve in the proximal forearm often has radiating pain distally across the dorsal forearm and wrist but should have a point of maximal tenderness in the proximal forearm adjacent to the brachioradialis and not at the crossing of the 1st and 2nd compartments.

The diagnosis of intersection syndrome is typically made based on history and physical examination. However, MRI findings may demonstrate tendon thickening, rounded tendon configuration, and peritendinous edema within the tendons sheaths of the first and second dorsal extensor tendon compartments at the area of intersection.

**Indications for Treatment**

Initial treatment for intersection syndrome includes a removable wrist splint in 15° of extension that is worn while sleeping and during any exacerbating activities. If symptoms persist despite splinting, steroid injection into the second dorsal compartment is considered. Surgical release of the tendons of the second dorsal extensor compartment is indicated for those patients whose symptoms are refractory to nonoperative treatment.

**Technique: Corticosteroid Injection**

A solution of 40 mg (1 mL) methylprednisolone and 0.5 mL of 1% lidocaine is prepared with a 25-gauge needle. The needle is directed to the dorsoradial aspect of the wrist, adjacent to the area of maximal swelling (Fig. 6). This corresponds to the painful and erythematous region of the wrist, typically 4 cm proximal to the wrist joint. It is typically easiest to palpate the second dorsal compartment tendons just distal to the crossing point of the first compartment, and this is a reliable location for injection. The location of the injection should also be on the radial side of line down the axis of the forearm that intersects Lister’s tubercle, as this will be the path of the second compartment tendons. One can usually feel the needle “bounce” off the tendons like a trampoline. Resistance may be felt as the injection is attempted; this usually signifies that the needle tip is intratendinous. When this occurs, the needle is slowly withdrawn into the tendon sheath, and the injection should be reattempted.
Radiocarpal Arthritis (CPT 20600, ICD-9 715.13)

Several post-traumatic, inflammatory, and noninflammatory disorders may result in degenerative changes isolated to the radiocarpal joint, including malunited intra-articular distal radius fractures, rheumatoid arthritis, and arthritis from carpal collapse.[21,22]

Diagnosis

Pain and loss of motion are the most frequent complaints of patients with radiocarpal arthritis. The history should elicit any prior injury (ie, distal radius fracture, scapholunate liga-
mearth, scaphoid fracture) or inflammatory condition (rheumatoid arthritis), which may have predisposed the pa-
tient to radiocarpal arthrosis. The history should also elicit which specific activities are painful for each patient and whether wrist motion in a particular direction aggravates symptoms. Patients can usually describe if their pain is radial or ulnar sided.

Physical examination begins with inspection of the wrist for any obvious deformities or focal areas of swelling, partic-
ularly on the dorsum of the wrist. Skin changes of inflamma-
tory conditions, such as psoriasis, should be carefully evalu-
ated. Range of motion of the wrist is often decreased in all planes. The patient should also be evaluated for CTS, which frequently accompanies wrist arthritis.

On standard radiographs, the radiocarpal and midcarpal joints can be evaluated for joint space narrowing; character-
istic patterns of arthrosis associated with scapholunate in-
competence or scaphoid nonunion may also be observed. Additionally, distal radioulnar joint arthrosis or translocation of the carpus associated with inflammatory arthropathies may be evident.

Treatment

Treatment starts with NSAIDs as well as volar-based wrist splints, and if these fail intra-articular corticosteroid injec-
tions may be considered as both a diagnostic and therapeutic modality, especially if there is question as to whether sympt-
oms may be due to tendinopathy or compressive neuropathy as opposed to intra-articular pathology. We use the same injection technique not only for cases of radiocarpal degener-
ative disease but also for ulnar-sided intra-articular pathol-
ogy, such as ulnocarpal impaction or triangular fibrocartilage complex tears.

Surgical management is offered to patients who fail nonop-
erative management, and specific procedures are offered based on clinical and radiographic presentation. Proximal row carpectomy, total wrist arthrodesis, and a variety of partial wrist arth-
rodeses may all be performed with excellent clinical outcomes given appropriate indications and techniques.[21,22]

Technique

A dorsal approach is favored when considering injections of the radiocarpal joint. We usually prefer to place a rolled blue towel beneath the patient’s wrist to slightly flex the wrist, which preferentially distracts the radiocarpal joint dorsally and facilitates needle entry. The most common injection site is a “soft spot” between the extensor pollicis longus (3rd dorsal compartment) and extensor digitorum communis (4th dorsal compartment) tendons, 1 cm distal to Lister’s tubercle, which is a palpable prominence on the dorsal distal radial metaphysis. Fluoroscopy is helpful for radiocarpal injections, and the radiopaque tip of a pen is useful to mark the location of entry and direction for the injection.

A 5-mL syringe with a 25-gauge needle is typically loaded with 2 mL of 1% lidocaine and 40 mg (1 mL) of methylprednisolone. Gentle traction may be applied to the wrist to distract the joint space; the needle is then introduced into the joint. The needle should be directed from a distal dorsal to proximal volar direction of approximately 5° to 10° to match the native volar inclination of the distal radius articular surface (Fig. 7), and one should feel a “give” as the needle passes through the dorsal capsule. The injection is then administered; no resistance should be encountered with correct intra-articular needle placement. Fluoroscopy can confirm the needle to be located between the radial articular surface and the proximal carpal row.

Ganglion Cyst Aspiration and Injection (CPT 20612, ICD-9 727.42)

Ganglion cysts are the most common soft-tissue neoplasm encountered by hand surgeons. They occur 3 times more frequently in women and the majority occurs between the second and fourth decades of life.[23]

The cyst may be single or multiloculated and typically consists of a viscous, mucin-filled substance.[24] They typically originate from joint capsule, tendon, or tendon sheaths through a continuous duct. Although ganglion cysts have been described from a variety of joints of the hand and wrist, they most commonly occur on the dorsum of the wrist, aris-
ing from the scapholunate ligament. The less common volar ganglion cysts are typically located radially in close proximity to the radial artery and the origin is less predictable, often arising from the radiocarpal joint, scapho-trapezio-trapezoid joint, or even involving the flexor pollicis longus sheath to the thumb. Although frequently benign, pain, weakness, and cosmetic concerns can compel patients to seek medical attention for treatment of ganglion cysts.

Diagnosis

Patient may report a specific traumatic event before the development of a ganglion cyst, although they frequently arise spontaneously with no antecedent trauma. Patients may report variable behavior of the cyst, as some may progressively enlarge over several months, whereas others intermittently enlarge but later subside or even disappear completely. The cyst may be painful and is typically worsened by repetitive flexion and extension movements of the wrist.

The cyst will typically have a firm, smooth, rubbery consistency on palpation and may be tender. Ganglia arising from tendon sheaths may be more mobile. Most ganglion cysts will transilluminate, whereas solid masses typically do not. A careful Allen’s test in the setting of a volar-radial ganglion cyst can help determine how reliant the hand is on radial artery perfusion.

Radiographs are usually unremarkable but should be closely examined for any signs of scapholunate instability for dorsal wrist ganglions. Degenerative joint disease is observed with cysts arising at the interphalangeal joints, especially mucous cysts at the distal interphalangeal joint.

Most ganglion cysts may be confidently diagnosed based on the history and physical examination, although other conditions may result in dorsal wrist swelling, such as extensor tenosynovitis, carpal bossing, radiocarpal arthritis, abscesses, and other neoplasms.

Treatment

Nonoperative management of symptomatic ganglion cysts is initially offered and typically includes an attempt at aspiration of the ganglion; concomitant injection of lidocaine with corticosteroid into the joint capsule or tendon sheath can be considered, although it is unclear whether aspiration alone or aspiration with cortisone injection is superior.

The results of aspiration for ganglions are variable, with success rates reported between 30% and 70%.25,26 Results are reported as better in cases of ganglions from tendon sheaths.27 We agree with authors who caution against aspiration of volar ganglia secondary to the proximity of the radial artery as well as the palmar cutaneous branch of the median nerve.28

Technique: Aspiration and Corticosteroid Injection, Dorsal Wrist Ganglion

The wrist is positioned flat on a comfortable surface, with the dorsal aspect of the wrist facing up for dorsal-based ganglia. The skin proximal to the cyst is locally infiltrated with 5 mL of 1% lidocaine using a 25-gauge needle. Every attempt is made to keep the anesthetic proximal to the cyst so the lesion is still palpable for accurate aspiration. An 18-gauge needle on a 10-mL syringe is inserted directly into the cyst. The contents of the cyst are then aspirated; the contents should be sent for pathology as well as cultures if an adequate specimen is obtained, and there is any concern for infection or inflammatory synovitis. In our institution, we typically do not send the specimen if classic jelly-like appearing ganglion cyst fluid is withdrawn. Although we do not typically perform corticosteroid injection with ganglion aspirations, one could be administered through the same needle used for the aspiration.

A similar approach may be used for volar ganglia, although great care should be taken to avoid inadvertent needle entry into the radial artery. We typically will offer volar ganglion aspiration when a portion of the cyst is located at or distal to the volar wrist crease, at which point, the radial artery will have already taken off dorsally beneath the cover of the first dorsal compartment tendons. We typically do not advocate aspiration when the cyst is entirely proximal to the wrist crease. Aspiration should clearly be performed before performing any injections to avoid intravascular administration of anesthetic or corticosteroid.

Thumb CMC Joint (Basilar Joint);
CPT 20660, ICD-9 715.14

Arthritis of the CMC joint of the thumb, commonly referred to as basilar joint arthritis, is among the most frequent degenerative disorders affecting the hand. Constant multidirectional forces at the articulation of the thumb metacarpal base and trapezium subject this joint to unique forces and the development of premature arthrosis, more commonly in females.29

The joint functions as a unique biconcave saddle joint, permitting substantial mobility in all planes; the relative lack of osseous constraint, however, renders the basilar joint inherently unstable. Capsuloligamentous structures, therefore, are primarily responsible for stabilizing the thumb CMC articulation, especially the anterior oblique, or “volar beak,” ligament that resists dorsoradial translation.30 Attenuation of the anterior oblique ligament leads to instability of the CMC joint and progressive degenerative changes.

Diagnosis

Patients typically report pain localized to the thenar eminence that is exacerbated during specific activities, particularly those involving gripping, pinching, and twisting. Pain and disability are most frequently encountered during turning doorknobs, opening jars, and with writing and other fine motor movements.

Physical examination demonstrates maximal tenderness most frequently at the volar-radial aspect of the CMC joint, at the proximal-radial border of the thenar eminence. The base of the metacarpal may be especially prominent dorsally, and crepitus or a tactile click may be elicited during motion evaluation, and may be particularly pronounced during the “grind” test, when the examiner performs a load shift maneu-
ver to the thumb. In chronic cases, a deformity may develop with adduction of the thumb metacarpal and compensatory hyperextension of the metacarpophalangeal joint.

Radiographic evaluation includes typical anteroposterior, lateral, oblique, and specialized basilar joint views, which are acquired by instructing the patient to press opposing thumb tips together, with the nail plates in plane with the projection of the X-ray beam.31 The degree of CMC joint narrowing as well as concomitant changes to the scapho-trapezio-trapezoid joint may be evaluated.

**Indications for Treatment**

Nonoperative treatment begins with NSAIDs and splinting with a hand or forearm-based opponens splint with the interphalangeal joint free. We prefer a rigid splint for night use and a soft sleeve for day use. Typically, a 3- to 6-week trial will greatly alleviate symptoms, particularly in patients in early stages of basilar joint arthritis. Patients are counseled, however, that the natural history of the condition is to likely progress over time. Few data exist regarding outcomes of intra-articular injections of the CMC articulation, although injection typically provides more relief in patients with milder forms of CMC arthritis.32

Operative management is offered to patients who continue to experience symptoms recalcitrant to conservative measures. Several surgical techniques may be performed based on the clinical severity of the disease. Volar ligament reconstruction or metacarpal osteotomy may be offered for early arthropathy of the joint, whereas resection of part or all the trapezium with various reconstructive options is considered for more advanced stages of basilar joint arthritis.33

**Technique: Corticosteroid Injection**

We perform this injection under fluoroscopy, and rest the ulnar aspect of the patient’s hand on the flat surface of the c-arm. The dorsal base of the first metacarpal is marked. A 3-mL syringe is typically loaded with 0.5 mL of 1% lidocaine without epinephrine and 20 mg of triamcinolone (in 0.5 mL). We use a higher concentration of corticosteroid here, given the small amount of injectant the CMC joint can accommodate. The injection site is along a line on the midline dorsum of the thumb just proximal to the base of the thumb metacarpal and dorsoulnar to the EPB tendon (Fig. 8).

Due to the often frequently distorted anatomy in the setting of CMC arthritis, the tip of a pen under fluoroscopy is useful to mark the appropriate entry point. The injection is then performed by introducing either a 25-gauge needle perpendicular to the skin under fluoroscopic guidance. The needle is redirected until the practitioner feels a “give” as the needle enters the joints space; traction on the thumb can be of particular benefit, and fluoroscopy is helpful to confirm intra-articular placement (Fig. 9). Before administering the injection, aspiration should be performed to ensure that the deep branch of the radial artery is not violated and that inadvertent intravascular injection is avoided. Minimal resistance should be encountered at the start of the injection, although resistance will develop as the joint usually accommodates no more 0.5 to 1 mL. At the point resistance is maximized, relieving pressure on the syringe will usually refill the syringe to some degree, as is typical for intra-articular injections.

**Aftercare for Hand and Wrist Injections**

Manual pressure is usually applied to the injection site, and an adhesive bandage is applied. The patient is then encouraged to normally use the hand and wrist following a majority of injections; in our practice, we typically will advise patients to return to the office in 4 to 6 weeks to monitor their response to the aspiration and injection or have them return if they experience a recurrence in symptoms to discuss possible surgical management. The use of a splint following injections for certain conditions (ie, thumb CMC, de Quervain’s syndrome) is at the surgeon’s discretion, but we typically recommend 1 to 2 weeks of splinting until symptom-free for all conditions discussed here except trigger finger, then weaning the brace and returning to activity as tolerated.

**Figure 8** The trapezium (T) and base of the 1st metacarpal (MC), traction is then applied to the thumb, and the injection is directed proximal to the base of the 1st metacarpal.

**Figure 9** Fluoroscopy is used to confirm intra-articular placement of the needle tip in the CMC joint of the thumb.
Complications

Fortunately, corticosteroid injections of the hand and wrist are associated with a low complication rate. Several case reports have documented tendon ruptures following injection, although no causative link between corticosteroid administration and tendon rupture has been identified. Most authors, including our practice, recommend that intratendinous injection be avoided to prevent corticosteroid-mediated disruption of collagen within tendons.

Diabetic patients should be cautioned that their serum glucose levels may be elevated for a 2- to 3-day period after injection; we routinely encourage these patients to diligently monitor their blood glucose levels during that period and to modify their glycemic control regimen or seek medical attention appropriately if levels rise.

Although several corticosteroid preparations are available, less soluble preparations are believed to be more irritant to the soft tissues and have resulted in depigmentation as well as atrophy of the subcutaneous tissues, particularly in darker skinned and thin patients. Extra-articular injections in subcutaneous locations with minimal adipose are most at risk for this complication, such as de Quervain's, ECU, and FCU injections. The practitioner should counsel patients regarding the possibility of these complications, although the use of soluble forms of corticosteroid has drastically decreased the occurrence of soft-tissue-related complications.

Conclusions

A variety of disorders affecting the hand and wrist may be amenable to therapeutic and diagnostic corticosteroid and analgesic injections. Injections have been demonstrated to provide relief for CTS, tendinopathy, and arthritis of the radiocarpal and basilar joints. A careful clinical evaluation is necessary to make the correct diagnosis and establish appropriate indications for nonoperative or operative treatments. When injections are considered, detailed knowledge of local anatomy as well as proper technique will ensure the safe and reliable administration of injections in the hand and wrist.

References