Hand and Wrist Tendinopathies

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KEYWORDS

• Tendinopathy • Tendonitis • Tendinopathies in athletes
• Sports-related injuries of the wrist and hand • Flexor tendon injures
• Extensor tendon injuries • Overuse injuries of the hand and wrist

KEY POINTS

- Sports-related tendinopathies of the hand and wrist are common and are predominantly related to overuse.
- Most cases can be diagnosed with history and physical examination alone, with the need for advanced imaging in recalcitrant cases.
- Nonoperative management, consisting of rest, activity modification, antiinflammatory medications, temporary splinting or bracing, hand therapy, and possibly steroid injections, plays a pivotal role. Surgical intervention may be offered in those patients who fail nonoperative treatment.

INTRODUCTION

Hand and wrist tendinopathies are commonly seen in athletes, ranging from contact to noncontact racquet/stick sports. Many of these typically do not cause the athletes to lose time from their sports because treatment is symptomatic and rarely time specific. Diagnosis for tendinopathies in the hand and wrist is predominantly made on clinical examination. If the diagnosis is uncertain or the patient fails nonoperative treatment, advanced imaging may help. Most of these conditions respond to nonoperative treatment with activity modification, antiinflammatory medications, hand therapy, and corticosteroid injections. Although the level of steroid used for injection is typically very low, athletes in competitive leagues, in which testing is performed for performance-enhancing medications, should be aware of possible testing parameters for banned substances before having an injection. Although the authors do not believe these injections will improve overall performance, sports vary regarding their specific testing parameters and banned substances, and thus the medical personnel and the athletes should be aware of the specifics for their sports. When symptoms persist in spite of nonoperative treatment, clinicians offer surgical treatment. This surgery can

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typically be done under local anesthesia (WALANT [wide awake local anesthesia no tourniquet]) or local anesthesia with sedation. Following operative treatment, a structured rehabilitation program to resume motion and tendon gliding is imperative under the guidance of a hand therapist and then athletic trainer/coach.

EXTENSOR TENDINOPATHIES

De Quervain Tenosynovitis

Tendinopathy involving the first dorsal extensor compartment, or de Quervain tenosynovitis, is a notable source of radial-sided wrist pain in athletes participating in racquet sports, rowing, golf, volleyball, and bowling.[1–4] In tennis,[3] golf,[4] and rowing,[1] the condition has been attributed to varied grips, altered swing mechanics, and tight grips with poor technique, respectively. In contrast, in volleyball, repetitive microtrauma from impact of the ball on the dorsal radial wrist and increased training time has been implicated with the risk of developing de Quervain tenosynovitis.[2] Regardless of the proposed sport-specific mechanisms, the end result is restricted, painful motion of the tendons of the abductor pollicis longus (APL) and extensor pollicis brevis (EPB) within the fibro-osseous sheath in which they travel immediately proximal to the radial styloid.[5] The tendon sheaths of those affected may be up to 5 times thicker as a result of accumulation of mucopolysaccharides and increased vascularity, consistent with myxoid degeneration rather than acute inflammation.[6,7]

A higher rate of de Quervain tenosynovitis has been shown in women, with a slight predilection for individuals more than 40 years of age or of African American decent.[8] Affected individuals invariably have some degree of swelling in the vicinity of the radial styloid and tenderness with palpation to the first extensor compartment tendons. The Eichhoff and Finkelstein maneuvers (**Fig. 1**) have been described to clinically confirm the diagnosis of de Quervain tenosynovitis. They are commonly thought of as the same maneuver; however, there are differences.[9–11] The Eichhoff maneuver is performed by asking the patient to gently grasp the thumb in the palm while the wrist is ulnarly deviated by the examiner. Pain over the region of the first extensor compartment is considered a positive maneuver and considered consistent with de Quervain tenosynovitis. The Finkelstein maneuver, as originally described, has the examiner passively flex the thumb and ulnarly deviate the wrist, with a positive maneuver producing pain over the first extensor compartment. Wu and colleagues[12] compared these maneuvers on 72 wrists (36 patients) and found the Finkelstein maneuver was more accurate, with fewer positive results and less discomfort for the patients.

Fig. 1. Eichhoff maneuver. The patient is asked to gently grasp the thumb in the palm as the wrist is ulnarly deviated by the examiner. Reproduction of the patient's pain is a positive maneuver.

More recently, the wrist hyperflexion and abduction of the thumb (WHAT) maneuver (**Fig. 2**) has been described as an additional diagnostic tool with better sensitivity (0.99 vs 0.89) and specificity (0.28 vs 0.14).[13] A positive maneuver is reproduction of symptoms with resisted thumb abduction with the wrist maximally flexed.

As with most tendinopathies, conservative treatment begins with avoiding the inciting event. A short course of immobilization, hand therapy, and nonsteroidal anti-inflammatory medications can be an effective adjunct to limit pain and symptoms. Injection of corticosteroid and local anesthetic into the tendon sheath of the first dorsal compartment is often combined with these conservative modalities. Earp and colleagues[14] reported on the effectiveness of a single injection and determined that 82% of patients are symptom free for the first 6 weeks and more than half were without symptoms at 1 year. A more recent study by Oh and colleagues[15] found that more than 70% of patients who responded to 1 or 2 injections had resolution of symptoms. Surgical release may be warranted in cases of recalcitrant symptoms; however, patients are counseled about the possibility of an extended recovery, incomplete relief, and transient numbness in the superficial radial nerve distribution.[16] In our practice, new patients with de Quervain tenosynovitis are offered a corticosteroid injection in combination with a forearm-based thumb spica orthosis. If possible, athletes are encouraged to await return to play until symptoms have resolved, but no formal restrictions are placed. When symptoms persist, we offer first extensor compartment release, which is done through a transverse incision, taking care to protect the sensory

Fig. 2. WHAT maneuver. The patient's wrist is maximally flexed and the thumb is radially abducted against resistance provided by the examiner. Reproduction of the patient's pain is a positive maneuver.

branches of the radial nerve and lateral antebrachial cutaneous nerves, under local anesthesia. The incision in the extensor retinaculum is along the dorsal/ulnar aspect of first extensor compartment in order to minimize the chance of tendons subluxing in a volar direction with wrist flexion and thumb motion. The EPB often has a separate subcompartment that must be recognized and released. A soft dressing is applied, and early movement of the thumb is encouraged to promote tendon gliding. Return to activities depends on wound healing and comfort, but is generally at 2 to 3 weeks after surgery.

Intersection Syndrome

Intersection syndrome is characterized by radial-sided wrist pain, swelling, tenderness, and occasional crepitus in an area approximately 4 cm proximal to the Lister tubercle (**Fig. 3**). Controversy remains with regard to the precise location of the syndrome: the intersection of the muscle bellies of the APL and EPB and the extensor tendons of the second compartment, or stenosing tenosynovitis within the second compartment itself. One of the few reports on this condition, provided by Grundberg and Reagan[17] in 1985, concluded that the disorder was stenosing tenosynovitis of the sheath of the common radial wrist extensors, suggesting that space limitations within this compartment lead to accumulation of reactive tissue beneath the APL and EPB. In their limited cohort, all patients improved with surgical release of the second compartment, indicating its role with this condition.

As with other tendinopathies of the hand and wrist, this has been associated with repetitive use and may be seen in athletes participating in rowing, weightlifting, and cycling. Pain is often elicited with resisted wrist extension and radial deviation, and careful attention should be paid to the location of tenderness because this can be

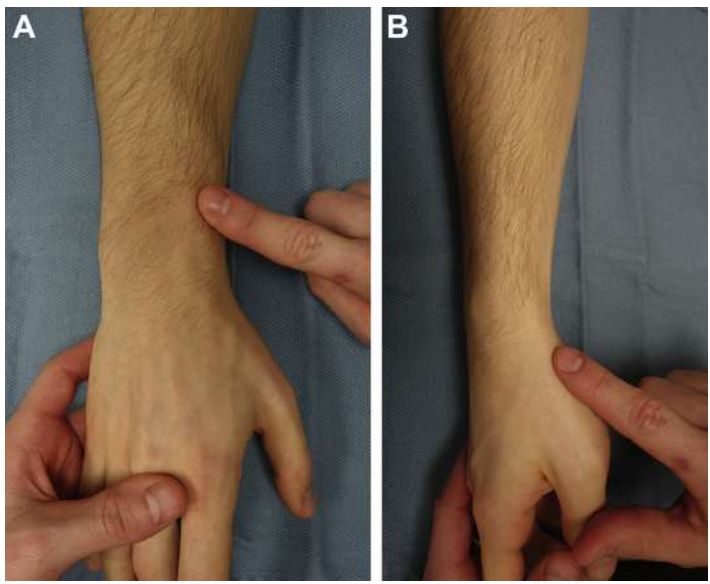

Fig. 3. Intersection syndrome. Patients with intersection syndrome have symptoms approximately 4 cm proximal to Lister tubercle in the area of intersection between the first and second extensor compartments (*A*). In contrast, the location of pain with de Quervain tenosynovitis is more distal, in the area of the radial styloid (*B*).

misdiagnosed as de Quervain tenosynovitis. Treatment involves a combination of activity modification, temporary immobilization with a wrist splint in neutral extension, stretching exercises, and antiinflammatory medications. Steroid injections into the tendon sheath of the second compartment in the area of maximal tenderness may be provided in refractory cases. It has been our experience that most cases resolve with conservative modalities, hence the paucity of reported cases in the literature. In the event that symptoms persist in spite of nonoperative treatment, we release the second extensor compartment and debride any inflamed tenosynovium. This operation is typically performed out of season, with a short period of immobilization and therapy to regain motion and strength. Four to 6 weeks is expected to return to full activities.

Extensor Carpi Ulnaris Conditions

Disorder involving the extensor carpi ulnaris (ECU) tendon is a common source of ulnar-sided wrist pain, particularly in athletes using a club or racquet.[18–20] A broad spectrum of modalities have been described, including stenosing tenosynovitis; tendinosis; bony erosion of the sixth compartment floor; subluxation; and, rarely, rupture.[21] Given the anatomy of the ulnar side of the wrist, thorough physical examination is imperative. Tenderness about the ECU tendon sheath and pain or weakness with resisted wrist extension and ulnar deviation is invariably present. The ECU synergy maneuver (**Fig. 4**), described by Ruland and Hogan,[22] provides another tool to help better differentiate tendon versus intra-articular disorder. To perform this maneuver, the patient's elbow is flexed to 90° with the forearm fully supinated. The patient is then asked to radially abduct the thumb against resistance as the examiner places a counterforce on the middle digit. In doing so, the second extensor compartment tendons activate and to keep the wrist in neutral position, and the ECU fires. The maneuver is deemed positive if the patient's ulnar-sided wrist pain is recreated. The investigators noted symptomatic relief in all patients with a positive test following an ECU tendon sheath lidocaine injection, whereas those with a negative test were found to have intra-articular disorder on either MRI or wrist arthroscopy. ECU subluxation, or snapping ECU, can be evaluated by having the patient flex and ulnarly deviate the wrist with the forearm in supination because that creates the greatest angulation of the ECU tendon with respect to the ulna.

In the setting of stenosing tenosynovitis or ECU tendinopathy, initial treatment is primarily conservative, with activity modification, antiinflammatories, and rest with a short course of immobilization. Although some clinicians prefer above-elbow immobilization, the authors prefer a short-arm orthosis with fingers and thumb free and the wrist in ulnar deviation. The authors are aware of no data to suggest one is more effective than the other, but, from our experience, patients are more comfortable with the elbow free. A trial steroid injection into the ECU tendon sheath may be considered as an adjunct for both diagnostic as well as therapeutic purposes; however, the longevity of such an injection is not known. Care should be given when injecting the ECU tendon sheath to ensure that it is at the appropriate depth to guard against skin hypopigmentation and atrophy from superficial injection. Surgical decompression is reserved for chronic cases that have failed to improve with a minimum of 2 to 3 months of conservative treatment and is typically performed during the off-season. Our preferred operative treatment, in the absence of instability, involves radial incision of the fibro-osseous canal of the sixth compartment, debridement of any inflamed tissue within the ECU subsheath, and repair of the overlying extensor retinaculum; however, controversy exist as to the importance of the retinacular repair in preventing ECU tendon instability.[23] Anomalous tendon slips between the ECU and the extensor digiti minimi

Fig. 4. ECU synergy maneuver. The patient's elbow is flexed to 90° with the forearm in a fully supinated position. The patient is then asked to radially abduct the thumb against resistance as the examiner places a counterforce on the middle digit. Reproduction of pain in the area of the ECU is a positive maneuver.

have been reported and current, limited research suggests excision at the time of decompression.[20] Montalava and colleagues[18] describe their experience in treating 28 professional tennis players, 14 of whom had ECU tendinosis. They were able to manage this condition with orthoses with the athletes continuing to play. Symptoms resolved between 2 and 24 weeks and none of the athletes required surgery. Treatment of ECU instability is largely the same, with the exception of immobilization. In these patients, the wrist is immobilized above the elbow in pronation, wrist extension, and slight radial deviation in order to limit the provocative position of the ECU, typically with a modified Munster orthosis. Montalava and colleagues[18] also described nonoperative treatment of ECU instability, with some patients showing instability and some with subluxation of the ECU completely out of the groove. Symptoms resolved with 3 to 4 months of nonoperative treatment in all 12 patients. When detachment of the extensor retinaculum occurred (3 patients), ultrasonography was used to monitor healing. Immobilization is discontinued when reattachment occurs or at 12 weeks. Surgical management of these patients in the setting of failed conservative treatment entails imbrication of the subsheath in acute cases (<6 months), or reconstruction using a radially based flap of the extensor retinaculum that is passed beneath the ECU and secured to itself, or ECU groove deepening. Our preferred treatment (**Fig. 5**) involves ECU groove deepening. A longitudinal incision is made over the sixth extensor

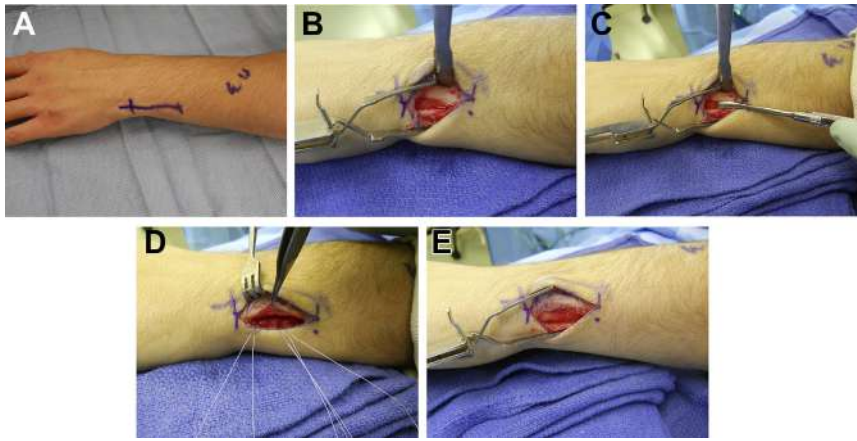

Fig. 5. Example of reconstruction of ECU instability with ulnar groove deepening. (*A*) Location of incision, (*B*) appearance of ulna after elevation of ECU and subsheath, (*C*) Freer elevator placed by ECU groove before deepening, (*D*) appearance after placement of suture anchors in ulna before reattachment of subsheath, and (*E*) appearance after closure of extensor retinaculum.

compartment, taking care to protect the sensory branch of the ulnar nerve. The retinaculum is opened along the ulnar aspect and tagged for later repair. The subsheath is evaluated and dissected off the ulna. If there is notable synovitis, the subsheath is opened and debrided. The groove in the ulna is then evaluated. Using a barrel-shaped bur, the groove is deepened to roughly the depth of a freer elevator. The subsheath is then imbricated and reattached to the ulna using suture anchors, followed by repair of the retinaculum. MacLennan and colleagues[24] reported on 21 patients with ultrasonography confirmation of subluxation treated in this manner, with improvements in grip strength, wrist motion, pain, satisfaction, and DASH (Disabilities of the Arm, Shoulder, and Hand) scores. Alternatively, an ulnarly or radially based strip of extensor retinaculum can be used to stabilize the ECU.[25] Allende and Le Viet[20] reported on 27 patients, 17 of whom were injured playing sports, who had stabilization of the ECU using a radially based sling of extensor retinaculum secured to the ulnar head. Of these patients, 23 were noted to have a good to excellent result based on a composite score of strength, motion, and pain improvement in addition to return to preinjury activities. Twenty-two of the 27 patients returned to previous activities, 10 of whom were professional athletes who were able to perform at their previous level by a mean of 8 months (range, 3–21 months). There are no comparative studies showing that 1 method is superior. Postoperatively, patients are immobilized for 6 weeks in an above-elbow cast or orthosis, followed by a therapy program, with emphasis on regaining wrist motion and forearm rotation. Approximately 2 weeks later, we begin strengthening and allow racquet or stick handling once the patient has painless passive and active motion. We expect return to play between 8 and 10 weeks.

Extensor Pollicis Longus Entrapment

Tendon entrapment of the extensor pollicis longus (EPL) tendon is a rare cause of pain or injury in athletes. Despite the infrequency of this condition, early identification and intervention is vital because cases of spontaneous rupture have been reported.[26] The condition is characterized by pain with active or passive thumb flexion, swelling,

tenderness, and crepitus at a level immediately distal to the Lister tubercle, around which the EPL tendon passes. This position is a known watershed area of limited vascularity with the EPL tendon, thus making it potentially vulnerable to ischemic rupture following local trauma.[27] Classically, rupture of the EPL has been associated with nondisplaced distal radius fractures treated with immobilization, with an incidence as high as 5% (**Fig. 6**).[28] In addition, given the intimate proximity of the EPL to the Lister tubercle, any violation of the dorsal cortex when attempting to operatively manage a distal radius fracture from a volar approach can increase the propensity for EPL injury. Diep and Adams[29] retrospectively identified 7 patients (6 women and 1 man) with EPL tendonitis or rupture who had sustained a nondisplaced distal radius fracture within the prior year. Only 2 of the 4 patients with EPL rupture had prodromal symptoms, which included tenderness, snapping, and weakness. All 4 patients were offered surgical intervention and were satisfied with their thumb function postoperatively. Of the 3 patients without rupture, clinical examination revealed tenderness over the course of the EPL tendon and Lister tubercle and wrist pain with thumb motion, but EPL function was noted to be intact. MRI or ultrasonography was used to confirm the diagnosis of EPL tendonitis. Decompression of the EPL tendon was subsequently completed with tendon rupture not experienced in all 3 patients. In lieu of other available evidence, the authors recommend early decompression and transposition for cases of suspected EPL entrapment to prevent the possibility of attritional rupture, a complication that may require an extensor indicis proprius transfer. Steroid injections are avoided in these patients, given the vulnerable watershed zone of the EPL and the potential increased propensity for rupture.

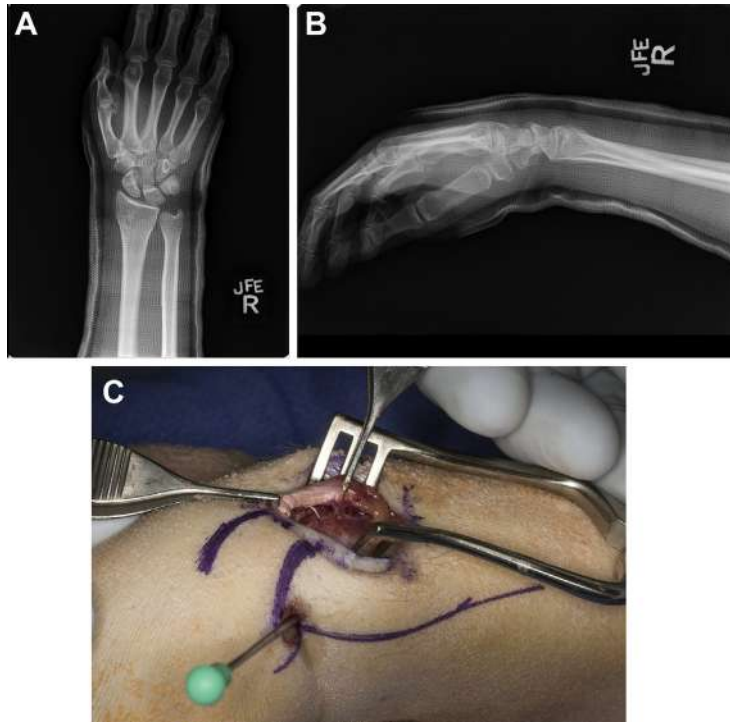

Fig. 6. A patient with a nondisplaced distal radius fracture (*A*, *B*) who developed EPL tendinopathy that required decompression (*C*). (*Courtesy of* Sanjeev Kakar.)

FLEXOR TENDINOPATHIES

Flexor Carpi Radialis Tendinopathy

Although a rare source of tendinopathy, the sharp angulation of the flexor carpi radialis (FCR) tendon across the ridge of the trapezium and tight fibro-osseous sheath through which it passes makes it prone to stenotic tendinopathy. Bishop and colleagues[30,31] reported on10 patients, in whom the primary symptom was pain localized to the proximal aspect of the trapezium and accentuated by resisted flexion and radial deviation (**Fig. 7**). Activities that involve repetitive flexion of the wrist, such as basketball, volleyball, and racquet sports, may increase the susceptibility for this condition, although the risk for development is not completely understood. Use of a lidocaine injection placed into the FCR sheath may aid in the diagnosis of FCR tendinopathy; however, Bishop and colleagues[30] only appreciated an improvement in pain in 5 of their patients, despite complete resolution in 9 patients following decompression. Given the proximity of the trapezium, which encircles the FCR tendon, from 61% to 80% at the level of the trapezial tubercle, and the scaphoid, radiographs of the wrist should be obtained to rule out occult fracture or early degenerative changes.[31] Conservative treatment by means of activity modification, a short course of wrist and basal thumb immobilization, stretching and strengthening exercises, and oral antiinflammatory medications are the main treatment modalities. A corticosteroid injection into the FCR sheath may be considered; however, current literature is lacking in terms of

Fig. 7. Examination for FCR tendinopathy. The FCR tendon is palpated as the patient attempts to flex and radially deviate the wrist against resistance provided by the examiner. Reproduction of pain is a positive maneuver.

symptom resolution with this modality. Refractory cases may improve with FCR tunnel decompression, particularly in cases of isolated tendinopathy.

Flexor Carpi Ulnaris Tendinopathy

Tendinopathy of the flexor carpi ulnaris (FCU) are uncommon. Similar to the palmaris longus and unlike other tendons of the wrist and hand, the FCU does not pass through an enclosed sheath during its course. Presentation therefore differs from other tendon disorders in that triggering does not occur. Clinically, athletes may present with activity-related pain localized to the FCU tendon. Examination shows palpable tenderness approximately 2 to 3 cm proximal to the pisiform, in addition to pain localized to the same location with resisted wrist flexion and ulnar deviation. Budoff and colleagues[32] reported on 5 patients (6 wrists) diagnosed with FCU tendinopathy who failed nonsurgical management consisting of antiinflammatory medications, splinting, therapy, and steroid injections (4 patients). Angiofibroblastic hyperplasia (ie, tendinosis) was found in all patients, a finding that has not been described with other tendinopathies of the hand and wrist. This intrasubstance degenerative tissue was excised and the tendon subsequently repaired in a side-to-side manner, with complete to near-complete symptom relief reported in all patients at a minimum of 1-year follow-up. In light of this, the investigators concluded that this type of degenerative tendinopathy may be better treated by strengthening and stretching rather than by modalities aimed at inflammation, similar to recommendations for lateral epicondylosis or tennis elbow.

Trigger Digits

Stenosing tenosynovitis, or trigger digit, is a common cause of hand pain. This phenomenon is a pathologic disproportion of available space in the flexor tendon sheath and the digital flexor tendons. The underlying cause is often difficult to ascertain; however, sports activities involving repetitive gripping or mild trauma may result in relative tendon or retinacular thickening, thus resulting in mechanical impingement. Patients invariably present with pain and tenderness overlying the palmar aspect of the metacarpal head (in the area of the A1 pulley). In addition, they may describe digit snapping, catching, or locking. To minimize symptoms, patients often limit motion of affected digits, resulting in flexion deformities of the proximal interphalangeal joint, and an inability to fully flex the digit into the palm may be appreciated. Numerous studies have evaluated the efficacy of steroid injections, including the number of injections that should be considered before surgery.[25] Kerrigan and Stanwix[33] performed a cost-minimization analysis to identify the least costly strategy for effective treatment of trigger finger. Of the 5 algorithms included, management with 2 steroid injections before surgery was the least costly, with immediate surgical release costing 248% to 340% more. Halim and colleagues[34] more recently evaluated the cost of nonsurgical treatment of trigger finger in terms of dollars reimbursed by payers. In their prospective study of 82 patients, offering up to 3 injections before surgical release yielded potential savings of $72,730 ($826 per digit) or 43% of the cost, with the first injection having the highest component of cost savings ($15,956). In our practice, patients are offered up to 2 injections, with a 60% to 70% success rate reported. In refractory cases, decompression is performed under local anesthetic. This decompression is performed through a longitudinal incision for fingers and a transverse incision in the thumb. The A1 pulley is released and, in the fingers, adhesions between the flexor digitorum superficialis (FDS) and flexor digitorum profundus tendons are separated. This procedure is performed under WALANT so the patient can actively move the finger to ensure the triggering has resolved. In the event that triggering persists following A1

pulley release, the authors excise 1 slip of the FDS. There does not seem to be a difference between the radial and ulnar slips, so we tend to excise the one that has the most fraying or tendon degeneration if present. The incision is closed with absorbable sutures and a surgical glue. A soft dressing in applied following surgery and immediate motion with tendon gliding exercises are performed. Athletes are restricted from gripping and heavy lifting activities until the skin has healed, with return to sport typically in 2 to 3 weeks.

SUMMARY

Tendinopathies of the hand and wrist are a common source of injury in athletes given the repetitive nature of most sports. Diagnosis can often be made with a thorough history and physical examination alone, minimizing the need for advanced imaging. As a whole, this group of injuries responds well in the early or acute phase to conservative measures such as rest and activity modification, temporary immobilization, therapy, and antiinflammatory medications. For recalcitrant cases, steroid injections can be effective. With the exception of EPL entrapment, surgical intervention is reserved for chronic cases that have failed to respond to these conservative modalities.

DISCLOSURE

There are no financial conflicts of interest to disclose.

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