Review Article

Medial Epicondylitis: Evaluation and Management

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Abstract

Medial epicondylitis, often referred to as "golfer's elbow," is a common pathology. Flexor-pronator tendon degeneration occurs with repetitive forced wrist extension and forearm supination during activities involving wrist flexion and forearm pronation. A staged process of pathologic change in the tendon can result in structural breakdown and irreparable fibrosis or calcification. Patients typically report persistent medial-sided elbow pain that is exacerbated by daily activities. Athletes may be particularly symptomatic during the late cocking or early acceleration phases of the throwing motion. Nonsurgical supportive care includes activity modification, NSAIDs, and corticosteroid injections. Once the acute symptomology is alleviated, focus is turned to flexor-pronator mass rehabilitation and injury prevention. Surgical treatment via open techniques is typically reserved for patients with persistent symptoms.

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Dr. Schickendantz or an immediate family member serves as a paid consultant to Arthrex; has stock or stock options held in TrazerHRA; and serves as a board member, owner, officer, or committee member of the American Orthopaedic Society of Sports Medicine. Neither of the following authors nor any immediate family member has received anything of value from or has stock or stock options held in a commercial company or institution related directly or indirectly to the subject of this article: Dr. Amin and Dr. Kumar.

J Am Acad Orthop Surg 2015;23: 348-355

http://dx.doi.org/10.5435/JAAOS-D-14-00145

Medial epicondylitis, or "golfer's elbow," is a pathology commonly encountered by orthopaedic surgeons. Despite an overall prevalence of <1%, medial epicondylitis may affect as many as 3.8% to 8.2% of patients in occupational settings.[1-3] Medial-sided pathology can be found in as many as 10% to 20% of patients with epicondylitis.[4] A result of common flexor tendon (CFT) microtrauma and degeneration, medial epicondylitis typically occurs in the fourth through sixth decades of life, the peak working years, and equally affects men and women.[1-3]

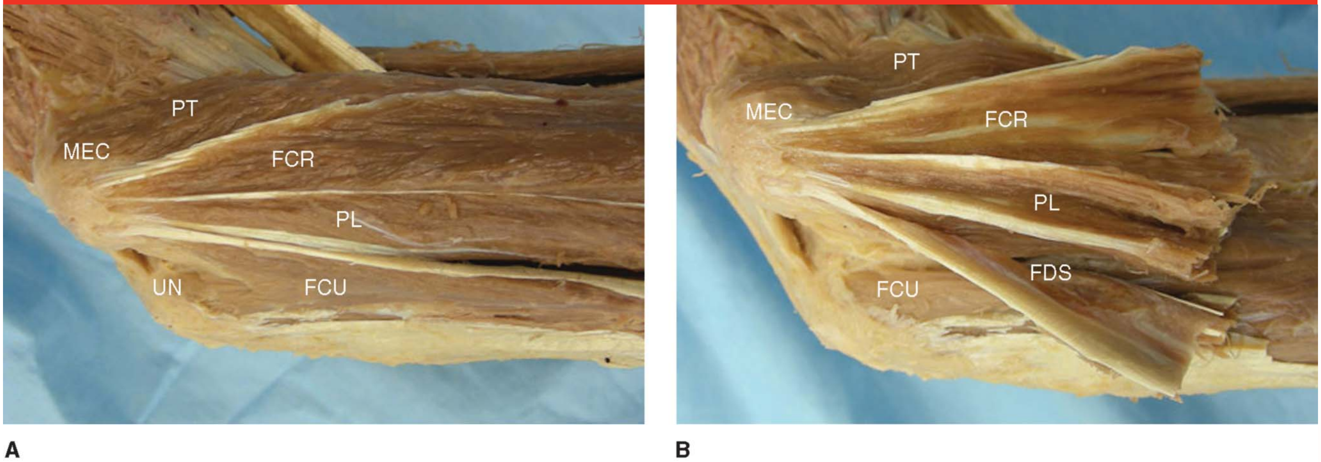
Although nonsurgical therapy and open surgical management are mainstays of treatment, recent studies have investigated the impact of nontraditional therapies such as extracorporeal shock wave therapy (ESWT) and modified surgical techniques.

Anatomy and Pathology

The flexor-pronator tendon is the confluence of five muscles of the forearm: the pronator teres (PT), flexor carpi radialis, palmaris longus, flexor carpi ulnaris (FCU), and flexor digitorum superficialis (Figure 1). This CFT is approximately 3 cm long and, in most elbows, crosses the ulnohumeral joint medially. The tendon attaches to the medial humeral epicondyle anteriorly and attaches proximally to the anterior bundle of the ulnar collateral ligament (UCL), with the fibers parallel to the UCL.[5] The CFT, particularly the ulnar head of the PT, also becomes confluent with a hyperplastic section of the anteromedial joint capsule.

Most authors believe the principle mechanism of injury is repetitive eccentric loading of the muscles conducting wrist flexion and forearm pronation combined with valgus overload at the elbow.[6] Strain of the medial elbow with a valgus overload moment, which occurs with overhead throwing, stimulates dynamic stabilization of the joint via eccentric contraction of the CFT. Simultaneous wrist flexion or forearm pronation

Figure 1



A and **B**, Photographs of a cadaver elbow demonstrating the ulnar nerve (UN), medial epicondyle (MEC), and the anatomy of the flexor-pronator muscles, including the pronator teres (PT), flexor carpi radialis (FCR), palmaris longus (PL), flexor digitorum superficialis (FDS), and flexor carpi ulnaris (FCU). (Reproduced with permission from Otoshi K, Kikuchi SI, Shishido H, Konno SI: The proximal origins of the flexor-pronator muscles and their role in the dynamic stabilization of the elbow joint: An anatomic study. *Surg Radiol Anat* 2014;36[3]:289-294.)

during ball release may produce even greater eccentric stress on the tendon.[7] Historically, the PT has been identified as the primary dynamic stabilizer and the most likely musculotendinous unit to be injured in medial epicondylitis. Recent cadaver studies, however, have implicated every musculotendinous unit except the palmaris longus.[8-11]

Repetitive supraphysiologic stress on the tendon eventually results in microtrauma and degeneration. Histopathologic examination has revealed a staged process of pathologic tendon change.[12] Initially, repetitive trauma results in peritendinous inflammation. Continued injury results in angiofibroblastic hyperplasia, an invasion of vascular and fibroblastic elements into the tendon. Eventually, replacement of the normal tendon with angiofibroblastic hyperplasia results in structural breakdown and irreparable fibrosis or calcification. Activity causing such pathology to the CFT can eventually transfer forces deeper to the UCL, which mirrors CFT fiber orientation and histologic anatomy.[5]

Clinical Presentation

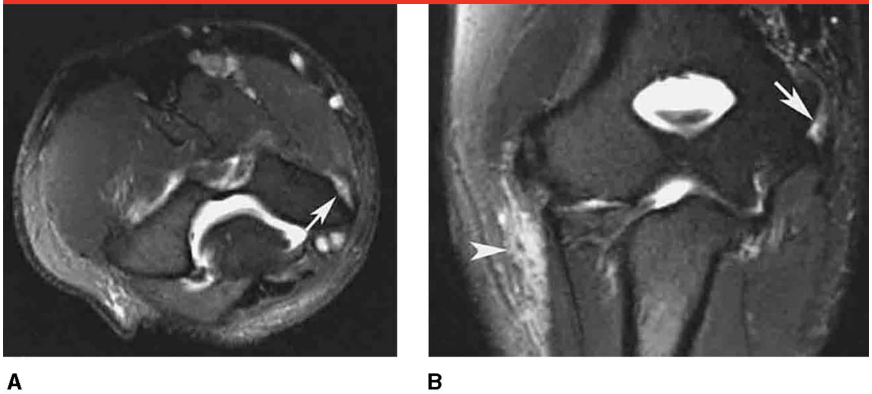
Medial-sided elbow pain encompasses a significant differential diagnosis, including ulnar neuritis, tendinopathy, ligamentous instability, intra-articular pathology, and trauma. A thorough history and physical examination is critical to determine the likelihood of medial epicondylitis. In the athlete, this condition is typically associated with overhead throwing, golf, or tennis; however, in the literature, it has been associated with other sports, including football, weightlifting, and bowling.[13,14] Medial epicondylitis is also commonly found in occupational settings, especially those involving repetitive forceful grip, manual handling of loads >44 lbs (20 kg), or exposure to constant vibratory forces at the elbow.[1,2,14]

Patients typically present with persistent medial-sided elbow pain that is often localized to the medial epicondyle, with radiation into the proximal forearm. Elbow pain is exacerbated by activity and is particularly bothersome during the late cocking phase in overhead throwing or during early acceleration for the thrower, tennis player, or golfer.[15] Patient history may include an acute traumatic blow to the elbow resulting in an avulsion of the CFT. More commonly, the pain is characterized by an insidious onset, with persistence despite rest.[6]

Physical examination may detect tenderness 5 to 10 mm distal and anterior to the medial epicondyle that is accompanied by soft-tissue swelling.[6] Resisted wrist flexion, forearm pronation, or forceful grip may be weakened compared with that of the contralateral side and may exacerbate elbow pain.[16] Patients may present with elbow flexion contracture secondary to pain and guarding; however, most patients present with normal passive and active range of motion (ROM) at the elbow and wrist. Peripheral neurovascular status is typically intact.

Patients suspected of having medial epicondylitis should be examined for other pathologies of the ipsilateral

Figure 2



Axial (**A**) and coronal (**B**) T2-weighted fat-suppressed fast spin-echo magnetic resonance arthrograms of the elbow. Abnormal high signal intensity within a thickened common flexor tendon (arrow) is visible on the axial view, indicating medial epicondylitis. On the coronal view, abnormal high signal intensity is present within a thickened common flexor tendon origin (arrow), and contrast is visible at the lateral elbow injection site (arrowhead). (Reproduced with permission from Kijowski R, De Smet AA: Magnetic resonance imaging findings in patients with medial epicondylitis. *Skeletal Radiol* 2005;34[4]:196-202.)

arm. Up to 84% of occupational patients may have concomitant work-related disorders, such as carpal tunnel, lateral epicondylitis, or rotator cuff tendinitis.[2] The overhead athlete must be examined for valgus instability secondary to an injury to the UCL. Evaluation of the UCL is performed by applying valgus stress to the elbow in 30° of flexion, with the forearm pronated and the wrist flexed. Ciccotti and Ramani[6] also described the use of the milking test, in which the examiner pulls on the thumb with the forearm supinated and elbow flexed. Either maneuver may elicit pain along the UCL, which can indicate an element of instability at elbow.

Ulnar neuritis is another common concomitant pathology. In patients with suspected ulnar neuropathy, the examination should include two-point discrimination in the ulnar sensory distribution and a comparison of the hypothenar bulk of the symptomatic and asymptomatic extremities. A positive Tinel sign can indicate compression of the ulnar nerve. Proximally, overdevelopment of the medial head of the triceps may compress the nerve against the medial intermuscular septum.[17,18] Distal to the medial epicondyle, the ulnar nerve travels under the arcade of Struthers and through the bifid FCU arcade distally, which may be inflamed and irritate the passing nerve.[6] However, a positive Tinel sign may be found anywhere along the length of the nerve. Sensory changes in the ulnar hand may be reproduced by applying stress to an irritated ulnar nerve via the elbow flexion test, which is performed with maximal elbow flexion, forearm pronation, and wrist extension for 30 to 60 seconds.[6] The presence of ulnar nerve subluxation should also be noted during examination, especially in patients who report a popping sensation during daily activities or overhead throwing. Ulnar neuritis with or without subluxation may exacerbate medial-sided elbow pain; therefore, treatment modalities specifically for medial epicondylitis provide inadequate relief. Patients with neurologic complaints or findings should also be examined for signs of cervical radiculopathy, particularly of the C6 and C7 roots, because these patients may be at increased risk of developing medial epicondylitis secondary to forearm muscle imbalance.[19]

In addition to a thorough patient history and physical examination, radiologic studies can support or verify a diagnosis of medial epicondylitis. Although most radiographs demonstrate normal findings, up to 25% may show evidence of calcification of the CFT or UCL.[6] Ultrasonography may be a cost-effective modality for visualizing CFT tendinosis and pathologic change. In a small series, Park et al[20] showed that a sonogram performed by a radiologist had sensitivity, specificity, and positive and negative predictive values of >90% for diagnosis of medial epicondylitis. The authors most commonly discovered hypoechoic or anechoic areas of focal tendon degeneration on ultrasonography. This modality also allows for dynamic examination, which may improve specificity and sensitivity.[21] However, the diagnostic accuracy of ultrasonography is highly dependent on the operator and may be less effective without well-trained sonographers.

MRI remains the standard of care for radiologic detection of medial epicondylitis (Figure 2). Noncontrast MRI is effective for detecting pathologic change in the tendon, such as frank tendinous disruption as well as other medial elbow pathology (eg, UCL or osteochondral injuries).[22] On T2-weighted sequences, intermediate to high signal intensity at the CFT, especially in the setting of peritendinous edema, is indicative of medial epicondylitis.[23] Advanced imaging is typically used when concern for concomitant pathology is high (eg, evaluation of the UCL in the overhead thrower) or if the clinical picture is unclear regarding the source of medial elbow pain.

Management

Various nonsurgical and surgical treatment modalities are used to manage medial epicondylitis. The goals, however, remain similar: to relieve acute symptomatology, rehabilitate the pathologic tendon, and prevent future recurrence. As with many chronic tendinopathies, nonsurgical therapy is the mainstay of treatment. Surgical procedures are typically reserved for patients with recalcitrant or recurrent symptoms despite nonsurgical management.

Acute Symptoms

The initial focus of nonsurgical supportive care is the relief of medial-sided elbow pain. Patients should refrain from activities that instigate or exacerbate symptoms, especially those that require repetitive wrist flexion, forearm pronation, and valgus stress about the elbow. Athletes with concomitant UCL injury should refrain from throwing for 6 to 12 weeks, with particular care taken to avoid valgus stress during the first 6 weeks of treatment. Periods of acute pain and swelling may be alleviated with icing, which provides both analgesic and vasoconstrictive effects.[6] NSAIDs may also provide effective pain relief and may be used routinely for 1 to 2 weeks as tolerated by the patient. These medications are particularly effective in reducing the synovitis associated with flexor-pronator tendon degeneration.[6,23] Night splinting and supportive orthoses may be used simultaneously, especially extension splinting in patients with ulnar neuritis. Counterforce bracing limits the maximal contractile force generated by the flexor-pronator musculotendinous unit.[6] Chang et al[24] demonstrated pain relief in baseball pitchers with medial epicondylitis by using forearm kinesiology taping techniques as a method of counterforce bracing. However, splinting and bracing should not involve prolonged elbow immobilization secondary to joint stiffness. In the setting of injury to the UCL, a hinged elbow brace can be used to provide varus-valgus stability and prevent full elbow extension.

ESWT may provide pain relief for a subset of patients. Electrical stimulation of the diseased tendon may promote angiogenesis, tendon healing, and some degree of short-term analgesia.[25] In a study of patients with newly diagnosed epicondylitis treated with ESWT or steroid injection, Lee et al[26] reported worse clinical pain scores at 1 and 2 weeks with ESWT, but better patient satisfaction at 8 weeks. However, Krischek et al[27] reported excellent or good clinical results with ESWT in only 7 of 30 patients at 1-year follow-up, which was notably worse than the results achieved in patients with lateral epicondylitis who underwent similar treatment. Definitive recommendations for the use of shockwave therapy for medial epicondylitis, including treatment duration and stimulation protocol, cannot be made at this point.

When noninvasive techniques prove inadequate, a corticosteroid injection is often effective in reducing medial elbow discomfort. The corticosteroid is injected into the peritendinous and synovial tissues rather than into the tendon itself.[6] Similar to oral anti-inflammatory medications, the corticosteroid may reduce the surrounding synovitis and resultant pain. Historically, direct injection deep to the flexor-pronator tendon has been the delivery technique of choice, although transcutaneous methods may be effective, as well.[28] Care should be taken to prevent iatrogenic complications such as subcutaneous atrophy, tendon weakening, or nerve injury. Local depigmentation may occur as well, especially in patients with darker skin.[6,29] Needle injection also provides the benefit of tendon trephination, which may stimulate bleeding and tendon healing.[30] In a prospective study of 60 elbows treated with steroid injection for medial epicondylitis, Stahl and Kaufman[31] noted an acute improvement in pain during the 6 weeks after injection but no difference by 3 months. Lee et al[26] demonstrated even shorter-term gains after steroid injection, with acute improvement in pain scores over the first 2 weeks followed by a plateau for up to 8 weeks. Suresh et al[30] combined needle stimulation and injection of autologous blood into the disrupted tendon, which resulted in decreased visual analog scale and Nirschl scores at 10 months.

Rehabilitation and Prevention

Physical therapy and rehabilitation remains a central aspect of recovery from medial epicondylitis. Once acute symptoms are alleviated, the focus turns to flexor-pronator mass stretching and strengthening. Each phase of rehabilitation requires the patient to perform targeted exercises with increasing repetition and speed. A return to full, painless ROM is the initial goal. Motion of the wrist and elbow is emphasized, with open chain exercises (non-weight bearing) and self-directed passive stretching techniques. Shoulder ROM is emphasized in the overhead thrower and in nonathletes with concomitant shoulder pathology. Elbow extension may need support with extension block bracing if a baseline flexion contracture exists. Passive ROM and eccentric contraction are avoided initially to prevent applying unintended excessive stress on the tendon. Once a painless functional motion arc is achieved, tendon strengthening begins. Concentric open and closed chain exercises are used, with increasing weight and repetitions to increase flexor-pronator mass power.

Finally, eccentric strengthening is implemented. All patients, particularly throwers, benefit from strengthening of the shoulder girdle and scapular stabilization. Core and lower body strengthening may also aid in throwing mechanics and activities involving moderate to heavy resistance. Ultimately, reconditioning of the upper limb to maintain tendon excursion and strength during rigorous tendon stress is central to preventing undue stress about the elbow and a recurrence of symptoms.

Currently, no specific guidelines exist regarding return to sport,[32] although Ciccotti and Ramani[6] suggested a progressive return to sport once the patient can tolerate sprint repetitions of concentric and eccentric resistance exercises. Sport-specific concerns, such as equipment and technique, should also be addressed to reduce undue stress at the elbow. Elbow pads may alleviate symptomatic ulnar nerve subluxation during athletic activity. In the selection of golf clubs, the length, shaft weight, club head weight, and club head strike zone must be considered. Proper technique is particularly important, especially in the amateur athlete. Medial epicondylitis is often found in the trail arm of the swing, secondary to greater valgus stress than that in the lead arm.[9] Stress on the PT of the trail arm is more likely in amateur golfers than in professionals, who use the lead arm in a protective manner to obtain optimum swing speed and power without excessive stress.

In tennis, racquet size, weight, head weight, strike zone, and string tension can impact stress at the elbow. Amateurs may benefit from vibration dampeners directly attached to the strings. Ilfeld[33] described poor forehand stroke mechanics as a cause of medial elbow stress. Late ball strike, with the racquet head behind the elbow at contact, was a significant contributor to medial epicondylitis. It can be exacerbated with an open-stance technique, particularly with a topspin stroke, which relies on rapid angular acceleration to the disadvantageous strike point.

Surgical Options

Surgical débridement for medial epicondylitis is typically reserved for patients with persistent symptoms despite an aggressive regimen of nonsurgical therapy for 4 to 6 months. The exception to this guideline is the elite athlete with definitive tendon disruption appreciable on MRI.[6] For these patients, surgical repair of the tendon may allow return to sport at preinjury performance levels earlier than nonsurgical treatment. The Morrey classification is used to guide surgical goals.[34] Type I lesions require epicondylar débridement. Pathology involving ulnar nerve symptoms require decompression (type IIA) or submuscular transposition (type IIB).

To date, there is no literature available on arthroscopic management of medial epicondylitis. The current technique of elbow arthroscopy is believed to place the medial collateral ligament and ulnar nerve at risk of iatrogenic injury.[6] In cadaver studies of the medial elbow, an anteromedial portal 1 cm anterior and 1 cm proximal to the medial epicondyle and a modified "mobile" secondary medial portal off the anterior aspect of the distal humerus were used.[35,36] However, the clinical efficacy of such techniques for medial epicondylitis has yet to be explored.

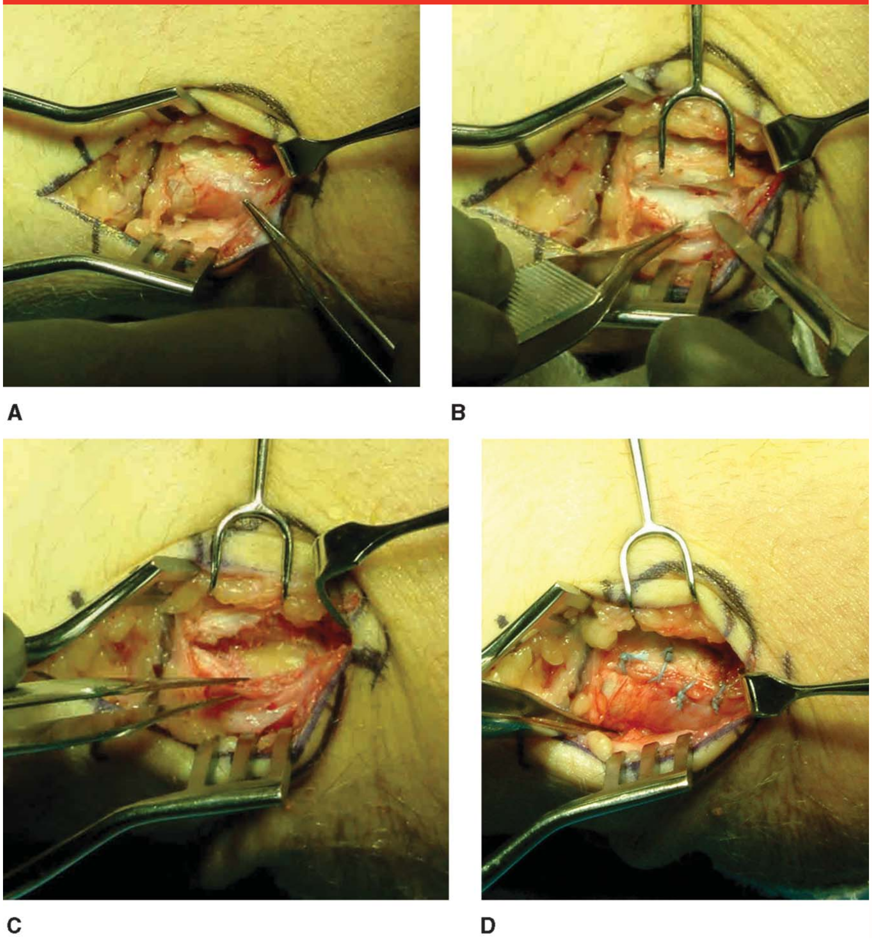
Currently, surgical management of medial epicondylitis is performed using an open procedure similar to the method described by Ciccotti and Ramani[6] (Figure 3). An incision is made at the medial epicondyle with care taken to avoid injury to the medial antebrachial cutaneous nerve during subcutaneous dissection. Pathology of the PT is common, and further exposure of diseased musculocutaneous tissue is accomplished using the PT–flexor carpi radialis interval. The CFT is exposed and examined for friable tissue, which is débrided. This technique allows the surgeon to visualize and protect both the ulnar nerve posterior to the medial epicondyle and the UCL deep to the CFT, particularly the anterior band. These structures may require secondary procedures such as nerve decompression, transposition, ligament repair, or reconstruction. For focal CFT lesions, limited débridement with side-to-side tendon repair may be performed. For lesions with significant disease, more extensive débridement may be indicated followed by CFT reattachment en mass to the medial epicondyle. The epicondyle is microfractured before tendon reattachment to provide a vascular bed for tendon insertion. Using this technique, Vangsness and Jobe[13] reported excellent or good results in 34 of 35 patients with medial epicondylitis, and only 1 patient failed to return to preinjury athletic performance at 6-year follow-up.

Cho et al[37] described a modified method, using a mini-open muscle resection technique in 10 patients with epicondylitis. A 1.5-cm incision was made at the medial epicondyle to expose the flexor-pronator tendon pathology, which was grossly debulked. After epicondylar microfracture, the overlying fascia was closed over the tendon, creating an enclosed hematoma to promote healing. The débrided tendon was not repaired nor was it completely removed and reattached to the epicondyle. All 10 patients returned to their respective occupations within 3 months and no poor results were reported. This technique, however, may limit exposure to the ulnar nerve, which may also be symptomatic and require decompression.

Failure to address additional medial elbow pathologies could result in failure of surgical treatment. Gabel and Morrey[38] reviewed 30 elbows with medial epicondylitis (16 of which had concomitant ulnar neuropathy) treated with various open techniques of tendon débridement and ulnar nerve procedures. Patients with mild ulnar neuropathy did not present preoperatively with a sensory or motor deficit and exhibited no evidence of nerve compression intraoperatively. Moderate and severe neuropathy was determined by subjective response to provocation testing via sustained elbow flexion, Tinel sign, and direct nerve compression. Of the 25 elbows with no or mild ulnar neuritis, 24 had excellent or good outcomes at a mean 7-year follow-up. However, three of the five patients with elbows with moderate or severe ulnar neuropathy reported fair or poor results at final follow-up. The authors noted that the only preoperative or intraoperative parameter correlated to outcome was the severity of ulnar neuropathy. Kurvers and Verhaar[39] reported a similar result in their series of 38 patients with medial epicondylitis treated surgically. Eleven of 16 patients treated with tendon débridement and reattachment were symptom free by a mean 44-month follow-up. However, of 24 patients with concomitant ulnar neuritis treated with nerve decompression, only 3 were symptom free at final follow-up.

Gong et al[40] described an alternative surgical technique in 19 patients with medial epicondylitis and ulnar neuritis. The ulnar nerve was decompressed from the cubital tunnel and released from the two heads of the FCU via a Z-lengthening of the flexor-pronator mass. The proximal limb remained attached to the medial epicondyle, while the distal limb was translated distally and repaired, with the nerve resting upon the brachialis. At a mean 38-month follow-up, all patients reported improved pain scores at rest and with activity, as well as complete relief of neuropathic symptoms.

Figure 3



Intraoperative photographs of an elbow with medial epicondylitis showing the pathologic change of the intact common flexor tendon (**A**), the tendon after débridement of diseased tissue (**B**), exposure of the medial epicondyle (**C**), and side-to-side repair of the common flexor tendon (**D**).

Depending on the severity of CFT disease, postoperative care may involve gentle arm use or immobilization of the limb in 90° via a splint or sling for 1 to 2 weeks postoperatively. After this period, active ROM is begun, with return to activities of daily living. Strengthening exercises are started at 6 to 8 weeks postoperatively, with eventual return to full activity or sport at 3 to 6 months.

Summary

Medial epicondylitis involves degeneration of the flexor-pronator musculotendinous mass of the forearm. Most patients with this condition are not athletes; however, medial epicondylitis has been associated with the throwing athlete, golfer, or patient whose work requires repetitive wrist flexion. Patients typically present with persistent medial elbow pain during activities of daily living that is unrelieved with rest. Athletes may be particularly symptomatic during the late cocking or early acceleration phases of the throwing motion. Nonsurgical management is generally effective in reducing daily symptoms and allowing return to sport at preinjury levels. Initially, efforts are focused on pain relief by reducing peritendinous synovitis and resisting tendon degeneration via noninvasive and invasive methods. Physical therapy and sport-specific rehabilitation programs are used for strengthening and prevention of re-injury. For elite athletes with distinct tendon disruption or patients with symptoms that are refractory to non-surgical treatment, open débridement and simultaneous treatment of secondary pathologies can be beneficial. Such patients typically return to pre-injury performance at 3 to 6 months postoperatively.

Acknowledgement

The authors would like to thank T. Sean Lynch, MD, and Ronak Patel, MD, for their guidance and manuscript writing.

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