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Lateral epicondylosis and calcific tendonitis in a golfer: a case report and literature review

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Objective: *To detail the progress of a young female amateur golfer who developed chronic left arm pain while playing golf 8 months prior to her first treatment visit.*

Clinical Features: *Findings included pain slightly distal to the lateral epicondyle of the elbow, decreased grip strength, and positive orthopedic testing. Diagnostic ultrasound showed thickening of the common extensor tendon origin indicating lateral epicondylosis. Radiographs revealed an oval shaped calcified density in the soft tissue adjacent to the lateral humeral epicondyle, indicating calcific tendonitis of the common extensor tendon origin.*

Intervention and Outcome: *Conventional care was aimed at decreasing the repetitive load on the common extensor tendon, specifically the extensor carpi radialis brevis. Soft tissue techniques, exercises and stretches, and an elbow brace helped to reduce repetitive strain. Outcome measures included subjective pain ratings, and follow up imaging 10 weeks after treatment began.*

Conclusion: *A young female amateur golfer with chronic arm pain diagnosed as lateral epicondylosis and calcific tendonitis was relieved of her pain after 7 treatments over 10 weeks of soft tissue and physical therapy focusing specifically on optimal healing and decreasing the repetitive load on the extensor carpi radialis brevis.*
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KEY WORDS: epicondylosis, calcific tendonitis, golf

Objectif : *exprimer en détail la progression d'une jeune golfeuse de calibre amateur qui a développé une douleur chronique au bras gauche en jouant au golf 8 mois avant son premier traitement.*

Caractéristiques cliniques : *douleur légèrement distale à l'épicondyle latérale du coude, prise plus faible et test orthopédique positif. L'ultrason diagnostic a démontré l'épaississement du tendon extenseur commun, ce qui indique une épicondylose latérale. Les radiographies ont révélé une densité calcifiée de forme ovale dans les parties molles adjacentes à l'épicondyle humérale latérale, ce qui indique une tendinite du tendon extenseur commun.*

Intervention et résultat : *les soins conventionnels visaient à diminuer la charge répétitive sur le tendon extenseur commun, particulièrement le muscle court extenseur radial du carpe. Les techniques des parties molles, les exercices et les étirements, ainsi qu'un support de coude ont contribué à réduire la tension répétitive. Les niveaux de douleur subjectifs ont été établis, et une imagerie a eu lieu 10 semaines après le début du traitement.*

Conclusion : *une jeune golfeuse de calibre amateur souffrant d'une douleur chronique au bras a reçu un diagnostic d'épicondylose latérale et de tendinite calcifiante et fut guérie de sa douleur après 7 traitements répartis sur une période de 10 semaines de thérapie physique et des parties molles axée sur la guérison optimale et la réduction de la charge répétitive sur le muscle court extenseur radial du carpe.*
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MOTS CLÉS : epicondylose, tendinite calcifiante, golf

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Introduction

The sport of golf has grown in popularity over recent years, especially in North America. In any sport, with an increase in popularity comes an increase in injury incidences. Golfers commonly report injuries to the lower back, lower extremity, and upper extremity. The most common upper limb area to be injured in amateur golfers is the elbow.[1] The term "golfer's elbow" has traditionally been used as a common expression to describe medial epicondylosis. A much more widespread elbow problem in golfers is in fact lateral epicondylosis (LE). Among amateur golfers, lateral elbow pain was found to be 5 times more common than medial elbow pain.[2] In golfers, LE results from repetitive forearm extension and excessive gripping of the club during the swing. Additional identified risk factors that can contribute to elbow injuries in golfers include poor swing mechanics, poor conditioning, inadequate warm-up, inappropriate equipment, overuse, age, and preexisting pathological conditions.[1,2]

The diagnosis of LE was first recorded in the literature by Runge in 1873.[3] It is the most common cause of lateral elbow pain affecting approximately 1–3% of adults each year, and is more commonly seen in the dominant arm.[4,6,7] Men and women are affected with an equal prevalence, typically in their 4th to 5th decade of life.[5–7] Though special imaging is rarely ordered for cases of LE, the most common radiographic finding is calcification along the lateral epicondyle within the common extensor tendon.[8]

Calcified tendinopathy or calcific tendonitis (CT) is a chronic condition where deposits of calcium phosphate crystals accumulate in the midsubstance of the tendon fibers.[9–11] Epidemiological studies report that the prevalence of CT is highly variable (3–22% in the general population) depending on the location within the body.[10,11] CT has been shown to worsen tendinopathy conditions causing increased rupture rates, slower recovery times, and high frequencies of complication after surgery.[9,14] Women are affected slightly more often than men, with patients typically between 30 and 60 years of age.[12,15]

This case report will describe an amateur female golfer who experienced lateral arm pain while playing golf and during her activities of daily living. Imaging revealed an oval shaped calcific density in the soft tissue adjacent to the lateral epicondyle of the humerus. The patient underwent a simple non-invasive conservative treatment plan using soft tissue techniques, an elbow brace, as well as stretching and strengthening exercises.

Case Report

In this case, a 27-year old female amateur golfer developed left arm pain while playing. The pain first occurred for a short duration 8 months prior to the patient's initial visit. She also recalls starting a new job one month later, where typing on a laptop re-aggravated her symptoms. Hitting golf balls at the driving range was described to be extremely painful at that time. The patient reported trouble picking up heavy objects with her left hand. The symptoms then subsided for a period of 6 months, until an acute exacerbation 1 week prior to her initial visit. At that time the patient found it difficult to move her elbow and experienced shooting pains down her forearm. Rest, ice, an elbow brace, and medication (ibuprofen taken 4 times a day) were self administered by the patient but failed to improve her condition. She rated her pain as 4/10 on a Visual Analog Scale (VAS). The patient reported no previous history of trauma or injury and a systems review was unremarkable.

On physical examination, postural observation revealed mild anterior head carriage, and slight anterior rolling of the left shoulder. No swelling or discoloration was noted. Palpation reproduced pain and tenderness over the left lateral epicondyle, wrist extensor muscles, and radiocapitellar joint. The left extensor carpi radialis brevis was particularly tight, as was the sternocleidomastoid, levator scapulae, and scalenes. The chief complaint was reproduced with resisted wrist extension and passive wrist supination. Resisted wrist supination and finger extension were both pain free. Orthopedic testing found Cozen's test and Varus stress test to be positive for left elbow pain (Table 2). A cervical spine screen was negative and an upper limb neurological exam was within normal limits. Grip strength was found to be weaker on the left when compared to the right.

The patient was diagnosed with left lateral epicondylosis. Due to the acute nature of the patient's pain and the extreme difficulty moving her elbow, she was referred for ultrasound and radiographic imaging to rule out more sinister differentials (osteochondritis dissecans of the capitellum or radiocapitellar arthritis). Diagnostic ultrasound showed thickening of the origin of the common extensor tendon from the lateral humeral epicondyle,

indicating LE. Radiographs revealed an oval shaped calcified density in the soft tissue adjacent to the lateral humeral epicondyle, indicating CT of the common extensor tendon origin (Figure 1).

Treatment

The patient was treated with 7 sessions over 10 weeks. Passive treatment consisted of NSAIDs (Naprosyn taken as required) and ice to help decrease inflammation. A fitted tennis elbow brace was prescribed to help reduce the repetitive load on the common extensor origin. Soft tissue techniques in the form of forearm interosseous release and light massage of the extensor muscles, specifically to the extensor carpi radialis brevis (ECRB) muscle, were performed during each session for 3 to 5 minutes. The wrist extensors and flexors were stretched. Isometric bicep curls and triceps extensions were prescribed. Postural strengthening exercises included scapular setting, chin retraction, and wall angels. Wall-clocks were given as a shoulder girdle proprioceptive exercise. Additionally, active care consisted of the patient being given plasticine crunches to increase grip strength. See Table 1 for a complete list of exercise progression.

After 10 weeks the patient had fully recovered. She was able to return to playing golf pain free. Follow up imaging studies showed that the common extensor tendon thickening and calcification had resolved. This patient was not considered a surgical candidate, as a trial course of conservative care was successful in allowing her to return to sport pain free.

Discussion

Calcific tendonitis

The pathogenesis of CT is still not fully understood. Suggestions as to the origin of calcification include vascular or mechanical trauma, hypoxia, extracellular matrix vesicle organelles, metaplasia of tendon cells, and metabolic endocrine disorders.[12,13] In CT, calcium phosphate (hydroxyapatite) deposits within the tendon cause inflammation and painful symptoms. These deposits may trigger an inflammatory reaction through the up regulation of inflammatory mediators. The potential for crystals to elicit an inflammatory reaction is reported to depend on their morphology. Surface area, size, density, and calcium phosphate ratio of the crystal all display positive correlations with clinical symptoms.[16] Asymptomatic patients tend to have calcific deposits that appear granular with sharply defined and well-circumscribed borders. Alternatively, acutely painful patients have enlarged deposits

Figure 1 *Imaging results for the patients left elbow. A) Diagnostic ultrasound showing thickening of the origin of the common extensor tendon, indicating lateral epicondylosis. B) Anterior to posterior radiograph showing an oval shaped calcified density in the soft tissue adjacent to the lateral humeral epicondyle, indicating calcific tendinosis.*

Table 1 *Exercises and stretches prescribed to improve strength, flexibility and grip endurance of the forearm musculature.*

Exercise or Stretch	Repetitions	Sets	Time for hold and/ or contraction (Sec)
Wrist extensor stretch	3	1	30
Wrist flexor stretch	3	1	30
Scapular setting	10	3	5
Chin retraction	10	3	
Wall angels	5	3	
Wall clocks	5	1	30
Plasticine crunches	10	3	
Isometric bicep curls	10	3	5
Isometric tricep extension	10	3	5

with liquefied, poorly circumscribed borders.[17] The condition itself has 4 well-defined phases. The first, formative phase, initiates from one of the causes listed above. During this phase the tendon undergoes fibrocartilaginous transformation. Then the calcific phase occurs, in which the calcific deposit enlarges producing pain and mechanical symptoms. Next, the resorptive phase involves macrophages and multinuclear giant cells absorbing the deposit and is often very painful. Finally, the reparative phase consists of fibroblasts restoring the collagen pattern back to normal tendon tissue.[12,15]

As mentioned in the introduction, there is strong evidence that suggests CT worsens the clinical manifestations of tendinopathy. Tendon biology can also be influenced by age, gender, previous injury, and hormonal variations (especially thyroxine). Furthermore, endocrine and connective tissue conditions may be implicated in the development of CT. With this in mind, the presence of an endocrine co-morbidity could alter the natural history of CT and lead to a chronic symptomatic state.[10] For example, it is known that hypothyroidism causes a build up of glycosaminoglycans in the extracellular matrix of tendons, which could predispose the tendons to develop calcific deposits. Tendinitis is often found as a presenting complaint in patients with hypothyroidism, and symptom resolution is frequently obtained with treatment of the underlying deficiency.[10]

Lateral Epicondylosis

The lateral epicondyle has a pyramidal morphology, with each of the three sides (anterior, posterior, and inferior) serving as a specific attachment site. The anterior surface contains attachments for the ECRB and extensor digitorum communis muscles, which are in fact part of the common extensor tendon origin. Posteriorly the anconeus muscle originates, while the apex and inferior surface are attachments for the lateral collateral ligament.[4] Important anatomical consideration must also be given to the radial nerve (Figure 2). The posterior interosseous nerve (PIN) branch is commonly entrapped in the supinator muscle at the radial tunnel, causing symptomotology similar to LE. Thus PIN entrapment is an important differential that should be considered in longstanding cases of LE.[4]

Epicondylitis is a term that implies the presence of inflammation, however, it is only the very early stages of LE that demonstrate this histological trait. Investigations have shown the disease process to be a degenerative tendinopathy, thus tendinosis or lateral epicondylosis is cited as the preferred terminology.[3,6] However, biochemical analysis has shown increased levels of the neurotransmitter glutamate and substance P receptors within the common extensor origin of patients with LE. These findings suggest a mechanism for neurogenic pain generation and provide a potential explanation for pain relief from steroid injection into a condition that is largely absent of inflammation.[4]

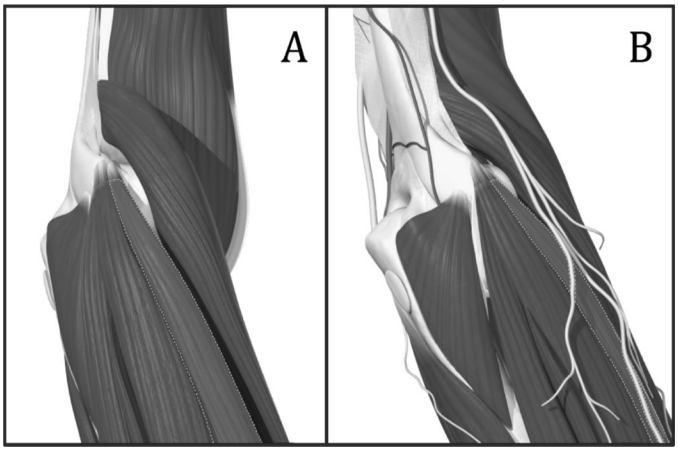

Figure 2 *The most common mechanism for lateral epicondylosis is caused by repetitive eccentric contraction of the extensor carpiradialisbrevis (ECRB) muscle. This causes microtears within the common extensor tendon origin. A) ECRB muscle at proximal lateral epicondyle attachment. B) ECRB muscle with overlying posterior interosseous nerve.*
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Biomechanical assessment shows that LE is primarily caused by excessive ECRB eccentric contraction causing a microtraumatic tear in the common extensor tendon origin (Figure 2).[3] Extensor carpi radialis longus attaches to the lateral supracondylar ridge of the humerus, not the lateral epicondyle, and thus is not involved in LE. Other hypothesized causes of LE include direct trauma, hypovascularity of the region, and anatomical predisposition.[3,6,7] Identified risk factors associated with LE include a history of heavy tool use, and significant forearm strain while performing repetitive tasks.[4]

During the clinical encounter, patients with LE will present with pain localized to the lateral aspect of the elbow that radiates down the forearm with certain movements or carrying items in their hand.[3,6] Symptoms are usually exacerbated by resisted wrist extension or passive wrist flexion. There will often be more pain in the morning or after the elbow has been held in a flexed position for a prolonged period of time.[4,7]

The physical exam should start with screens of the cervical spine and shoulder to rule out any radicular or referred pain from these structures.[3] As was reported with the amateur golfer, palpation will typically discover a point of maximal tenderness just distal and anterior to the lateral epicondyle over the origin of the ECRB muscle.[4] Several orthopedic tests are regularly positive with this condition; these include Cozen's test, Mill's test, Thomson test, Bowden test, and the Chair test (Table 2).[6,7] Grip strength should be tested and compared with the opposite hand to determine if there is a significant difference.[3,6,7] Two important differentials to rule out during the physical exam are PIN entrapment and posterolateral rotatory instability. Approximately 5% of LE patients simultaneously have PIN entrapment. This condition is indicated by pain on resisted supination with the elbow flexed (entrapment in the supinator muscle) or pain with resisted long finger extension (Maudsley's test) when the elbow is extended (entrapment in the ECRB muscle).[3,6] Abnormal sensation to the web of the thumb also suggests injury to the PIN.[2] Posterolateral rotatory instability is caused by injury and laxity in the lateral collateral ligament of the elbow. It is important to evaluate the integrity of this structure with a Varus stress test. This condition should be considered if patients have undergone treatment for LE and continue to have persistent symptoms.[6]

The differential diagnosis list for LE also includes synovial plica, cervical radiculopathy, osteochondritis dissecans of the capitellum, and radiocapitellar arthrosis,[3,4,6] several of which require special imaging in order to rule out. In fact, imaging studies are often more helpful in ruling out a differential cause of elbow pain than in making a diagnosis of LE.[3] Radiological examination of LE patients is usually normal.[5] Occasionally intra-articular pathology or calcifications within the surrounding soft tissue structures are observed.[4] As was demonstrated in the case report, calcifications have been associated with persistent LE and are reported to be present in approximately 7–25% of patients.[3,4,6,8] Ultrasound examination of LE patients can identify thickening of the common extensor tendon, intrasubstance tendon tears, focal hypoechoic regions within the tendon, adjacent bony irregularity, and calcifications.[4,6,7,12] Magnetic resonance imaging is generally not indicated for LE patients. Its main usefulness is in the exclusion of osteochondral defects, identifying non-displaced physeal fractures, quantifying the extent of tendon tearing, and preoperative planning.[3,4,6]

The success rate for conservative treatment of LE patients is around 90%.[2,3] It can include several interven-

Table 2 *Orthopedic tests regularly used to aid in the diagnosis of lateral epicondylosis.*[6,7]

Cozen's test	Patient resists the examiner while in a position of 90 degrees of elbow flexion and full wrist extension.
Mill's test	Examiner passively takes the patient into maximal elbow extension and wrist flexion.
Thomson test	Patient resists the examiner while in a position of 60 degrees of shoulder flexion, maximal elbow extension, forearm pronation, and 30 degrees of wrist extension.
Bowden test	Patient squeezes a blood pressure cuff and attempts to maintain a specific degree of pressure.
Chair test	Patient attempts to lift a moderately lightweight chair by gripping it from the chair back with both elbows extended and forearms pronated.

tions used either alone or in combination. Ice should be applied several times throughout the day during the acute phase of LE. Once the subacute phase begins, heat can be applied to help promote increased blood flow to the area and reduce muscle spasm.[2] Ultrasound therapy can also be useful to influence blood flow and tissue extensibility while decreasing pain.[2] Medications suggested for pain control include acetaminophen as well as oral or topical NSAIDs.[4] Acupuncture was also shown to display a trend of shortening pain symptoms in LE patients.[6,18] Low-level laser therapy at 904 nm wavelength has demonstrated positive results for tendon pathology through stimulation of fibroblast activity.[6] Additionally, counterforce wrist extension braces have been shown to be helpful. The brace is believed to decrease the repetitive load on the elbow by preventing the forearm muscles from fully contracting, leading to decreased tension within the common extensor origin.[2,4,6] It is important to note that braces placed just distal to the lateral epicondyle reduce loads greater than braces placed directly over the lateral epicondyle.[3,18] Shock wave therapy has produced contradicting evidence in terms of its efficacy for treating LE. Some investigators have found patients improved, while others have reported a lack of effectiveness.[3,19] Osteopathic and chiropractic manipulation of the elbow has been effective in certain cases of LE. The goal of manipulation is to release adhesions within joint articulations, promote realignment, and normalize function.[2,18] Injections of various substances have also been used to decrease pain and promote healing in numerous tendonopathies including LE. See Table 3 for a complete list of substances used for injection and proposed mechanisms of action.[3,4,6] Regarding physical therapy, exercises are generally aimed at strengthening the wrist extensors and flexors, but supinator, pronator, and grip strength exercises should also be included in an effort to prevent re-injury. Stretching exercises and eccentric training for the forearm extensor and flexor muscles can also aid in recovery.[3,4] Theoretically, eccentric training induces hypertrophy in the musculotendinous junction, increasing tensile strength to the area and reducing the amount of strain on the tendon. Eccentric contractions may also stimulate tendon cells to produce collagen and decrease neovascularization that contributes to pain.[4] There has been some research done on injury prevention programs for golfers. These tend to focus more on developing muscular endurance and motor control of the lower back and shoulder areas.[20]

There are several poor prognostic factors to successful conservative treatment of LE patients. These include dominant arm involvement, high baseline pain levels of long duration, poor coping mechanisms, and manual labor occupation.[4] A wide variety of surgical treatment options exist for LE patients. Both open and arthroscopic techniques have high success rates of 84–97%. However, only 4–11% of LE patients who seek medical care will require surgery.[3,4] Operative management is indicated for patients with: 1) Persistent pain. 2) Functional disability. 3) After 6 to 12 months of failed conservative therapy.[3,4,6] Complications that may arise from elbow surgery include peripheral nerve injury, heterotropic ossification of soft

Table 3 *Substances commonly used for injection of tendonopathies and the proposed mechanisms by which they mediate their actions.*[3,4,6]

Anesthetic and Corticosteroids	Act directly at the site of injection to reduce local pain and inflammation.
Botulinum Toxin A	Causes a paralytic effect in muscles by irreversibly inhibiting acetylcholine release at the neuromuscular junction.
Platelet Rich Plasma (PRP)	Releases massive quantities of advantageous cytokines, such as growth factors, known to be important to tendon healing.
Whole Blood	Pain relief is hypothesized to be secondary to growth factors acting as humoral mediators and inducing a healing cascade.
Prolotherapy	The practice of injecting an irritating substance into a tendon or ligament to promote the growth of new tissue.

tissues, and posterolateral rotatory instability from overly aggressive debridement.[4]

Summary

Injuries in amateur golfers have been widely reported.[1,2] Some of the more common injuries to be discussed in the literature include the lower back, wrist, elbow, and stress fractures.[1,21,22] The cause of injury to LE patients is believed to be multi-factorial and include repetitive microtrauma to the ECRB of the common extensor tendon as well as significant forearm strain during repetitive tasks, such as swinging a golf club. Conservative treatment is aimed at physical therapy featuring stretching and strengthening exercises along with several other possible co-interventions. In this case, a young female amateur golfer with elbow pain diagnosed as LE and CT was relieved of her pain after 7 treatments over 10 weeks.

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