Tennis elbow: A clinical review article

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ABSTRACT

Lateral epicondylitis, or tennis elbow is a common condition that presents with pain and tenderness around the common extensor origin of the elbow.

Tennis elbow is estimated to affect 1–3% of the adult population each year and is more common in the dominant arm. It is generally regarded as an overuse injury involving repeated wrist extension against resistance, although it can occur as an acute injury (trauma to the lateral elbow). Up to 50% of all tennis players develop symptoms due to various factors including poor swing technique the use of heavy racquet. It's also seen in labourers who utilise heavy tools or engage in repetitive gripping or lifting task.

In this article, we discuss the existing literature in the field and the current thinking on optimum treatment modalities. We have reviewed the literature available on med line and have discussed the condition with our specialist colleagues in the field.

1. Introduction

Tennis Elbow was first described by Runge¹ in 1873 and eventually given the label 'Lawn Tennis Arm' by Henry Morris, writing in the Lancet in 1882.² It has, however, acquired a number of other names including tendonosis, lateral epicondylitis and angiofibroblastic hyperplasia. As the most popular term suggests, it tends to occur in regular tennis players where there is a clear association with the late back hand and forced wrist extension.

Patients complain of an area of pain and tenderness over the bony prominence of the lateral epicondyle. This structure is also the common origin of the long extensor tendons for the forearm and hand and the underlying pathology appears to be an area of degenerative change within these tendons. There is a wide spectrum of severity ranging from slight tenderness to severe, continuous pain. Pain is characteristically exacerbated by resisted extension of the middle finger and also by extension of the wrist.

Lateral epicondylitis (tennis elbow) is 7 times more common than its medial equivalent (golfers elbow). Like most musculoskeletal conditions, it has a natural tendency to fade with time although, in a proportion of patients, it will deteriorate.

In 1974, Alanger³ estimated the prevalence in Sweden to be between 1 and 3%. The peak age interval is 40–50 years and in this group, the prevalence rises to 19%. Later in the United States, Dimberg described the condition in 7.4% of industrial workers and 40–50% of

regular tennis players.⁴ There was no correlation with gender in this series although there was a clear cut association with those who's occupation involved repetitive forearm and hand movement. It should be remembered that the most "at risk group" for tennis elbow are also likely to suffer from concomitant elbow pathology. There is, for example an ill defined overlap with radial tunnel syndrome.

Amongst the extensor tendons taking origin in the region of the lateral epicondyle, the extensor carpi radialis brevis has often been implicated as the key structure in tennis elbow. Its unusual anatomy exposes it to shearing forces in almost all movements of the arm. Biomechanical studies by Briggs⁵ support the view that tennis elbow is primarily a mechanically induced condition.

However, recent anecdotal reports suggest a possible association with the use of fluoroquinolone antibiotics. This phenomenon has been previously reported in the Achilles tendon although it should be remembered that these are infrequently used drugs and the risk is quite obviously very low.⁶

2. Histology

Terms such as tendonitis and epicondylitis suggest an inflammatory process and in that sense, these are both misnomers. The histological picture here is dominated by dense populations of fibroblasts, vascular hyperplasia and disorganised collagen. This has been termed angiofibroblastic hyperplasia and is believed to occur in tendon that has

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damaged by repetitive micro trauma.

Given the absence of inflammatory changes in tennis elbow, it is not entirely clear why the condition should be painful although for some patients it is exquisitely painful. Tendons involved in locomotion and ballistic performance which transmit loads under elastic and eccentric conditions are regarded as being susceptible to injury of this kind. Those with poor blood supply and those that straddle two joints are also more sensitive to damage. Muscles within the forearm fit into this bracket.

3. Investigations

The diagnosis of tennis elbow is usually made on physical signs. About 2/3 of patients will demonstrate an altered signal around the lateral epicondyle on MRI scanning⁷ and this phenomenon may continue long after the symptoms have resolved.⁸

Infra red thermography has been used to demonstrate a hot focus around the lateral epicondyle in 94–100% of tennis elbow patients.⁹ Isotope bone scan is also positive in 71% of cases although in practise, both of these would be considered exotic investigations.

Laser Doppler flowmetry has been used to investigate the blood supply in this region. There is some evidence that intramuscular blood flow is reduced around the origin of extensor carpi radialis brevis (ECRB) muscle.¹⁰ It has been suggested that reduced blood flow and anaerobic metabolism within the ECRB muscle may have a causative role in the pain of lateral epicondylitis.

4. Differentials for epicondylitis

These include radial tunnel syndrome, tenosynovitis or chronic wrist pain. It can be difficult to differentiate between these conditions. There is ambiguity in the literature as to where Posterior Interosseous Nerve (PIN) compression begins and tennis elbow ends.

5. Radial tunnel syndrome

Radial tunnel syndrome is the main differential for pain in the region of the lateral epicondyle. Patients with repetitive manual tasks seem to be at risk of both tennis elbow and radial tunnel compression with the junction between the two conditions being difficult to define. The Posterior Interosseous Nerve (PIN) is believed to be crushed under the free edge of the supinator muscle. However, other adjacent structures (including ECRB) may play a role.

The condition is associated with pain on resisted supination and resisted extension of the middle finger.

PIN decompression has been shown to be effective in relieving pain in this region.¹¹

Indeed, Jalovaara has suggested that around 30% of cases of tennis elbow are in fact suffering from PIN entrapment¹² (i.e. radial tunnel syndrome) although this figure is difficult to measure with any accuracy. Some authors openly acknowledge that it is impossible to distinguish clinically between the two conditions.

From an anatomical point of view, the inseparable origin of the radial wrist extensors and supinator muscle seems to link tennis elbow and radial tunnel syndrome.¹³

The well known surgical technique of Wilhelm denervates and releases PIN at the same time.¹⁴ Similarly, most tennis elbow procedures will relax the ECRB tendon and indirectly, decompress the radial nerve, raising the possibility that at least some patients who appear to respond to surgery for tennis elbow are in fact recovering from radial tunnel syndrome.^{15,16}

Again, however, the evidence on this is mixed with De Smet casting doubt on the importance of PIN compression.¹⁷

Pfandl et al. has suggested that PIN release should be performed in those tennis elbow patients that have proved resistant to other therapies.^{18,19}

6. Treatment

Over 40 treatments have been described for tennis elbow and so many of are used routinely that there is clearly no single optimum treatment. Well established treatments for tennis elbow are often justified by level five evidence (i.e. expert opinion).

In 1993, Labelle et al. attempted to write a quantitative meta analysis paper of previous publications on tennis elbow but found themselves forced to publish a qualitative review instead.²⁰ The authors observed that only a minority (18) of the 185 papers reviewed satisfied their inclusion criteria. The problems then, as now, are multiple. There is no consensus on the definition of the disease with the distinction between acute and chronic epicondylitis being poorly defined. Similarly, objective outcome variables are difficult to find. Some, but not all authors use Visual Analogue Scales to assess changes in pain. Grip strength is compromised in tennis elbow and this parameter is commonly measured in the upper limb clinic as a matter of routine. Pain inhibition characteristically reduces the power of middle finger extension in tennis elbow and measurements of this force are relatively easy to make, with changes in middle finger extension power being a common though far from universal outcome variable in this field. Since there are no standard outcome variables, meta-analysis of existing papers is almost impossible.

To date, there are no universally accepted regime of treatment. However, some general principles of treatment should be taken into consideration. Initially pain and inflammation need to be settled with pharmacological (analgesics, NSAIDS) and physical modalities: ice, rest, electrotherapies such as ultrasound, laser and high frequency galvanic stimulation, massage and trigger point injections.

6.1. Local steroid injections

The injection of corticosteroid preparation with local anaesthetic is the main stay of treatment for this condition. The physician feels for the point of maximum tenderness and then injects the cocktail using aseptic technique. Given the absence of inflammatory changes on microscopy, it is perhaps surprising how many patients respond to this type of treatment.

Hay et al. et al. have looked at the use of local steroid injection and compared it to oral nonsteroidal in new patients in a primary care setting.²¹ Hay's study is interesting in that as a group, primary care patients with tennis elbow may be very different from the cohort that is eventually referred to the hospital specialist. In this study, local corticosteroid injection was found to be an effective safe treatment with clear clinical advantage at four weeks when compared to naproxen. However as with the treatment of many musculoskeletal complaints, the correlation between initial response and longer term follow up was poor.

7. NSAIDS

It is traditional to offer oral NSAIDS for tennis elbow.²²

In 2007 Green reviewed the use of NSAIDS in tennis elbow for the Cochrane review. He found some evidence that topical NSAIDS relieve elbow pain at least in the short term. Evidence regarding oral NSAIDS is more ambiguous and may be less effective than a local steroid injection. In spite of this, it is common for patients in our own practise to claim that oral NSAIDS are of benefit.

7.1. Exercise/physiotherapy

Various exercise regimes have been proposed for the treatment for tennis elbow. Martinez-Silvestini et al. were unable to differentiate between the outcome of stretching exercises alone versus stretching and eccentric or concentric strengthening.²³

Croisier et al. has described the results of an iso-kinetic eccentric

programme of exercises in comparison to a non strengthening exercise programme and concluded that iso-kinetic exercises were more effective.²⁴

7.2. Autologous Blood Injection (ABI)

In 2011 Creaney, reported a prospective randomised trial on the use of growth factor to enhance healing in musculoskeletal injuries, particularly in sports medicine.²⁵ Autologous blood injections are thought to work by stimulating an inflammatory response which will bring in the necessary nutrients to promote healing. However, no benefit in the long-term follow-up has been found and its use is only recommended for those recalcitrant cases, where other modalities of treatment have failed.

7.3. Orthotics

The lateral epicondylar brace or elbow clamp is a popular treatment for tennis elbow. In 2004, a Dutch group compared the effectiveness of such a brace to physiotherapy using a combination of the two in a third group.²⁶ Their results were ambiguous. A brace alone may be useful as an initial therapy. In this study, combination therapy was found to be more effective than bracing alone but only for a short time.

7.4. Platelet Rich Plasma injections (PRP)

Platelet rich plasma (PRP) is blood plasma with concentrated platelets. The concentrated platelets found in PRP contain growth factors that are vital to initiate and accelerate tissue repair and regeneration. These bioactive proteins initiate connective tissue healing and repair, promote development of new blood vessels, and stimulate the healing process.

The technique requires patient-blood extraction, centrifugation and re-injection of the plasma into the lateral epicondyle. Good outcomes have been reported.²⁷ However, studies by Thanasis in 2011 showed no differences between PRP and whole blood injections.²⁸ Moreover, significant differences among available commercial systems and variations in the technique make it difficult to draw clear conclusions about the use of PRP.

Current research on PRP and lateral epicondylitis is promising and more research is necessary to fully prove PRP's effectiveness.

7.5. Wrist extension splints

The functional position of the hand is one of slight extension and pronation, and since active muscle tone is required to achieve this, any kind of activity using the hand may be painful in lateral epicondylitis. For this reason, some workers have attempted to use wrist extension splints to hold the wrist in extension, thus obviating the need for any sort of background muscle tone. Certainly, the use of extension braces has been shown to reduce muscle tone on EMG study.²⁹

Altan et al. found marginally better relief of pain in the wrist extensor in comparison to the use of an elbow brace but concluded that for many people, wrist extensors are difficult to wear.³⁰

Luginbuhl et al. working in Switzerland found no effect in patients treated with extensor strengthening exercises and forearm banding and concluded that patients tend to improve with time irrespective of the treatment used.³¹

8. Ice

The local application of ice has been a traditional household remedy for musculoskeletal aches and pains. The evidence on this is limited but in a controlled clinical trial, Manias et al. was unable to demonstrate any advantage to the use of ice with exercises over exercise alone.³²

8.1. Extracorporeal Shock Wave Treatment (ECSWT)

In a prospective randomised, placebo controlled trial, Petrone et al. have shown that Extracorporeal Shock Wave Therapy is a safe and effective treatment for lateral epicondylitis.³³ Similarly, Radwan et al. have shown that ECSWT is at least as effective as percutaneous tenotomy.³⁴ However, as with the other therapies for this condition, other authors have struggled to reproduce these results. Haake et al. reported that ECSWT was ineffective in tennis elbow, concluding that previous studies appeared to have detected a positive effect due to poor design.³⁵

8.2. Botox

Botulinum toxin may induce a period of temporary paralysis that gives time for the soft tissue pathology to recover. Patients treated with botox appear to have some resolution of the reduced muscular blood supply reported in epicondylitis.³⁶

Again, there is no consensus in the literature as to whether this technique gives any real benefit. Wong et al. concluded that there may be some improvement in elbow pain using botox but that many patients experience a period of digital paralysis with weakness in extension.³⁷

Placzek et al. also described finger weakness following botox injections although his work did conclude that botox was an effective treatment for this condition.³⁸

In contrast, Hayton et al. failed to find a significant difference between treatment and control groups using botox although in this case, the study size was limited.³⁹

8.3. Lasers

Sterigioulas has reported good results using lasers as a treatment for tennis elbow.⁴⁰ Studies of this kind generally use a similar coloured light source as a sham treatment for the placebo group. In a comparative study in Turkey, Oken et al. found that laser therapy offered no long-term advantages over a brace or Ultrasound treatment for tennis elbow.⁴¹

8.4. Acupuncture

Acupuncture has been used in the treatment of many musculoskeletal complaints and tennis elbow is no exception. Trinh et al. has reviewed the literature in this field and concluded that acupuncture is effective in the short-term relief of the condition.⁴²

8.5. Surgery

Majority of patients with lateral epicondylitis (tennis elbow) respond to conservative measures and do not require surgical intervention. However, if symptoms were unresponsive after a prolonged period of conservative therapy. They should be reevaluated for surgical interventions. Numerous surgical procedures have been described for the treatment of lateral epicondylitis. Most involve debridement of the diseased tissue of the ECRB with decortication of the lateral epicondyle. This procedure has can performed through open, percutaneous, and arthroscopic approaches. In addition to debridement, rotation of the anconeus muscle flap has been reported to improve outcomes.

8.6. Open surgical technique

In a seminal article published in 1979, Nirschl described a technique that included the excision of an identifiable lesion in the origin of extensor carpi radialis brevis.⁴³ The authors reported a 97.7% improvement in a series of 88 elbows.

In 2008, Dunn et al. reported 97% improved results from a series of 139 elbows using the Nirschl technique.⁴⁴

Again, Verhaar et al. reported success with lateral extensor release

in 1993, suggesting that this was the procedure against which other treatments should be compared.⁴⁵

Wilhelm and other authors have suggested that denervation of the tender area is effective in removing pain.⁴⁶ It is not inconceivable that several of the surgical procedures described for tennis elbow are in fact denervating the local soft tissues and or indirectly decompressing the PIN.

8.7. Percutaneous release

The percutaneous release of the common extensor origin was first reported by Loose at a meeting in 1962. This procedure involves the release of extensor carpi radialis brevis, using local anaesthesia at the point of origin at the epicondyle.

Nazar M et al. reported good results with this technique despite being relatively simple procedure, which can be done as a day case and its effectiveness in relieving pain with minimal scarring.⁴⁷ This procedure remains controversial.

8.8. Arthroscopic treatment

Arthroscopic surgery has been attempted on tennis elbow with mixed results. Baker described improvement in a series of 30 patients in which the pathological tissue was debrided using a key hole technique.^{48,49} Jerosch et al. reported good results for this technique in Germany.⁵⁰ Owens reported similar success, with concurrent pathology in 3 out of 16 elbows.⁵¹ The authors noted that arthroscopy provides the option of addressing these other pathologies at the same time although such an approach requires specialist instruments and skills.

8.9. Surgical lengthening of the ECRB tendon

Lappihalti et al. have attempted to treat tennis elbow by lengthening of the ECRB tendon at the level of the wrist.⁵² About half of patients recovered although this study also noted a similar response to decompression of the PIN.

9. Conclusions on treatment

When we try to interpret research papers on this condition, it is important to remember just how different the various cohorts are. For example, few surgeons would choose surgery as their first line treatment and most patients entering a study using surgical treatment have already failed to respond to more mundane treatments such as time, steroid injection and physiotherapy.

The partial relief of chronic mild to moderate pain is a notoriously difficult field to work in and the apparent confusion in the literature is to be expected. Inconsistencies in study design make precise comparison between different research papers almost impossible. It is clear that neither botox nor ECSWT represent definitive cures for this condition. Where available, they may provide relief in a proportion of patients that have proven themselves to be resistant to other treatment modalities.

Conflicts of interest

As a review article with no original data, the authors have no conflict of interest in writing this article. No author has received financial reward of any kind for this work.

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