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Approaches to Treating Tennis Elbow: Surgical vs. Conservative Treatment

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ABSTRACT

Introduction

Tennis Elbow, known also as Lateral Epicondylitis (LE) is a very common overuse injury affecting not only tennis players. Mainly, it causes pain, weakness in grip strength and difficulties with daily activities. Most patients are successfully treated with non-surgical methods but some of them eventually require surgical intervention.

Aim of study

The objective of this study is to evaluate both surgical and non-surgical treatment methods for Tennis Elbow and seeks to introduce doctors and patients to the assets and downsides associated with them.

State of Knowledge

Tennis Elbow occurs in 1-3% of adults, most likely when frequently performing repeated movements of flexion and extension of the elbow. At the early stages inflammation is present, after that the vascular hyperplasia and active fibroblasts occur. Most common risk factors are manual labour, ipsilateral rotator cuff tear, ipsilateral Carpal Tunnel Syndrome (CTS), female sex, dominant-side involvement, and hypertriglyceridemia.

Summary (Conclusion)

There is a wide range of available conservative treatment methods for Lateral Epicondylitis including physical therapy, various injections, and medication. They should be considered as the first line treatment showing high success rate for mild and moderate cases. Surgical methods have high success rates as well though they are considered more invasive and performed only on chronic patients. Best approach ought to be carefully selected for each patient based on severity of symptoms and patient needs.

Keywords: *Conservative Treatment, Orthopedics, Review, Elbow, Elbow Tendinopathy, Tennis Elbow, Surgery*

INTRODUCTION

Tennis elbow, known also as a Lateral Epicondylitis (LE) is a highly prevalent musculoskeletal condition. It is the most common cause of the lateral elbow pain in adults. LE is an overuse injury of the extensor carpi radialis brevis – short extensor of the wrist, which has attachment to the epicondyle of the humerus. Because inflammation is only presented during very early stages of LE, the term tendinosis is preferred over tendinitis to describe this condition. After inflammation, there is a presence of vascular hyperplasia and active fibroblasts due to the cumulative microtrauma. Most common symptoms are pain on the lateral side of the elbow that mostly radiates down the forearm, and weakness in grip strength. Lateral elbow pain can have many different reasons, so it is essential to correctly diagnose LE and choose the most appropriate treatment option. Most often it is a self-limiting process, but there are many treatment options in case Tennis Elbow becomes chronic and more painful. In most cases, LE can be successfully treated with nonsurgical methods like rest, physiotherapy, nonsteroidal anti-inflammatory medication (NSAIDs) and bracing. Various injections may be

used as well but are considered a little more invasive. When the standard, conservative treatment is insufficient and we run out of options, the patient may need surgical intervention. There are 3 possible operational methods: percutaneous release, arthroscopy and open surgery. All of them are highly effective. (Bretschneider et al., 2022; Brummel et al., 2014; Lenoir et al., 2019)

Epidemiology

Lateral epicondylitis occurs approximately from 1-3% of adults annually, mostly at the age of 35-60.

Park et al showed in their study some risk factors that are proven to be connected with lateral epicondylitis: female sex, manual labour, ipsilateral rotator cuff tear, ipsilateral CTS, dominant-side involvement and hypertriglyceridemia. People working in services requiring heavy gripping and lifting, repetitive flexion and extension of the elbow and forceful exertion of the wrist and forearm, are more likely to develop Lateral Epicondylitis. Interestingly, it affects approximately 10% to 50% of people playing tennis systematically at some point of time during their careers, but only about 10% of all patients suffering from Tennis Elbow actually play tennis. Male tennis players are more likely to develop LE than female tennis players, but, in the general population, the incidence is slightly greater among women. Also, since it is considered that the backhand swing technique is the significant concurring factor, novice players develop the Tennis Elbow more often than experienced players. They are more likely to present improper technique. (Abrams et al., 2012; Hennig et al., 1992; Park et al., 2021; Shiri & Viikari-Juntura, 2011; Shiri et al., 2006)

Characteristics

Commonly, this condition affects the dominant extremity. The ECRB origin attachment has been the most implicated as the specific site of pathology. It is described as an overuse injury mainly because of repeated strain from jobs and activities involving loaded and repeated gripping and/or wrist extension. (Buchanan & Varacallo, 2024)

Inflammation is present during very early stages of LE. After inflammation, there is an appearance of the vascular hyperplasia and active fibroblasts. That is why the term tendinosis is preferred over tendinitis. At first, it was believed that microscopic or macroscopic rips of the extensor insertion were engaged in the disease process. (Cyriax, 1936; Kraushaar & Nirschl, 1999; Lahz, 1948; Nirschl & Pettrone, 1979; Shiri & Viikari-Juntura, 2011)

Thereafter, other researchers showed that the disease course is, in fact, a degenerative tendinopathy. Granulation tissue was found at the insertion of the extensor carpi radialis brevis (ECRB) as a consequence of cumulative microtrauma resulting from repetitive wrist extension and alternating forearm supination and pronation. The first that published about macroscopic tearing in association with the histology findings were Coonrad and Hooper. Later it was determined as “angiofibroblastic hyperplasia” and then “angiofibroblastic tendinosis”. Nirschl found it was characterized by disarranged, immature collagen formation with immature fibroblastic and vascular elements. It was further acknowledged by Chen et al that enhanced rates of apoptosis and cellular autophagy have been found in tenocytes,

eventuating in disruption of extracellular collagen matrix, and weakening of the tendon. (Chen et al., 2010; Coonrad & Hooper, 1973; Goldie, 1964; Nirschl, 1988)
Also, farraginous morphology in the capitellum shape and tendon insertion among the people may concur to the fact that some individuals develop Tennis Elbow and others do not. (Bunata et al., 2007)
Typically, rapid onset of the symptoms occurs more often in young athletes and chronic, uncooperative manifestations mostly occur in older patients. Pain that patients experience occurs at the lateral side of the elbow and most often radiates down the forearm. At times, the pain is proximal to the elbow. Beside pain, patients experience weakness in grip strength that affects work-related activities, sports performance, and day-to-day life activities. The pain may be described by patients from an intermitted ache to even constant severe sharp pain. (Brummel et al., 2014)
It is important to remember that lateral elbow pain can be caused by many other conditions such as elbow bursitis, radial nerve entrapment, triceps tendinitis, occult fracture, synovial plica, osteochondritis dissecans of the capitellum, radiocapitellar arthrosis, radial tunnel syndrome, cervical radiculopathy, and posterolateral rotatory instability. (Brummel et al., 2014; Buchanan & Varacallo, 2024)

Treatment Methods

Most patients can be treated with conservative treatment. Non-surgical options are significantly less invasive than surgical treatment options, therefore are considered as first-line treatment options. It is important to keep in mind that these methods might not be sufficient for all the patients, so the surgery may be unavoidable for some of them. At all cases, patients should be counselled on prevention and biomechanical optimal movement techniques. Then, the most important step for each patient is to rest from inciting activity and improve the technique of their movement. With rest, most patients will improve within 3 to 18 months.
Physical therapy includes manipulation, friction massage, stretching and strengthening the extensor wad when the pain recedes. Typically, physiotherapy is performed in combination with NSAIDs. (Cyriax, 1936; Mills, 1928)
Bracing is established to be an efficient method of reducing the pain of Tennis Elbow. Counterforce braces worn about the elbow distribute the tension on the ECRB to the other areas and relieve the tension at the region of pathology. There are other types of braces – wrist splints, elbow straps and sleeves. Several studies have indicated that their usage is efficient in elevating symptoms in comparison to placebo braces. It is crucial to rule out radial tunnel compression syndrome before implementing elbow strap treatment because of the risk of the symptomatic nerve compression at the place of entrapment. Patients suffering from radial tunnel compression syndrome normally experience pain along the dorsoradial part of the proximal forearm. Lateral Epicondylitis may be confused with radial tunnel compression syndrome because of the proximity of the place of tenderness to the lateral epicondyle presented in the radial tunnel compression syndrome (over the posterior interosseous nerve). (Garg et al., 2010; Jafarian et al., 2009; Naam & Nemani, 2012)

Extracorporeal shock wave is performed using a generator to transmit sound waves to the influenced by LE area. Vibration is created by the sound waves that reinjures the affected tendon to restart the healing cascade. In reference to the efficiency of the treatment, the results have been diverse.

Unfortunately, there are some reported side effects, such as temporary reddening of the skin, pain in the treated area, minor haematomas, migraines, and syncope. (Buchbinder et al., 2005; Haake et al., 2002)

There are several available injection therapies that can be used in LE treatment. The most common are corticosteroid injections. They are the pillar of the LE treatment. However, many studies that had been performed on this topic show inconsistent results and the mechanism of action is somewhat vague. It was observed by Altay et al that the technique was eventually more important than the actual injection. They compared peppering an injection of only lidocaine with peppering lidocaine with triamcinolone at the affected area and observed that both were evenly useful in treating the disease at 1-year follow-up. Wolf et al showed a better short-term amendment at 4 weeks with corticosteroids than with NSAIDs. However, they believe them to be evasive at long-term follow-up. Be mindful of the chance of skin hypopigmentation and fat atrophy as the side effects of using corticosteroid injections. Also, tissue breakdown may be a severe complication, considering the bony rise of the lateral epicondyle. (Altay et al., 2002; Assendelft et al., 1996; Wolf et al., 2011)

Among other alternative injection therapies there is botulinum toxin injection into the afflicted tendon. Overall, the meta-analysis of 4 randomized control studies observed a beneficial effect from that injection, despite the lack of consensus in the results. Crucial role in the efficacy played location of the injection. Wong et al found that investigators reported noticeable enhancement when the injection was placed 1 cm from the pain source, but Hayton et al reported that researchers observed no enhancement over placebo when the injection was placed 5 cm from the pain source. (Hayton et al., 2005; Kalichman et al., 2011; Wong et al., 2005)

Also, there are many papers reporting usage of blood products like autologous blood and various concentrations of platelet-rich plasma (PRP). Majority of the relevant studies are in patients with chronic Lateral Epicondylitis. The purpose of these products is to stimulate tissue healing process due to the high concentration of platelets and growth factor-rich plasma in PRP. Peerbooms et al in their study compared the impact of peppered PRP injections with peppered steroid injections for LE. They observed that patients injected with PRP had consequentially enhanced pain and functional scores when equated with those who were injected with steroids at 1 year. Ten, they followed up both groups of patients at 2 years and observed that each group consequentially improved in Visual Analogue Scale (VAS) scored. However, the steroid group came back to baseline in average disabilities of the arm, shoulder, and hand score whereas the PRP group consequentially improved in this score. (Gosens et al., 2011; Halpern et al., 2012; Peerbooms et al., 2010)

Even though this treatment seems promising, it is not available for every individual due to its high cost. Less expensive option are autologous blood injections. Their purpose is to stimulate an inflammatory response and tissue healing process in the affected area as well. The injection contains freshly drawn autologous blood often mixed with a local anaesthetic. Studies show

that autologous blood injections compared to corticosteroid injections have better result at 4 and 8 weeks and compared to PRP injections have similar improvement of the symptoms. However, in the long-term follow-up there was no benefit in using them. They are used only for the reluctant cases when other treatment methods fail. (Creaney et al., 2011; Cutts et al., 2020; Kazemi et al., 2010)

It is also important to include several available topical agents to treat LE. They reveal themselves as a useful alternative treatment option for the patients with sensitivity or intolerance to oral NSAIDs or gastrointestinal comorbidities. Creams or gels usually contain multiple active ingredients such as diclofenac, among others. Diclofenac has anti-inflammatory and analgesic effects.

Nitric oxide has been recounted to be a significant factor in tendon healing. It is believed that nitric oxide increases extracellular matrix production, enhancing mechanical properties. Patients receiving nitroglycerin patches along with standard rehabilitation showed crucially decreased elbow pain at 2 weeks and decreased epicondylar tenderness at 6 and 12 weeks, and improved wrist extensor strength at 24 weeks, in comparison with the placebo patches. Rehabilitation with nitroglycerin patches had better results than rehabilitation alone. After 6 months, 81% of the patients treated with nitroglycerin patches were asymptomatic during everyday activities, compared with 60% of the patients who had only tendon rehabilitation. (McCallum et al., 2011; Murrell, 2007; Paoloni et al., 2003)

Majority of patients can be treated effectively by non-surgical methods, but recovery may take several months. Approximately 4% to 11% of patients eventually need surgical treatment to relieve their symptoms. Researchers point out wide range of surgical options for LE from percutaneous to open, to arthroscopic treatment. Operational methods are reserved for patients with chronic LE with continuous or recurrent symptoms and disability regardless of all other treatments. (Coonrad & Hooper, 1973; Szabo et al., 2006)

Percutaneous surgical procedure showed very good results regarding reducing pain and improving strength at less than 16 weeks. This procedure involves a single-puncture incision along the lateral epicondyle with full extrication of the ECRB. In Baumgard and Schwartz study, they claimed no complications. Nazar et al also found very good results with relevant improvement in patients' disability scores. 87% of the patients claimed complete pain relief with no further complications at a mean follow-up of 3 years. (Baumgard & Schwartz, 1982; Nazar et al., 2012)

There are many various techniques of open surgical treatment. Resection of ECRB tendinosis tissue with or without repair of the extensor tenson origin is frequently chosen method. Nirschl and Pettrone found that 85% of their patients after this procedure were able to return to full activities including sports as a short-term outcome. Then, Dunn et al described comparably hight rates of success with 10- to 14-year follow-up using the same surgical procedure. During this open surgery technique, the patient is positioned supine on the surgical table with an attached arm board. Anteromedial to the lateral epicondyle, a small, 4-cm wide incision is made. The abnormal ECRB tissue can be easily identified by its dull, grey appearance. All the pathological tissue is excised. After the surgery, a posterior splint is applied with the elbow in 90 degrees of flexion for 1 week to allow wound healing. Operation must be followed by proper physiotherapy exercises. Commonly, at 6 to 8 weeks after the

procedure, patient may return to sports as tolerated. (Dunn et al., 2008; Nirschl & Pettrone, 1979)

Thanks to arthroscopy, complete intra-articular examination is possible and coexisting pathoanatomy may be treated, like plica, chondral lesions, and loose bodies. Arthroscopic procedure can be performed in various positions, but the prone position is preferred. After a nonsterile tourniquet is placed, the elbow is flexed to 90 degrees. Next, the joint is distended with a saline injection into the direct lateral portal.

Two portals are created. The first one, a proximal anteromedial portal is used to view everything via arthroscope and the second one, proximal anterolateral portal is used as the working portal. A shaver is inserted there, into the second, working portal to debride a portion of the capsule and reveal the underlying extensor tendon. The abnormal tendinosis tissue of the ECRB is excised off its origin. To protect the lateral ligamentous structures, caution is taken not to extend the resection posterior to a line dividing the radial head. Within the first week, the patient is encouraged to start with range-of-motion physiotherapy exercises. (Baker & Baker, 2008; Baker & Shalvoy, 1991)

Szabo et al in their nonrandomized comparative study assessed various operational methods: 23 patients after percutaneous technique, 41 after arthroscopy and 38 after open procedure were evaluated with a mean 48-month follow-up. No statistically important discrepancies regarding complications, failures, recurrences, and VAS pain scores were reported among the 3 operational groups. The conclusion was that each method is equally high effective technique to treat obstructive LE. (Szabo et al., 2006)

Systematic review objective

The aim of this study is to summarize the existing clinical trials and systematic reviews regarding Tennis Elbow treatment approaches. We intend to provide a better uptake of managing this condition. Treatment options will be presented sequentially to more advanced methods, all summarized in the Tabl. 1.

Tabl. 1 Comparison of Treatment Methods

(Altay et al., 2002; Assendelft et al., 1996; Baker & Baker, 2008; Baker & Shalvoy, 1991; Baumgard & Schwartz, 1982; Brummel et al., 2014; Buchanan & Varacallo, 2024; Buchbinder et al., 2008; Buchbinder et al., 2005; Burn et al., 2018; Coonrad & Hooper, 1973; Creaney et al., 2011; Cutts et al., 2020; Cyriax, 1936; Dunn et al., 2008; Garg et al., 2010; Gosens et al., 2011; Haake et al., 2002; Halpern et al., 2012; Hayton et al., 2005; Jafarian et al., 2009; Kalichman et al., 2011; Kazemi et al., 2010; Lo & Safran, 2007; McCallum et al., 2011; Mills, 1928; Murrell, 2007; Nazar et al., 2012; Nirschl & Pettrone, 1979; Paoloni et al., 2003; Peerbooms et al., 2010; Szabo et al., 2006; Wolf et al., 2011; Wong et al., 2005; Zhou & Wang, 2020)

METHOD	INFORMATION	PROS	CONS
Patient education	Education about prevention further deterioration and overuse	Cheap, easy method. Patient knowledge and cooperation may	Must be combined with other treatment options. Patient motivation and

	and about biomechanical optimal movement.	prevent them from recurrence of symptoms after treatment.	cooperation is needed. Possible lack of knowledge of the doctor or using unclear language for patients, may result in adverse effect.
NSAIDs	Reducing pain and inflammation.	Great addition to physical therapy to allow patient to perform more exercised without pain. Quick pain relief.	Increased risk of abdominal pain and diarrhoea along with other NSAIDs side effects. Mostly short-term benefits.
Topical NSAIDs	Reducing pain and inflammation.	Good treatment option for patients with sensitivity or intolerance to oral NSAIDs. Mild side effects because of small systemic effect. Quick pain relief.	Side effects may include minor skin irritation, burns, blisters, rashes, skin thickening. Topical NSAIDs have limited penetration. Mostly short-term benefits.
Topical nitrates	Enhancing blood flow to the area and promoting healing to the tendon. Decreasing pain and tenderness	Small systemic effect. They can broaden treatment plan. Useful during physiotherapy.	They wear off quickly so repeated applications are required. There is a risk of developing tolerance to nitrates. Limited research. Side effects include dizziness and headaches.
Braces, orthosis	Distributing the tension to the other areas, so stress and tension is relieved at the region of pathology. Reducing pain, improving healing and function.	Easy to use. Enhanced support and stability during movement. Prevention from further overuse. Great in combination with physiotherapy.	Some patients feel pain over the region of the maximal tenderness secondary to direct mechanical compression on the area itself. Risk of the symptomatic nerve compression. When using alone, only beneficial short-term.
Physiotherapy	Includes friction massage, manipulation, stretching and strengthening the extensor. Reducing pain and improving mobility.	Good in long-term results, especially when combined with other treatment methods. When performed correctly, no side effects. Individual	It requires patient investment and regularity. It is important to perform physiotherapy under supervision of qualified specialist to avoid improper technique of movement.

		approach based on patient needs.	
Extracorporeal shock wave therapy	Generator transmit sound waves focused to the centre of the influenced zone. Pain relief and improving healing.	Non-invasive, require no anaesthesia. Can be helpful in combination in chronic patients.	No significant improvements using this method alone. Limited research. Side effects include temporary reddening of the skin, minor haematomas, migraines, syncope, and pain in the treated area.
Corticosteroid injections	Reducing inflammation and pain. Peppering technique of injection is the most beneficial. Often combined with anaesthetic.	Slightly more beneficial than NSAIDs and placebo in short-term. Convenient in usage and low cost.	Ineffective long-term. Side effects include ruptures of the tendon when injections are repeated, local skin and fat atrophy and skin hypopigmentation.
Botulinum toxin injections	Botulinum toxin can induce a period of temporary paralysis that gives time for the soft tissue pathology to recover. Pain relief and muscle tension reduction.	Alternative treatment for chronic patients in combination with different methods. Reducing need for painkillers.	Many patients suffer a period of digital paralysis with weakness in extension. Only short-term relief. Limited evidence for effectiveness. Expensive.
PRP injections	Contains pro-inflammatory agents designed to inflame or irritate the tendon and stimulate a healing response. Pain relief and improved function.	More function improvement compared to corticosteroid injections. Alternative treatment method for chronic patients.	Expensive. Limited research. Long time required to see results, they are not good in quick pain relief, multiple sessions are needed.
Autologous blood injections	Stimulating an inflammatory response, promoting healing. Often mixed with local anaesthetic. Pain relief.	Natural. Less expensive than PRP injections although they have similar mechanism. Alternative treatment method for chronic patients. Slightly better results than corticosteroid injections	Limited research. No benefit in the long-term follow-up. Delayed benefits like in PRP injections.

		in short-term.	
Arthroscopic surgery	Two incisions to make portals: one 5 cm above the lateral epicondyle in the dorsolateral aspect of the arm and second 3-4 cm distal to the lateral epicondyle.	Small incision. Intra-articular visualisation allows identification of any other potential intra-articular pathology. Earlier return to work than after open surgery. Less complication rate than open and percutaneous techniques.	Requires more skills from the surgeon. Most studies compare only open surgery with percutaneous surgery, so more research is needed to properly compare this method to the others.
Percutaneous surgery	Single-puncture 1 cm incision over the midpoint of the lateral epicondyle or just distal to the lateral epicondyle. Full extrication of the ECRB without repair.	Smallest incision. Earlier return to work and better function than after open surgery.	Does not allow for joint inspection.
Open surgery	3- to 7 cm incision over the common extensor origin. Damaged portion of the tendon is removed with or without repair.	The eldest, most known method – a lot of available research. Intra-articular visualisation allows identification of other potential intra-articular pathology.	Longer surgery than percutaneous or arthroscopic. Longer rehabilitation. The biggest incision.
All surgical methods	Arthroscopic, percutaneous, and open surgery.	All of them have good results regarding reducing pain and improving strength. No significant differences between these surgical techniques in terms of functional outcome (DASH – Disabilities of Arm, Shoulder, and Hand), pain intensity (VAS score) and patient satisfaction at 1-year	Complications after each surgery may include: - Failing to address concurrent pathology - Iatrogenic lateral ulnar collateral ligament (LUCL) injury - Iatrogenic neurovascular injury - Infection - Heterotopic ossification - Stiffness or loss of motion

		follow-up. Equivalent success rate.	- Bleeding or haematoma

CONCLUSION

Tennis Elbow is a common condition. It is causing pain and issues with everyday activities. Therefore, it is crucial to know how to treat this condition properly. Conservative treatment approaches are considered less invasive and demonstrated great results in terms of pain relief and function improvement, especially when combined. In most instances (80%-90%), Lateral Epicondylitis can be effectively treated conservatively with non-operative methods with relief within 1 year. Surgical interventions should be preceded by prolonged non-surgical management for 6 to 12 months. All surgical methods: percutaneous, open, and arthroscopic show equally great outcome.

All surgical treatments must be followed by physiotherapy. To sum up, treatment should be personalized, with conservative treatment as the first option. Surgical treatment ought to be considered when non-surgical methods fail. When choosing surgery technique, surgeon abilities and preferences should be considered as well as patient needs.

Disclosure

Author's contribution

Conceptualization: F. Czyżewski; methodology: I. Wiak; F. Jasiński; software: K. Wojtach; check: A. Dziegciarczyk, F. Czyżewski; formal analysis: K. Bochen, W. Górska, J. Szałajska; F. Banyś; investigation: F. Czyżewski, A. Łukawski, I. Wiak; resources: A. Dziegciarczyk, K. Wojtach, F. Banyś; data curation: K. Bochen; F. Jasiński; writing-rough preparation: F. Czyżewski, W. Górska, J. Szałajska; writing –review and editing: A. Łukawski, I. Wiak, A. Dziegciarczyk; visualization: F. Banyś, A. Łukawski, K. Wojtach; supervision: F. Czyżewski, J. Szałajska; project administration: A. Dziegciarczyk

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The authors deny any conflict of interest.

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