TITLE PAGE

Title

Arthroscopic surgery versus open surgery in lateral epicondylitis in active work population; comparative study.

Authors

Socorro López Alameda. Hospital FREMAP de Majadahonda. Majadahonda, Madrid, Spain

David Varillas Delgado. Universidad Francisco de Vitoria, Faculty of Medicine, Pozuelo de Alarcón, Madrid, Spain

Juan de Felipe Gallego. Hospital FREMAP de Majadahonda. Majadahonda, Madrid, Spain

Maria Gabriela Gonzalez Granados. Hospital FREMAP de Majadahonda. Majadahonda, Madrid, Spain

Luis Enrique Hernández Castillejo. Hospital FREMAP de Majadahonda. Majadahonda, Madrid, Spain

Fernando García de Lucas. Hospital FREMAP de Majadahonda. Majadahonda, Madrid, Spain

Corresponding autor:

Luis Enrique Hernández Castillejo

Hospital FREMAP de Majadahonda. Majadahonda, Madrid, Spain

E-mail: mailto:luisenrique_med@hotmail.com

ABSTRACT

Introduction: Lateral Epicondylitis is common in workers who perform repetitive movements of the entire upper limb. 85% to 90% respond satisfactorily to conservative treatment but in resistant patients' surgical treatment is considered. Classic open surgery is successful between 70% to 97%, being similar with more modern techniques such as arthroscopic. We tried to demonstrate the superiority in clinical results of the Wolff technique by comparing functionals and pain outcomes of arthroscopic surgery with open surgery using fasciotomy as Wolff technique in the treatment of lateral epicondylitis.

Methods: Study of 47 patients of working age, with resistant Lateral Epicondylitis: 27 operated on arthroscopically and 20 by open surgery. Pre- and post-surgical Visual Analogue Scale (VAS) and function were assessed using short test of Disabilities of the Arm, Shoulder and Hand (QuickDASH), Mayo Elbow Performance Score (MEPS) and Broberg and Morrey Rating System (BMRS) scales, as well as the return to their previous work and the surgical time.

Results: The reduction in VAS showed no statistically significant differences between both groups (5.26 in arthroscopy versus 5.75 in fasciotomy; p=0.577), QuickDash (19.015 versus 19.430; p=0.946), MEPS (82.03 versus 81.5; p=0.930) and the BMRS (81.96 versus 82.65; p=0.900). The differences in terms of time off were also not statistically significant. The mean surgical time in the arthroscopic intervention group was 44.2 minutes and in the fasciotomy of 27.5 minutes, showing statistically significant results (p<0.001). A posterior interosseous nerve neurapraxia occurred with fasciotomy surgery with spontaneous recovery of the motor deficit.

Conclusions: Both techniques provide similar functional results and pain reduction.

Keywords: Lateral epicondylitis; Arthroscopy; Fasciotomy; Labor pain; Radial nerve release.

MAIN TEXT

Introduction

Lateral epicondylitis was first described in 1873 by Runge, as a pain in the lateral region of the elbow that affected tennis players, so it is called "tennis elbow" [1, 2] Its frequent appearance is known in non-sports people with a prevalence in the general population between 1-3%, in relation to repetitive movements in which the elbow is flexed while an object is seized and activities that require pronation and supination with the elbow in almost complete extension [3]. In this type of movement, a large load is applied to the wrist extensors, especially the extensor of carpi radialis brevis (ECRB) and activities such as plumbing, painting, gardening and cutting of meat serve as examples [4, 5].

Regarding its etiology, it seems multifactorial. In 1979, is described an “angio-fibroblastic hyperplasia” which consists of an alteration in the normal parallel arrangement of tendon fibers with invasion of fibroblasts and atypical vascular tissue similar to that of granulation [6, 7]. Also, has been published a classification of capsular lesions evidenced by arthroscopy [8, 9], observing an increase in a capsulosinovial fold of the annular ligament that would clamp the head of the radius by interposing in the hyper-radial joint [10].

Various conservative treatment options consisting of rest, ice, non-steroidal anti-inflammatory drugs (NSAIDs), physiotherapy, shock waves, corticosteroid infiltrations, etc. have been described [11, 12]. Despite these treatments, 5-10% of patients develop chronic symptoms that end up requiring surgery [13, 14]. Various surgical techniques have been described; the open release described by Nirschl and Ashman [15] is one of the most used techniques, with another alternative being the percutaneous release described in 1985 [16]. The development of arthroscopy allowed the establishment of a new boom treatment [17]. In 2013, Wolff describes an open surgery technique that seeks to solve the problem through two mechanisms: the extensor aponeurotomy releases tension on the origin of the musculature and the supinator aponeurotomy releases the posterior interosseous nerve (PIN) [18].

The main objective of the study is to compare the results of conventional arthroscopic treatment and treatment by aponeurotomy described by Wolff in lateral epicondylitis in the active work population.

Hypothesis

- The clinical results with the Wolff technique are superior to arthroscopic surgery

Material and methods

1. Study design:

Cohort study carried out in FREMAP Hospital between January 2014 and December 2017, longitudinal, with a minimum follow-up of one year.

2. Patients

Patients who underwent arthroscopic intervention by one of the authors (arthroscopy: J.F.G) (27 patients) and by open release by the other (Wolff: S.L.A.) (20 patients) were followed-up. All patients carried out the same rehabilitation protocol.

Informed consent of all the participants in the study was obtained. The protocol of the study was approved by the Committee of Institutional Ethics (Hospital FREMAP, Majadahonda) and agreed with the Declaration of Helsinki for Human Research of 1974 (last modified in 2000).

Inclusion criteria were; working-age patients (18-65 years) diagnosed with lateral epicondylitis secondary to work activity and no response after 3 months of rehabilitative treatment with simple radiography without noticeable alterations and compatible ultrasound. According to Park [19], in our protocols this time is established as adequate to perform a surgical indication since these authors demonstrate a stabilization in the improvement of patients with conservative treatment at 3 months, increasing expenses without clinical improvement if the treatment is prolonged.

Exclusion criteria were; patients with concomitant pathology in the homolateral upper limb and patients who did not want to collaborate in the study.

3. Arthroscopic technique

The patient is placed in contralateral recumbency with upper limb to operate flexed in support. Axillary blockade is performed, and ischemia cuff is used in the proximal region of the arm. The joint is distended with 10 ml of saline introduced through the soft point (Figure 1). This moves the neurovascular structures forward and allows more controlled entry of the arthroscope. The place of vision after the realization of the portals is the proximal anteromedial placed about 2 cm proximal to the epitrochlear and 1 cm in front of the intermuscular septum. The proximal anterolateral portal constitutes the work portal and serves to debride the capsule first and then with a vaporizer to be

able to resect the origin of the ECRB (Figure 2). In order not to injure the lateral collateral ligament, the release should remain ahead of the bisector of the radial head with the elbow flexed at 90º [20]. The portals are closed with a simple suture and the arm is bandaged. It can move the elbow immediately according to pain tolerance and after removing the stitches in about 10-12 days the rehabilitation treatment is started.

Open surgery technique (Wolff technique) [18]: the patient is placed in a contralateral position with an upper limb to operate flexed in support. Axillary blockade is performed, and ischemia cuff is used in the proximal region of the arm. The patient is placed supine with the forearm in pronation on the hand table. A longitudinal incision is made in the axis of the forearm from about 2 cm from the epicondyle to about 6 cm (Figure 3). A circumferential aponeurotomy of the extensor carpi radialis brevis and longus, the extensor *digitorum communis* and the extensor *carpi ulnaris* is performed (Figure 4). The intermuscular septum is also released and the supine aponeurotomy is performed, taking care not to injure the posterior interosseous nerve (Figure 5). Ischemia is released and careful hemostasis is performed. The subcutaneous cellular tissue is closed with a resorbable suture and the skin is not reabsorbable. A brachial bandage is placed, and the patient can move immediately according to pain tolerance. The stitches are removed in about 10-12 days and the rehabilitation treatment is started.

4. Statistical analysis

Was carried out using the SPSS 21.0® software for Windows (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp). Quantitative variables were expressed in means and standard deviation or medians and ranges and qualitative variables in percentages and percentages. Visual Pain Scale test (VAS) and the test QuickDASH, as well as the Broberg and Morrey Rating System (BMRS) test and the Mayo Elbow Performance Score (MEPS) were collected pre and postoperatively. Student's T test and its non-parametric variant of Mann-Whitney U were used for the comparisons. Statistically significant results were interpreted those with p value <0.05.

Results

A cohort study of 47 patients of which 27 underwent arthroscopy (57.4%) and the other 20 patients underwent surgery using Wolff technique (42.6%).

22 patients were men (46.8%), while 25 were women (53.2%). The average age of the study patients was 46.85 years (±8.024 years), all of them of working age. In the intervention group

through arthroscopy, the mean age corresponded to 47.44 years (±8.078 years), being in the Wolff group of 46.05 years (±8.088 years).

The affected side of epicondylitis injury was the right side in 34 cases (72.3%), and the left side in 13 cases (27.7%). Dominance was practically full on the right side with 46 cases (97.9%), only one of the cases was left side in arm´s dominance (2.1%). There were 2 reinterventions, one in each group, both being by arthroscopy.

The comparisons between QuickDASH, MAYO and BMRS between groups that were carried out are shown in table 1.

The mean VAS was analyzed at the end of the follow-up, with mean value of 3.22 in the arthroscopy technique and 2.80 in the Wolff technique without checking statistically significant results between the groups (p=0.663).

The days of discharge that all patients in the study had were on average 86.4 days. The days of work leave in the arthroscopy group corresponded on average 83.78 days and in the Wolff group 89.95, data that also did not report statistically significant differences (p=0.751).

The time spent in surgery in Wolff technique group, was an average time of 27.5 minutes, and 44.2 minutes in the arthroscopic intervention group (p <0.001).

Regarding the complications, only a paralysis of the NIP was evidenced in a patient undergoing open fasciotomy, which coincides with one of the reoperations performed. This patient is the only one who has obtained a Total Permanent Disability (IPT) at the time of the study. The rest of the patients returned to their previous work.

Discussion

There are many techniques described in the treatment of epicondylitis. In our study we have not been able to show a superiority regarding the functional results of the fasciotomy described by Wolff compared to arthroscopic technique.

The demographic data of patients in the study presented are repeated in the different series reviewed [14, 21-24], as well as the higher prevalence of right elbow surgery, which in this series was the dominant one in a high percentage (97.9%), a fact that is not repeated in other series [21].

The analysis of the functional results is satisfactory in the study data, especially in the QuickDash, BMRS and MEPS tests with results that can be classified as good and in accordance with those found in the literature. The Carratalá study [21] compares the arthroscopic technique versus the

open surgery described by Nirschl [6], finding MEPS values considered "*acceptable*". In a recent study in which the prognostic factors of arthroscopic surgery are analyzed [22], the MEPS values achieved were discreetly lower than those shown previously [6, 22], but they can still be classified as good. In another prospective randomized study [25], in which the arthroscopic technique is compared with radiofrequency tenotomy, scores above 90 points are evidenced at the end of the follow-up, which is equivalent to an excellent result, without significant differences between the two groups.

Tsolias [23] recently published a prospective randomized study in which one group performed a V-Y advancement technique and the other group in the study added the release of the radial nerve by extending it to a Thompson lateral dorsal approach. The MEPS values shown were discreetly better in the nervous release group, but without statistically significant differences, so they conclude that this gesture does not provide clinical improvements. Although, the technique they describe is not the one proposed in this work. Jiménez [14] proposes the release of the NIP as a fourth gesture added to epicondylar denervation, excision of the angiofibroblastic degeneration nucleus and epicondylectomy and with all this they publish excellent values of MEPS and BMRS, both above 90 points.

Several studies has been published about the involvement of radial entrapment in the clinical presentation of epicondylitis and there are authors who continue to make a surgical gesture in this regard [14, 18, 26-28]. It coincides with Jimenez´s study [14], in which it is difficult to establish a clinical difference and the complementary tests do not help much, so it was decided not to perform EMG in screening.

In a recently published systematic review [29], 30 articles from publications between the years 2000 and 2015 are selected and the results between open, arthroscopic and percutaneous surgery are analyzed, finding that the functional results of open and arthroscopic surgery may be superior to percutaneous surgery but the patients reflect less pain with less invasive techniques (arthroscopic and percutaneous). It should be noted that it is a very heterogeneous group of studies and of low methodological quality, with most of the level of evidence being IV.

However, in another systematic review [24], a more exhaustive selection of randomized controlled and experimental studies publications is made, also comparing open, arthroscopic and percutaneous surgery. In some of the elbows operated by open surgery, the release of the NIP is added. The data obtained allow to ensure with moderate evidence that there is no significant difference between the three techniques in terms of DASH, VAS and patient satisfaction. In this review, the average DASH scores obtained (53 for open surgery vs. 48 in arthroscopic and 49 in percutaneous) are

striking, relatively high compared to others published [29] and in relation to the results shown in this study presented in the QuickDASH test.

In contrast, several studies have very positive levels of VAS, below 2 points [21, 24, 29] and do not coincide with those shown in this work, which are maintained in higher ranges at the end of the follow-up (around 3 points), although they improved with surgery around 5 points of the scale (in both groups without statistically significant differences). It is possible to think that this data is more clearly influenced by the work context in which the patients in this study are, although Guillou [22] fails to show as a negative prognostic factor in his study that the pathology was considered a professional disease and does correlate with a worse prognosis. For smoking patients, the follow-up time is a positive prognostic factor since it establishes that postoperative improvement continues to progress even for years (the longer the follow-up, the better results). Although the study does not seem to have an influence in the workplace, 37.5% of the patients did not return to their previous work, which is undoubtedly noteworthy. Jiménez's work [14] also collects this data with 14.28% of patients who did not return to their previous activity. In the series of work presented, all patients returned to their previous work except one patient who ended up with a Total Permanent Disability (IPT), who had a post-surgical paralysis of the NIP due to neurapraxia that improved spontaneously, but with recurrence of epicondylitis clinic that required a reintervention.

The mean incorporation of the patients in both groups was around 3 months postoperatively without statistically significant differences between the groups. These times are somewhat higher than those published in other series [30, 31] but in return the rate of reinstatement is strikingly higher.

As complications, only a posterior interosseous nerve paralysis was collected in the open fasciotomy group that completely recovered two months after surgery. Possibly, as a result of the electrostimulation of the extensor muscles used for the treatment of paralysis, this patient suffered a new recurrence of symptoms that required a study with MRI without finding findings and arthroTAC, evidencing a thickening of synovial plica. For this reason, a second arthroscopic surgery was performed in which the excision of the capsular fold and new tenotomy of the ECRB was performed with good objective evolution, although not subjective on the part of the patient.

Other studies also describe in their series 2 neurapraxias with spontaneous recovery 10 weeks after surgery [14, 32]. In Burn's systematic review, only two articles collect complication rates, being nonexistent in both [24]. Pomerantz [33] talks about rates between 4.3% and 1.1% for open, percutaneous and arthroscopic surgery respectively; while Karkhanis [34] describes rates between 10.6% and 0%. Lee [25] publishes rates of approximately 11% of persistent pain with MEPS less

than 90 points two years after surgery, one of the patients previously undergoing arthroscopy requiring a new re-surgery 12 months after the first.

hen studying the average time of surgery, significant differences appear. There is no doubt that even in expert hands in arthroscopy, arthroscopy preparations delay the time spent in the operating room, compared to open surgery. In exchange, the intra-articular information it provides may be interesting. There are not many studies that collect this data. Burn [24] publishes that percutaneous surgery is twice as short as open surgery, but no references to arthroscopy have been found.

The limitations are those of a cohort study; the number of corticosteroid infiltrations previously performed, and which may result in a confounding factor has not been analyzed. Some patients have a one-year follow-up and in others it is not known exactly. This time can be considered insufficient for an expected and significant improvement, as evidenced by the functional test data used. This follow-up, since it is not the same in all patients, can contribute information bias to the results of the study, so subsequent studies should be carried out to confirm the results found in this first approach.

Conclusions

We can affirm that there are no clinical differences that justify the use of one or another surgical technique. Despite what has been studied and published regarding epicondylitis, there is no evidence to date that one technique is superior to another, and this study can only support this conclusion. It may be necessary to know the exact etiology of this pathology beforehand to find the best way to treat it.

Acknowledgements

The authors appreciate the participation of patients in the study.

The present study has been no funded.

Conflict of interests

We have no Conflict of Interest

References

[1] Bisset L, Coombes B, Vicenzino B. Tennis elbow. BMJ Clin Evid 2011;2011.

[2] Keijsers R, de Vos RJ, Kuijer PPF, van den Bekerom MP, van der Woude HJ, Eygendaal D. Tennis elbow. Shoulder Elbow 2019;11(5):384-92.

[3] Allander E. Prevalence, incidence, and remission rates of some common rheumatic diseases or syndromes. Scand J Rheumatol 1974;3(3):145-53.

[4] Walkowski AD, Goldman EM. Anatomy, Shoulder and Upper Limb, Forearm Extensor Carpi Radialis Brevis Muscle. StatPearls. Treasure Island (FL): StatPearls Publishing
StatPearls Publishing LLC.; 2019.

[5] Yang K, Choi IJ, Lee JH. Accessory head of the extensor carpi radialis longus muscle merging with extensor carpi radialis brevis muscle. Surg Radiol Anat 2018;40(9):1001-3.

[6] Nirschl RP, Pettrone FA. Tennis elbow. The surgical treatment of lateral epicondylitis. J Bone Joint Surg Am 1979;61(6a):832-9.

[7] Lenoir H, Mares O, Carlier Y. Management of lateral epicondylitis. Orthop Traumatol Surg Res 2019;105(8s):S241-s6.

[8] Yang YP, Yuan S, Li N, Ao YF. [Analysis of factors influencing the efficacy of extracapsular arthroscopic surgery for refractory tennis elbow]. Zhonghua Wai Ke Za Zhi 2019;57(11):818-23.

[9] Arrigoni P, Cucchi D, D'Ambrosi R, Menon A, Aliprandi A, Randelli P. Arthroscopic R-LCL plication for symptomatic minor instability of the lateral elbow (SMILE). Knee Surg Sports Traumatol Arthrosc 2017;25(7):2264-70.

[10] Mullett H, Sprague M, Brown G, Hausman M. Arthroscopic treatment of lateral epicondylitis: clinical and cadaveric studies. Clin Orthop Relat Res 2005;439:123-8.

[11] Altintas B, Greiner S. [Lateral epicondylitis: conservative - operative]. Orthopade 2016;45(10):870-7.

[12] Tarpada SP, Morris MT, Lian J, Rashidi S. Current advances in the treatment of medial and lateral epicondylitis. J Orthop 2018;15(1):107-10.

[13] Viola L. A critical review of the current conservative therapies for tennis elbow (lateral epicondylitis). Australas Chiropr Osteopathy 1998;7(2):53-67.

[14] Jimenez I, Marcos-Garcia A, Muratore-Moreno G, Medina J. [Four surgical tips in the treatment of epicondylitis]. Rev Esp Cir Ortop Traumatol 2016;60(1):38-43.

[15] Nirschl RP, Ashman ES. Tennis elbow tendinosis (epicondylitis). Instr Course Lect 2004;53:587-98.

[16] Yerger B, Turner T. Percutaneous extensor tenotomy for chronic tennis elbow: an office procedure. Orthopedics 1985;8(10):1261-3.

[17] Grifka J, Boenke S, Kramer J. Endoscopic therapy in epicondylitis radialis humeri. Arthroscopy 1995;11(6):743-8.

[18] Manon-Matos Y, Oron A, Wolff TW. Combined common extensor and supinator aponeurotomy for the treatment of lateral epicondylitis. Tech Hand Up Extrem Surg 2013;17(3):179-81.

[19] Park KW, Chamberlain AM, Osei DA.

[20] Kuklo TR, Taylor KF, Murphy KP, Islinger RB, Heekin RD, Baker CL, Jr. Arthroscopic release for lateral epicondylitis: a cadaveric model. Arthroscopy 1999;15(3):259-64.

[21] Carratalá V, Lucas FJ, Miranda I, Ortego JI, Sánchez-Alepuz E.

[22] Guillou J, Pouges C, Limousin M, Strouck G, Fontaine C. Arthroscopic treatment of work-related lateral epicondylitis - prognostic factors. Hand Surg Rehabil 2019;38(1):24-7.

[23] Tsolias A, Detrembleur C, Druez V, Lequint T, Lefebvre B. Effect of Radial Nerve Release on Lateral Epicondylitis Outcomes: A Prospective, Randomized, Double-Blinded Trial. J Hand Surg Am 2019;44(3):216-21.

[24] Burn MB, Mitchell RJ, Liberman SR, Lintner DM, Harris JD, McCulloch PC. Open, Arthroscopic, and Percutaneous Surgical Treatment of Lateral Epicondylitis: A Systematic Review. Hand (N Y) 2017:1558944717701244.

[25] Lee JH, Park I, Hyun HS, Shin SJ. A Comparison of Radiofrequency-Based Microtenotomy and Arthroscopic Release of the Extensor Carpi Radialis Brevis Tendon in Recalcitrant Lateral Epicondylitis: A Prospective Randomized Controlled Study. Arthroscopy 2018;34(5):1439-46.

[26] Gurcay E, Karaahmet OZ, Kara M, Onat SS, Ata AM, Unlu E, et al. Ultrasonographic Evaluation of the Radial Nerves in Patients with Unilateral Refractory Lateral Epicondylitis. Pain Med 2017;18(3):396-402.
[27] Neal S, Fields KB. Peripheral nerve entrapment and injury in the upper extremity. Am Fam Physician 2010;81(2):147-55.
[28] Roles NC, Maudsley RH. Radial tunnel syndrome: resistant tennis elbow as a nerve entrapment. J Bone Joint Surg Br 1972;54(3):499-508.
[29] Pierce TP, Issa K, Gilbert BT, Hanly B, Festa A, McInerney VK, et al. A Systematic Review of Tennis Elbow Surgery: Open Versus Arthroscopic Versus Percutaneous Release of the Common Extensor Origin. Arthroscopy 2017;33(6):1260-8.e2.
[30] Shahid M, Wu F, Deshmukh SC. Operative treatment improves patient function in recalcitrant medial epicondylitis. Ann R Coll Surg Engl 2013;95(7):486-8.
[31] Isikan UE, Sarban S, Kocabey Y. [The results of open surgical treatment in patients with chronic refractory lateral epicondylitis]. Acta Orthop Traumatol Turc 2005;39(2):128-32.
[32] Ahmad Z, Siddiqui N, Malik SS, Abdus-Samee M, Tytherleigh-Strong G, Rushton N. Lateral epicondylitis: a review of pathology and management. Bone Joint J 2013;95-b(9):1158-64.
[33] Pomerantz ML. Complications of Lateral Epicondylar Release. Orthop Clin North Am 2016;47(2):445-69.
[34] Karkhanis S, Frost A, Maffulli N. Operative management of tennis elbow: a quantitative review. Br Med Bull 2008;88(1):171-88.

Tables and table legends

Table 1. Comparison of the different quality tests carried out at end of follow-up in the study groups.

	Arthroscopy	*Wolff*	*p value*
VAS	5.75	5.26	p=0.577
QuickDASH	19.015	19.430	p=0.946
BMRS	81.96	82.65	p=0.900
MEPS	82.04	81.50	p=0.930

Figure legends

Figure 1. Joint distension process with saline solution.

Figure 2. Resection of the origin of the extensor carpi radialis brevis.

Figure 3. Longitudinal incision in the axis of the forearm from about 2 cm from the epicondyle to about 6 cm.

Figure 4. Circumferential aponeurotomy of the extensor carpi radialis brevis and longus.

Figure 5. Posterior interosseous nerve.