ORIGINAL PAPER/PŮVODNÍ PRÁCE

Comparison of the Results of Expanded Arthroscopic Debridement and 18-Gauge Percutaneous Tenotomy in Lateral Epicondylitis

Srovnání výsledků rozšířeného artroskopického debridement a 18-gauge perkutánní tenotomie u laterální epikondylitidy

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ABSTRACT

Purpose of the study

This retrospective comparative study aims to evaluate the clinical outcomes, cost-effectiveness, and complication rates associated with two minimally invasive surgical techniques: extended arthroscopic debridement and 18-gauge percutaneous tenotomy.

Material and methods

The study included 31 patients with resistant lateral epicondylitis who underwent either arthroscopic debridement (n=14) or percutaneous tenotomy (n=17) between January 2019 and June 2023. Outcomes were assessed using the Mayo Elbow Performance Score (MEPS) and the Patient-Rated Tennis Elbow Evaluation (PRTEE) at preoperative, 3-month, 6-month, and 12-month intervals. Additionally, a detailed cost analysis was performed to compare the economic implications of both surgical techniques.

Results

The results demonstrated significant improvements in both groups at 3 and 6 months postoperatively. However, by the 12-month follow-up, the arthroscopic group maintained stable clinical outcomes, while the percutaneous group showed a decline in MEPS and PRTEE scores, suggesting a potential regression in long-term efficacy. Despite this, the percutaneous tenotomy group benefited from a shorter procedure time, fewer complications, and a quicker return to work, making it a highly cost-effective alternative.

Conclusions

In conclusion, while extended arthroscopic debridement offers sustained clinical benefits, particularly in long-term follow-up, 18-gauge percutaneous tenotomy emerges as a viable primary intervention due to its simplicity, low complication rate, and significant cost savings. Future studies with larger cohorts and longer follow-up periods are warranted to further elucidate the long-term effectiveness and patient satisfaction associated with these techniques.

Key words: lateral epicondylitis, elbow arthroscopy, percutaneous tenotomy.

INTRODUCTION

Lateral epicondylitis is a pathology commonly seen in athletes and professions requiring intensive wrist use. In chronic cases, it can significantly impact the patient's quality of life and lead to substantial loss of work productivity. Rather than being an inflammatory condition, it is defined as tendinosis, a chronic degenerative process affecting the attachment site of the extensor muscles of the forearm to the lateral epicondyle of the humerus. Due to repeated microtrauma in the extensor muscle group, the tendons in this region are gradually damaged. This pathological process is associated with a mechanism that exceeds the tendon's capacity for self-repair (1).

The diagnosis of tendinitis is primarily based on clinical findings. Pain occurring slightly distal to the lateral epicondyle during resisted wrist extension with the forearm in pronation and the elbow fully extended is a significant indicator of lateral epicondylitis (6). Many treatment methods for lateral epicondylitis have been described and applied in the literature. These treatment options include nonsteroidal anti-inflammatory drugs (NSAIDs), corticosteroid injections, extracorporeal shock wave therapy (ESWT), orthotic use, topical nitrate applications, platelet-rich plasma (PRP) injections, acupuncture, activity modification, and physical therapy (8). The foundation of conservative treatment methods for lateral epicondylitis consists of activity modification and NSAIDs. However, there is no standard algorithm in the literature regarding the order and timing of conservative treatment options. Nonetheless, 79–95% of patients can be treated with conservative methods (4). Generally, recovery is expected within one year with conservative treatment; cases that do not show improvement during this period are considered treatment-resistant, and surgical intervention is recommended (2). It is quite difficult to convince patients who have undergone non-surgical treatment for at least 6 months and have not shown any benefit from conservative treatment options to continue with them.

In patients unresponsive to conservative treatment, surgical options such as open, arthroscopic, and percutaneous methods can be preferred (3). In recent years, there has been growing interest in minimal invasive methods. This study aims to compare the effectiveness of the arthroscopic extended ECRB debridement technique with the percutaneous release technique using an 18-gauge needle to treat resistant lateral epicondylitis. We hypothesize that tenotomy performed with an 18-gauge needle can achieve successful results more cost-effectively and simply.

MATERIAL AND METHODS

Institutional ethics committee approval was obtained for this retrospective comparative study (ESH/BAEK 2024/1). Data from patients who underwent surgical treatment for resistant lateral epicondylitis between January 2019 and June 2023 were retrospectively reviewed. The diagnosis of lateral epicondylitis was based on positive Thomsen and Maudsley tests and the presence of pain on palpation of the extensor origin. Varus stress tests and posterolateral rotatory drawer tests were used to assess for any accompanying collateral ligament damage.

Patients diagnosed with lateral epicondylitis who did not respond to at least six months of conservative treatment (as outlined in the treatment algorithm, Fig. 1) were further evaluated with preoperative magnetic resonance imaging (MRI). MRI findings prior to surgery showed "abnormal thickening at the common extensor tendon insertion and increased fluid around the tendon" in all patients. No radial collateral ligament or lateral ulnar collateral ligament damage was reported in any of the patients.

The surgeries were performed by experienced surgeons at two different clinics. One surgeon performed extended arthroscopic debridement of the extensor carpi radialis brevis (ECRB), while the other performed percutaneous tenotomy using an 18-gauge needle. Patients undergoing the percutaneous method were informed by the surgeon that more invasive interventions might be necessary if the procedure was unsuccessful.

Before the operation, none of the patients had any limitations in elbow range of motion, significant osteoarthritic changes on radiographic images, or additional pathologies such as lateral ulnar collateral ligament injury or osteochondral damage detected by MRI. The Patient-Rated Tennis Elbow Evaluation (PRTEE) and Mayo Elbow Performance Score (MEPS) were assessed preoperatively, as well as at 3, 6, and 12 months postoperatively. Complications occurring during surgery and follow-up were also evaluated. Data from both groups were collected prospectively and later reviewed retrospectively from patient records.

Patients aged 18–65 who were diagnosed with lateral epicondylitis and did not respond to at least 6 months of conservative treatment according to the algorithm shown in Figure 1 were considered treatment-resistant. All patients had tenderness on palpation at the common extensor origin and corresponding MRI findings. In patients scheduled for surgery, steroid injections were avoided in the 3 months leading up to the procedure because they could reduce collagen fascicle strength and inhibit the inflammatory process that aids healing (10).

Furthermore, no steroid injections were administered to the surgical site within 1 year postoperatively, as this could affect the outcomes. The choice of surgical method depended on the surgeon to whom the patient was referred, with each surgeon performing only their preferred method. Patients were excluded from the study if, within the 3 months before surgery, they had received any injection treatment to the elbow, had a history of surgery in the elbow region, or had psychiatric disorders, rheumatologic diseases, radial tunnel syndrome, or cervical radiculopathy symptoms. Additionally, those with associated pathologies like plica or osteochondral defects as seen on X-ray or MRI were not included.

Procedures

A. Arthroscopic extended debridement

In arthroscopic extended debridement for lateral epicondylitis, the procedure begins with standard preoperative preparations, including prophylactic administration of 1000 mg cefazolin. The patient is positioned in the lateral decubitus position, and a tourniquet is inflated at 100 mm/Hg above systolic blood pressure.

The elbow joint is inflated with approximately 20 cc of saline via injection through the lateral soft spot. Two portals

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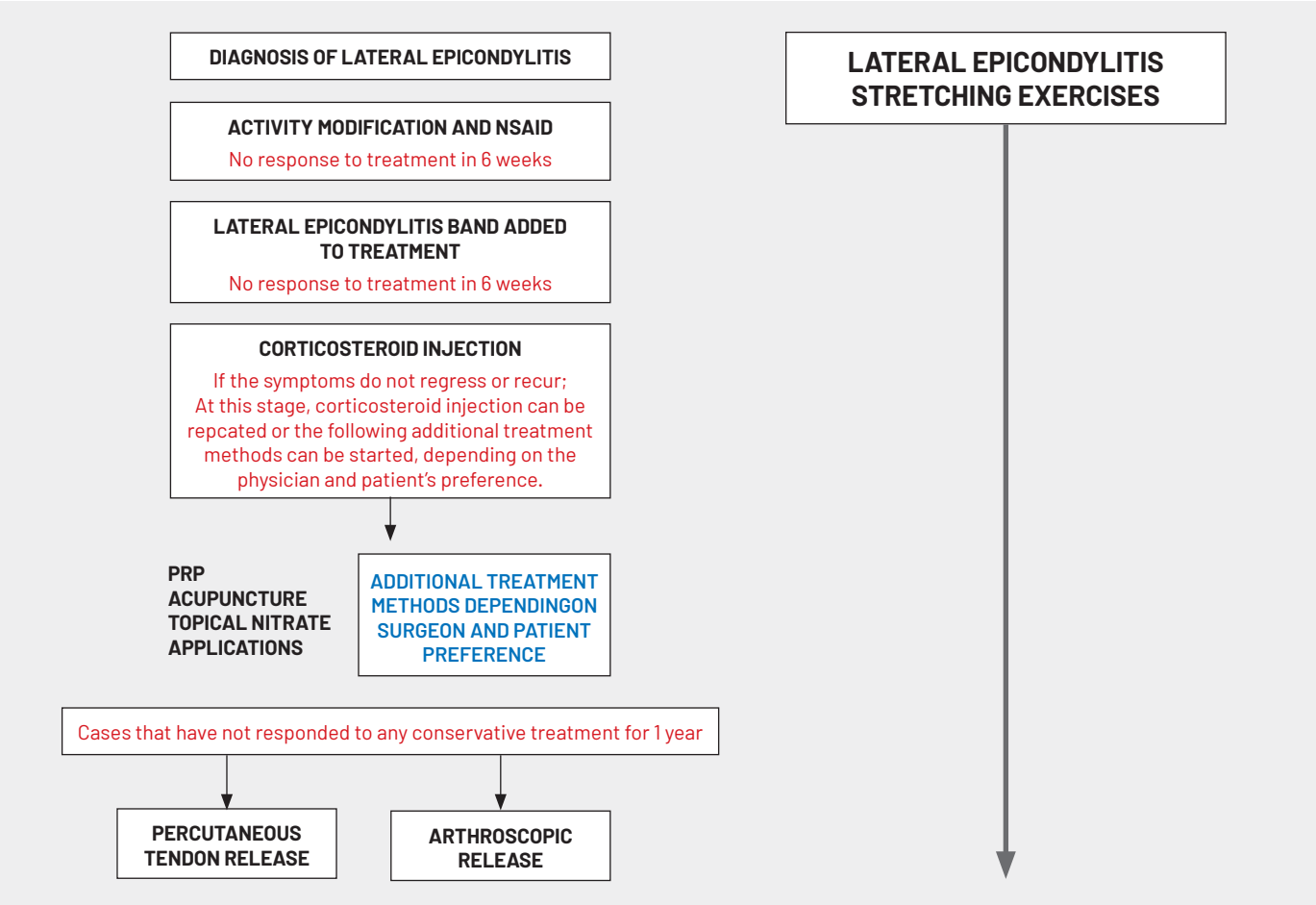

Fig. 1. **Treatment algorithm; the approach for cases that do not respond to corticosteroid treatment varies based on physician and patient preference.**

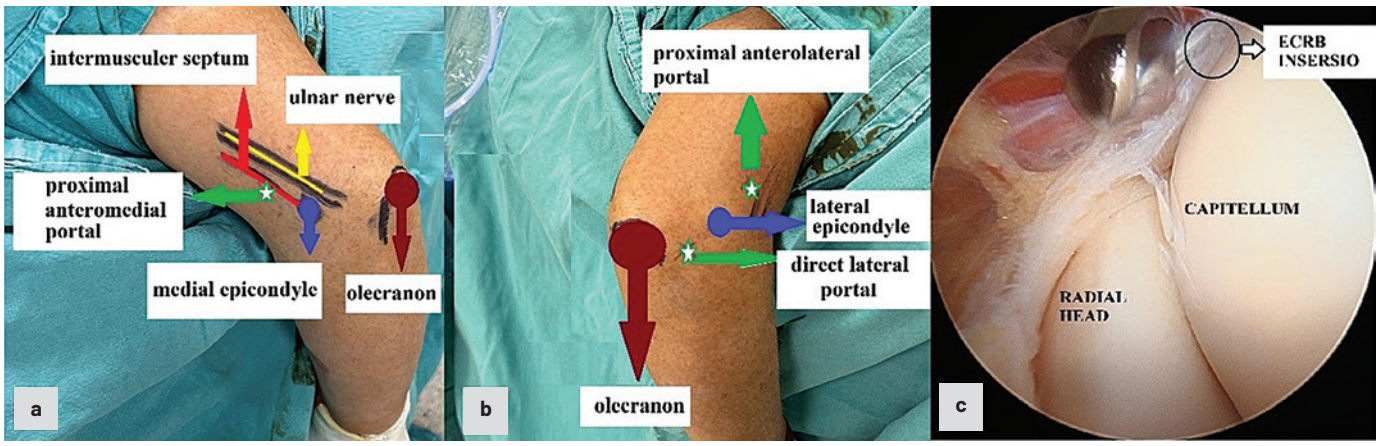

Fig. 2. **a – arthroscopic portals and key anatomical landmarks in the right elbow, viewed from the dorsomedial side; b – arthroscopic portals and key anatomical landmarks in the right elbow, viewed from the dorsolateral side; c – arthroscopic view of the elbow joint, showing the arthroscopic release of the extensor carpi radialis brevis attachment site.**

are created: a proximal anteromedial portal (2 cm proximal and 1 cm anterior to the medial epicondyle) and a proximal anterolateral portal (2 cm proximal and 1 cm anterior to the lateral epicondyle). A standard 30-degree, 4.0-mm arthroscope is inserted through the anteromedial portal for visualization.

The capsule covering the extensor carpi radialis brevis (ECRB) is debrided with a shaver through the anterolateral portal, exposing the ECRB tendon. Complete debridement of the pathological ECRB tendon and its origin on the lateral epicondyle is performed using a shaver and a radiofrequency wand. The „Scratch Test" is employed to differentiate pathological tendon tissue, as the shaver creates a fraying appearance when moved perpendicularly over diseased tendon. Debridement continues until the muscle fibers of the extensor carpi radialis longus (ECRL) are visible. Care is taken not to pass the dorsal midline of the radiocapitellar joint to protect the lateral ulnar collateral ligament (LUCL). At the end of the procedure, the tourniquet is released, portals are closed, and the elbow is wrapped with an elastic bandage. Patients are discharged the following day. (Fig. 2).

B. Percutaneous tenotomy with an 18-gauge needle

While the patient lying in a supine position in the local procedure room, the elbow is placed in 90 degrees of flexion, and the wrist is flexed approximately 60 degrees. The lateral epicondyle is marked, and a line is drawn from the lateral epicondyle to the third metacarpal. Local anesthesia is administered with 5 ml of lidocaine around the common extensor origin, focusing approximately 2 cm distal to the lateral epicondyle.

Anatomically, the origin of the extensor carpi radialis brevis (ECRB) is located at the distal end of the lateral supracondylar ridge and just proximal to the lateral epicondyle. At the radiocapitellar joint level, it runs between the middle and upper parts of the capitellum, just superficial to the capsule. Once local anesthesia takes effect, an 18-gauge needle is inserted through the skin, remaining on the volar side of the pre-drawn line. The needle is moved transversely to release the tendinous structures. The release is confirmed by palpating the opening created under the skin, and the release continues until the sound of the needle cutting the tendon is no longer heard.

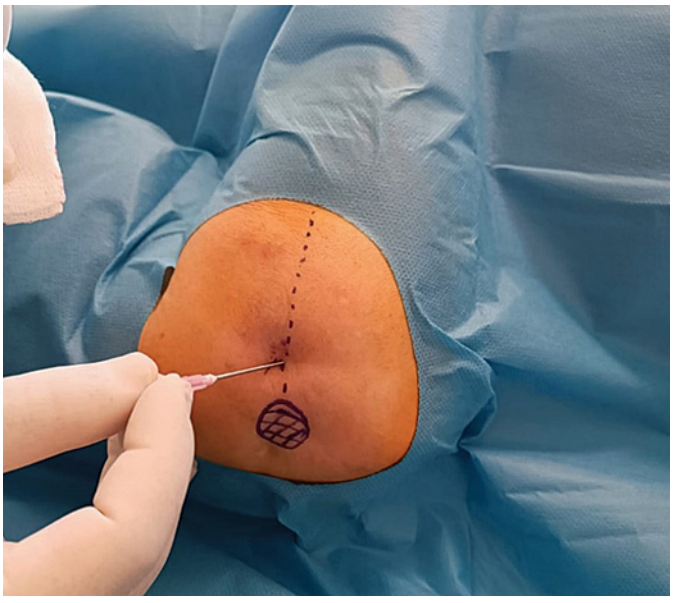

Fig. 3. **Procedure performed with an 18G needle distal to the lateral epicondyle. The circle indicates the lateral epicondyle and the dashed line represents the line extending from the lateral epicondyle to the third metacarpal.**

With the forearm fully pronated and the wrist and fingers in flexion, the elbow is extended to further separate the distal part of the extensor tendon from the release line. During the procedure, care is taken not to pass too far dorsally beyond the drawn line to protect the lateral collateral ligament, and the needle is kept shallow to avoid injuring the radial nerve, particularly when the elbow is in flexion and the forearm is in a neutral position.The needle entry site is closed with a steristrip after the procedure. (Fig. 3).

Rehabilitation

The same rehabilitation program was applied to both patient groups after the procedure. Postoperatively, rest was recommended for the first 5 days using an arm sling, along with cold applications. Active use of the elbow for daily activities and active motion was permitted on the first day after surgery. In the arthroscopic debridement group, aggressive exercises were allowed after 6 weeks, while in the percutaneous tenotomy group, patients were allowed to return to full activity as soon as the pain subsided. Patients were scheduled for follow-up appointments according to the monitoring protocol.

Cost analysis

A detailed cost analysis of both surgical techniques was conducted. As shown in Table 3, each cost item was evaluated individually. The cost of the initial outpatient examination was considered as the cost of the examination during which the decision for surgery was made after conservative treatment. The preoperative preparation fee included the costs of blood tests, chest X-rays, and the preoperative consultation with an anesthesiologist. In the anesthesia section, the costs associated with the anesthesia and reanimation department, including the anesthetic drugs used for the arthroscopic debridement group, were calculated, while for the percutaneous tenotomy group, the cost of the local anesthetic drug and its administration were considered. In the surgery fee section, calculations were made based on the „interventional arthroscopy" procedure fee for the arthroscopic debridement group and the „tenotomy/myotomy" procedure fee for the percutaneous tenotomy group. Additionally, the costs of materials used during the surgical procedures were included in this category. When calculating the follow-up examination fees, the total costs of follow-up examinations at 2 weeks, 3 months, 6 months, and 1 year postoperatively were evaluated.

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Table 1. **Demographic and clinical characteristics of the study population**

	ARTHROSCOPIC DEBRIDEMENT N:14	PERCUTANEOUS TENOTOMY N:17	P-VALUE
Age (year)	50.7 ± 5.9	52.7 ± 5.4	0.39
Sex female/male, n (%)	8/6 (57.1/42.9)	10/8 (58.8/41.2)	0.92
Labor, intensive work, n (%)	11 (78.6)	13 (76.5)	0.89
Smoker, n (%)	5 (35.7)	7 (41.2)	0.756
Symptom duration (months)	16.3 ± 7.3	18.1 ± 8.4	0.53
Dominant side, n (%)	12 (85.7)	14 (82.3)	0.79
Return to work (weeks)	6.1 ± 1.7	2.3 ± 1	**0.001**
Complication	none	none	0.99

Statistical method

IBM SPSS 25 software was used for statistical calculations. When comparing numerical data, the Kolmogorov-Smirnov test was first applied, followed by a distribution analysis. A paired samples test was used to compare patients' preoperative results with their postoperative results at 3 months, 6 months, and 1 year. For comparisons between the groups, an independent samples test was used. Cohen's d value was calculated, and the effect size was determined to be 0.22. In the study conducted with a total of 31 patients across the two groups, a significance level of p=0.05 was accepted, and the statistical power of the study was calculated to be 0.90. For the comparison of nominal data, Fisher's exact and Pearson Chi-square tests were used.

RESULTS

A total of 14 patients underwent arthroscopic treatment, while 17 patients received percutaneous tenotomy for treatment-resistant lateral epicondylitis. The study population consisted of 19 male and 12 female patients. The average age in the arthroscopic treatment group was 50.7 ± 5.9 years, while the average age in the percutaneous treatment group was 52.7 ± 5.4 years. The demographic characteristics of the study are presented in Table 1.

In patients who underwent arthroscopic surgery, no complete rupture of the joint capsule was detected. Six patients were evaluated with an intact capsule, while linear tears in the capsule were observed in eight patients. Synovial fraying was identified in six patients, along with soft indentations on the capitellum in three patients, and cartilage damage less than 50% in two patients. No additional intra-articular procedures were performed in conjunction with the capsule and ECRB debridement in any patient.

In the arthroscopic treatment group, the preoperative Mayo Elbow Performance Score (MEPS) was 44.2 ± 8.7. This score improved to 67.2 ± 10.6 at 3 months, 80.3 ± 9.1 at 6 months, and 78.9 ± 9.2 at 12 months postoperatively. A significant difference was found between the preoperative period and the postoperative scores at 3 months, 6 months, and 1 year ($p < 0.05$). However, there was no significant difference among the postoperative MEPS scores at 3 months, 6 months, and 1 year ($p = 0.583$).

In the percutaneous treatment group, the preoperative MEPS score was 42.4 ± 7.6, which improved to 63.5 ± 8.2 at 3 months, 77.6 ± 10.7 at 6 months, and 65.3 ± 12 at 1 year. A significant difference was found both between the preoperative period and the MEPS scores at 6 months and 1 year, as well as among the postoperative scores at 3 months, 6 months, and 1 year ($p < 0.05$). According to the MEPS data, by the end of the 12th month, the arthroscopic treatment group had 2 patients with excellent outcomes, 10 with good outcomes, 1 with moderate outcomes, and 1 with a poor outcome. In contrast, the percutaneous tenotomy group had 1 patient with an excellent outcome, 10 with good outcomes, 3 with moderate outcomes, and 3 with poor outcomes.

In the arthroscopic treatment group, the Patient-Rated Tennis Elbow Evaluation (PRTEE) score was recorded as 63 ± 8.3 preoperatively, 41.2 ± 9.1 at 3 months, 31.2 ± 4.9 at 6 months, and 30 ± 4.1 at 1 year. A significant difference was observed between the preoperative period and all postoperative time points ($p < 0.05$), while no significant difference was found among the postoperative scores at 3 months, 6 months, and 1 year ($p = 0.076$).

In the percutaneous treatment group, the preoperative PRTEE score was 65.6 ± 1.1, which decreased to 44.3 ± 8.9 at 3 months, 31.4 ± 5.8 at 6 months, and 38.1 ± 9.1 at 1 year. A significant difference was noted between the preoperative period and all postoperative time points, and also among the postoperative PRTEE scores at 3 months, 6 months, and 1 year ($p < 0.05$). (Table 2).

In summary, the clinical improvement observed in the arthroscopic tenotomy group at 3 and 6 months continued into the 1-year mark. In the percutaneous tenotomy group, similar clinical improvements were noted at 3 and 6 months, but a regression in clinical status was detected by the end of the

Table 2. **Changes in MEPS and PRTEE scores over time**

TIME POINT	ARTHROSCOPIC DEBRITMENT N:14	PERCUTANEOUS TENOTOMY N:17	P-VALUE
MEPS preoperative	44.2 ± 8.7	42.4 ± 7.6	0.52
3. months	67.2 ± 10.6	63.5 ± 8.2	0.29
6. months	80.3 ± 9.1	77.6 ± 10.7	0.46
12. months	78.9 ± 9.2	65.2 ± 15.6	**0.008**
PRTEE preoperative	63 ± 8.3	65.6± 1.1	0.36
3. months	41.2 ± 9.1	44.3 ± 8.9	0.31
6. months	31.2± 4.9	31.4±5.8	0.92
12. months	30 ± 4.1	38.1±9.1	**0.005**

1 year (see Fig. 4). No revision surgeries were performed on any patients who had poor outcomes at the end of the follow-up period (1 in the arthroscopic debridement group and 3 in the percutaneous tenotomy group). Additionally, there were no reported significant complications associated with either surgical approach.

Cost analysis revealed a significant difference between the two groups (p = 0.001). The percutaneous tenotomy method was found to be a much more cost-effective approach compared to arthroscopic debridement (see Table 3). The total cost for arthroscopic debridement was calculated at 36,685 TL, while percutaneous tenotomy amounted to only 8,633 TL. The major cost difference between the two methods is primarily due to the significant disparity in anesthesia and

Table 3. **Cost analysis table after the decision for surgical procedure. TL: Turkish lira**

PROCEDURE	ARTHROSCOPIC DEBRIDEMENT	PERCUTANEOUS TENOTOMY
Initial outpatient examination	300 TL	300 TL
Elbow X-ray (A-P / Lateral)	65 TL	65 TL
Preoperative preparation	515 TL	-
Anesthesia fee	12,315 TL	159 TL
Surgery fee	22,100 TL	69,74 TL
1-day accommodation fee	190 TL	-
Follow-up examinations	1,200 TL	1,200 TL
Total fee	36,685 TL	8,633 TL

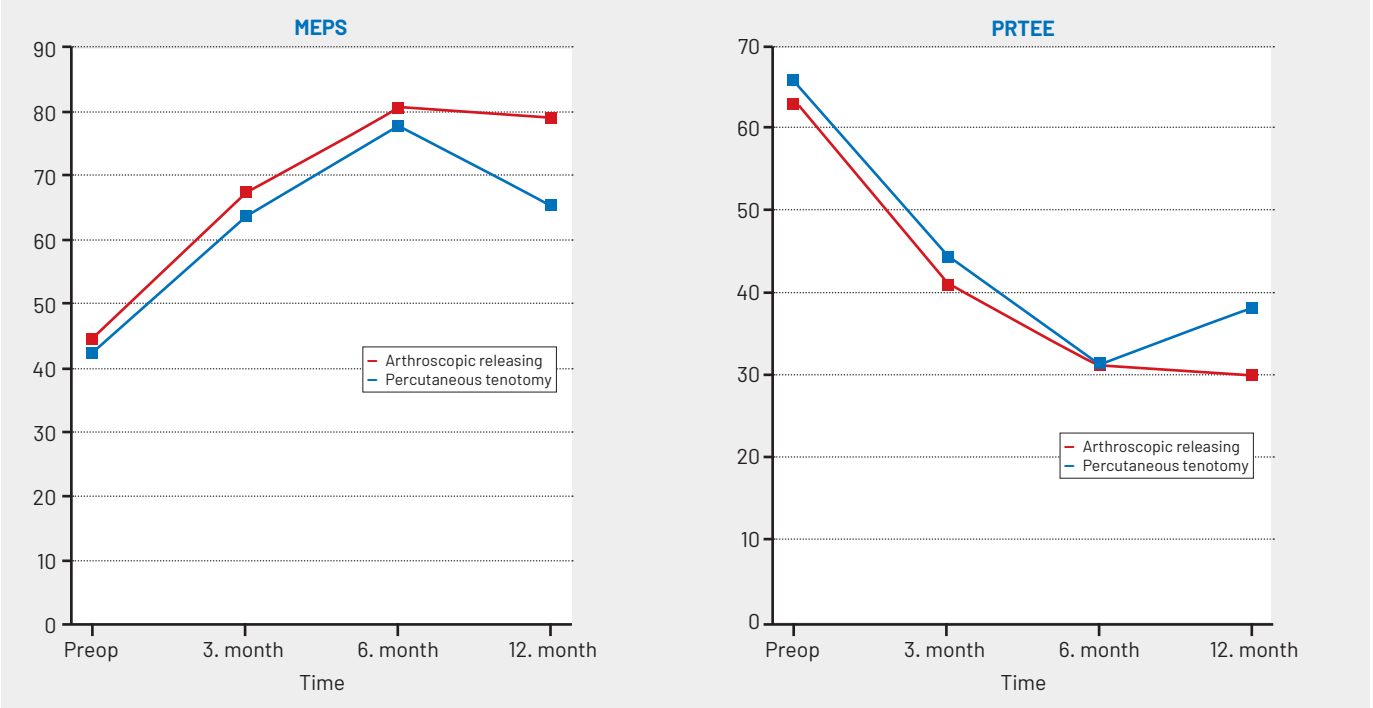

Fig. 4. **Clinical scores for arthroscopic debridement and percutaneous tenotomy groups; preoperative, 3 months, 6 months, and 12 months.**

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surgical fees.The percutaneous method provides a substantial cost advantage as it does not require preoperative preparation or hospital admission. Furthermore, the simplicity and less invasive nature of the percutaneous procedure contribute to faster recovery for patients, thereby reducing the burden on healthcare services.

DISCUSSION

This is the first study comparing 18 G needle percutaneous tenotomy with extended arthroscopic debridement. The most important finding of our study is that successful results can be achieved using the percutaneous relaxation technique with an 18 G needle. The percutaneous technique stands out due to its simplicity, short procedure time, low complication risk, and the ability for patients to return to work sooner. Comparable good results were obtained at the 3rd and 6th months compared to extended arthroscopic debridement; however, at the 12th month, the percutaneous technique showed a regression in results, whereas no regression was observed in the arthroscopic debridement group. Nonetheless, it has been determined that a higher level of success can be achieved with the percutaneous technique than with preoperative conditions.

Most patients diagnosed with lateral epicondylitis recover without the need for surgery. It has been reported that lateral epicondylitis is a self-limiting condition, and even without any treatment, symptoms may subside within a year (7). However, patients whose complaints do not improve despite various treatment methods may become unable to perform even simple daily activities, leading to socioeconomic problems. As a general approach, surgical treatment is recommended for patients with complaints lasting longer than 6 months (20). The most common complications following surgeries are wound site problems, and with the increase in patient's aesthetic concerns, there has been a growing tendency towards less invasive methods (14).

A significant portion of the literature on treating lateral epicondylitis focuses on the surgical release of the extensor tendons at the lateral epicondyle. Studies reporting more successful outcomes with arthroscopic methods compared to open surgical techniques have increased interest in arthroscopy (12). The most significant advantage of the arthroscopic method is that it allows for the evaluation and treatment of intra-articular problems. However, arthroscopic treatment requires a certain level of experience. According to the guidelines published by Savoie, a surgeon with limited experience in elbow arthroscopy should start procedures arthroscopically, and if the procedure exceeds 60 minutes, the option of open surgery should be considered (16). Additionally, the scope of the intervention to be performed during arthroscopic treatment is evaluated from various perspectives. Initially, the arthroscopic tenotomy of the ECRB (extensor carpi radialis brevis) was described, and subsequent studies have reported successful outcomes with ECRB debridement (13, 19).

Despite debridement, the persistence of symptoms in some patients led authors to speculate that residual tendinopathic tissues could contribute to poor outcomes. This has sparked an ongoing debate about the necessity of removing more pathological tissue during arthroscopic debridement of the ECRB (5). However, a study comparing traditional debridement with extended arthroscopic debridement reported similar outcomes at the end of one year (9).

For another treatment method, the percutaneous technique, various alternative methods for extensor tenotomy have been described. Under ultrasound guidance, percutaneous releases can be performed using a scalpel through a small incision or with an 18-gauge needle. It is thought that the percutaneous technique triggers an inflammatory environment by activating the coagulation cascade and releasing growth factors, which leads to tendon healing and remodeling (18). In the literature, excellent or good results reported with this procedure range between 70–94% (17). A systematic review examining percutaneous needle tenotomies analyzed six studies and suggested that it could be an alternative treatment method due to the reported successful outcomes (11).

When comparing percutaneous tenotomy to arthroscopic debridement, the estimated procedure time for percutaneous tenotomy is shorter (5–10 minutes), and the procedure can be performed under local anesthesia outside of the operating room. The fact that it does not require additional surgical expertise like arthroscopic surgeries and is technically a simpler procedure highlights the advantages of the percutaneous technique. Another advantage is the shorter return-to-work time for patients who undergo percutaneous tenotomy. Although the literature reports significantly fewer complications for both methods compared to open surgery, no complications were encountered in the cases we performed (14).

In the cost analysis of both methods, the cost of arthroscopic debridement was calculated as 36,685 TL, while the cost of percutaneous tenotomy was 8,633 TL. Similarly, a study conducted by Mayo Clinic reported that percutaneous procedures were approximately 6.5 times more cost-effective than arthroscopic procedures (15).

In our study, we observed that while both techniques produced favorable results in the first six months, the outcomes of the percutaneous technique deteriorated slightly by the 12th month. We believe this may be due to the inability to remove tendinosis tissue from the area with the percutaneous technique. Despite this, good and excellent results were achieved in a significant portion (64.7%) of patients.

Due to the short follow-up period, it remains unclear whether the decline in scores observed at the 12-month mark with the percutaneous method will continue and whether more invasive surgical interventions will be required. It should

be noted that in patients with unsuccessful outcomes from the percutaneous technique, revision surgery using the arthroscopic debridement method can be considered. The most significant limitation of our study is the small number of patients. The selection of which surgical technique to apply was not randomized or blinded; however, the potential bias was minimized by having two different surgeons apply their respective methods to the patients. More objective data could have been presented by examining grip strength and postoperative MRI results. Preoperative MRI evaluations were based on radiologists' reports, and the impact of these results on outcomes was not further assessed based on some classifications described in the literature, which represents another limitation.

CONCLUSIONS

The percutaneous release technique with an 18-gauge needle is simple, has a low complication rate and cost, and is relatively successful. It can be performed in a procedure room under local anesthesia. This technique can be considered as a primary intervention in patients with resistant lateral epicondylitis who do not respond to conservative treatments and do not require intra-articular intervention due to accompanying pathologies. ■

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