Systematic Review and Meta-Analysis

Medicine®

OPEN

# Comparison of arthroscopic debridement and open debridement in the management of lateral epicondylitis

## A systematic review and meta-analysis

Weikai Wang, MD, Jun Chen, MD, Juexiang Lou, MD, Guojian Shentu, MD, Guohong Xu, MD*

**Abstract**

**Background:** Previous studies have reported that both arthroscopic debridement (AD) and open debridement (OD) of extensor carpi radialis brevis are effective in the treatment of lateral epicondylitis. Despite this, few studies have focused on the comparative outcomes of these 2 procedures. The aim of this study was to assess whether AD is superior to OD in managing lateral epicondylitis.

**Methods:** A systematic search of the literature was conducted to identify relevant articles that were published in MEDLINE, Embase, and Cochrane Library databases during January 2019. All studies comparing the efficacy of AD and OD in terms of failure rate, complication rate, and clinical outcome measures were included. Statistical analysis was performed using Review Manager.

**Results:** Six clinical trials were included in the current meta-analysis. There was no significant difference with regard to disabilities of the arm, shoulder, and hand scores, visual analog scale, and failure rate. There was a statistically significant difference in surgical time in favor of the OD (mean difference [MD], −11.45, 95% confidence interval [CI], −12.45 to −10.44, $I^2 = 0\%$, $P < .001$). There was no significant difference of complication rate between the OD group (0.6%) and the AD group (1.0%) (MD, 0.62; 95% CI, 0.12–3.06; $P = .55$)

**Conclusion:** There was no significant difference between arthroscopic and open surgery with regards to failure rate, functional outcome score, and complication rate. The current meta-analysis found that arthroscopic surgery had a longer surgical time than open surgery for lateral epicondylitis.

**Abbreviations:** AD = arthroscopic debridement, DASH = disabilities of the arm, shoulder, and hand scores, ECRB = extensor carpi radialis brevis, NOS = Newcastle–Ottawa scale, OD = open debridement, RTW = return to work, VAS = visual analog scale.

**Keywords:** arthroscopy, debridement, extensor carpi radialis brevis, elbow, lateral epicondylitis, open

## 1. Introduction

Lateral epicondylitis, referred to as "tennis elbow," is the most common elbow disease in patients aged between 35 and 50 years old, with approximately 1% to 3% prevalence rate.[1,2] Extensor carpi radialis brevis (ECRB) is the most injured tendon of the elbow due to overuse and repetitive stress activities.[3] Although symptoms of lateral epicondylitis can resolve spontaneously after nonoperative treatment, about one in 10 patients without resolution after 6 months of onset may need surgical intervention.[4] Traditional surgical treatment involves open debridement (OD) of the ECRB origin, generally performed when symptoms cannot be released by conservative treatment such as steroid or platelet rich plasma injections and physiotherapy after 6 to 12 months. Recently, arthroscopic debridement (AD) has also become increasingly popular as a less invasive alternative to traditional OD. Some authors claimed that OD would violate the extensor aponeurosis to gain intra-articular visualization.[5,6]

Previous systematic reviews have reached different conclusion in regard to the clinical outcomes of AD and OD of ECRB. In 2007, a systematic review of 33 papers found that both OD and AD are effective for refractory lateral epicondylitis.[7] In 2017, Burn et al[8] reported a systematic review with high-level evidence to compare open and arthroscopic techniques for treating lateral epicondylitis, and they reported no clinically significant differences between open and arthroscopic techniques in terms of disabilities of the arm, shoulder, and hand (DASH) scores, pain intensity, and patient satisfaction at 1 year after surgery. In 2017, Pierce et al[9] also performed a systematic review, and they reported that there was no difference in DASH and patient satisfaction between open and arthroscopic techniques while arthroscopic approach had less pain compared with open

Editor: Johannes Mayr.

The authors have no funding and conflicts of interest to disclose.

Department of Joint and Sports Medicine, Affiliated Dongyang Hospital of Wenzhou Medical University, Dongyang, China.

* Correspondence: Guohong Xu, Department of Joint and Sports Medicine, Affiliated Dongyang Hospital of Wenzhou Medical University, No 60, Wuning Xi Road, Dongyang, Zhejiang, China (e-mail: guohongxu12@163.com).



How to cite this article: Wang W, Chen J, Lou J, Shentu G, Xu G. Comparison of arthroscopic debridement and open debridement in the management of lateral epicondylitis. Medicine 2019;98:44(e17668).

Received: 18 June 2019 / Received in final form: 5 September 2019 / Accepted: 27 September 2019

http://dx.doi.org/10.1097/MD.0000000000017668

approach. More recently, in a review in 2018, Lai et al[10] reported that arthroscopic approaches may result in faster recovery and earlier return to work (RTW). Riff et al[5] also performed an updated systematic review to compare outcomes of open and arthroscopic surgical techniques for lateral epicondylitis, and reported a greater proportion of patients were pain free in the open group than in the arthroscopic group (70% vs 60%). They recommended OD as the technique most likely to achieve a pain-free outcome. While these systematic reviews have assessed the efficacy of open and arthroscopic techniques, no studies have performed a meta-analysis on the comparative outcomes of these 2 procedures.

The purpose of the current study was to systematically review the existing literature comparing arthroscopic and open ECRB debridement techniques for lateral epicondylitis, and to perform a meta-analysis to compare their pooled effects of functional outcomes. Our hypothesis was that these studies would favor the AD with regards to clinical outcomes and complication rate comparing with the OD.

## 2. Materials and methods

### 2.1. Search strategy

Multiple comprehensive databases including PubMed, Embase, and the Cochrane Library databases were searched in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-analyses guidelines by 2 independent reviewers, with a senior author arbitrating on any disagreement.[11] No restrictions were placed on languages and dates. The detailed search strategy was as follows: (lateral epicondylitis OR tennis elbow OR ECRB) AND (surgery OR operative OR surgical OR open OR arthroscopic OR endoscopic).

The title and abstract were reviewed by 2 independent reviewers for all search results, and potentially eligible studies received a full-text review. Finally, the reference lists of the included studies and literature reviews found in the initial search were manually screened for additional articles meeting the inclusion criteria. When 2 published studies reported on the same population, the more recent study was retained.

### 2.2. Eligibility criteria

The inclusion criteria for clinical trials were as follows: English language only; clinical studies after surgical debridement or release comparing open and arthroscopic techniques, including randomized controlled trials, prospective cohort studies, retrospective cohort studies, and case series studies; at least 10 patients after debridement of ECRB for chronic tennis elbow; the mean follow-up time must be more than 12 months; and full text of studies available. The exclusion criteria were as follows: noncomparative studies; failure to report postoperative clinical or functional outcomes; review studies; cadaveric studies; biomechanical studies; surgical techniques; and studies with a follow-up period of 6 months or less.

### 2.3. Quality assessment

The Jadad scale was used to evaluate the methodologic quality of randomized studies[12] and the Newcastle–Ottawa scale (NOS) was used to evaluate the methodologic quality of nonrandomized studies.[13] The Jadad is a 5-point scale with ≥3 points considered as relatively high-quality study, and the NOS is a 9-point scale with ≥7 points graded as relatively high-quality study.[14] Each study was independently assessed by 2 authors and any disagreement was resolved by discussion.

### 2.4. Data extraction

Two blinded reviewers conducted data extraction and analysis using a predetermined data sheet. The relevant information included the following: study design, population size, population age, failure rate, postoperative functional outcomes measures, satisfaction, RTW, and follow-up time points. Failure was defined as poor outcome, or the need for further operative intervention. The functional outcomes focused on visual analog scale (VAS) score, DASH questionnaire. The detailed information of complication was also summarized.

The study was approved by the Health Sciences Institutional Review Board of Dongyang Hospital of Wenzhou Medical University.

### 2.5. Statistical analysis

All statistical analyses were performed using Review Manager 5.3 software (The Cochrane Collaboration, London, United Kingdom). Mean values were calculated for age, and follow-up time. Heterogeneity between studies was quantified using the $I^2$ statistic.[15] An $I^2$ value of $<25\%$ was chosen to represent low heterogeneity and an $I^2$ value of $>75\%$ to indicate high heterogeneity. Random effects models were used when the $I^2$ value was $>50\%$; otherwise, fixed-effects models were used. When the range was given instead of a standard deviation, the standard deviation was calculated using a previous method by Hozo et al.[16] For data with different dimensions among researches, effect measurement of standard mean difference was selected. For data unable to be merged due to inconsistent or absent data type, a descriptive analysis was performed. A $P$ value of $<.05$ was considered to be statistically significant.

## 3. Results

### 3.1. Study selection process

The initial literature search resulted in 1361 total studies. After removal of duplicates, the articles were screened for inclusion and exclusion criteria, and 58 unique studies were evaluated and full texts were assessed for eligibility. Details on screening process, inclusion criteria, exclusion criteria are shown in Figure 1. Finally, 6 clinical trials were included in this review (Fig. 1). The 6 studies included 608 patients, with 232 patients using OD and 376 patients using arthroscopic method. Of the 6 studies, 1 was mid-term studies (mean or median follow-up time was 5–10 years), 4 were short-term studies (mean or median follow-up time was less than 5 years), and 1 was unknown. The study characteristics are summarized in Table 1. The results of our meta-analysis are summarized in Table 2.[17–22]

### 3.2. Failure rate

Failures were reported in 4 studies, comprising a total of 479 patients (169 in the OD group and 310 in the AD group). The analysis showed there was no significant difference of failure rate between the OD group (5.9%) and the AD group (6.4%), and the

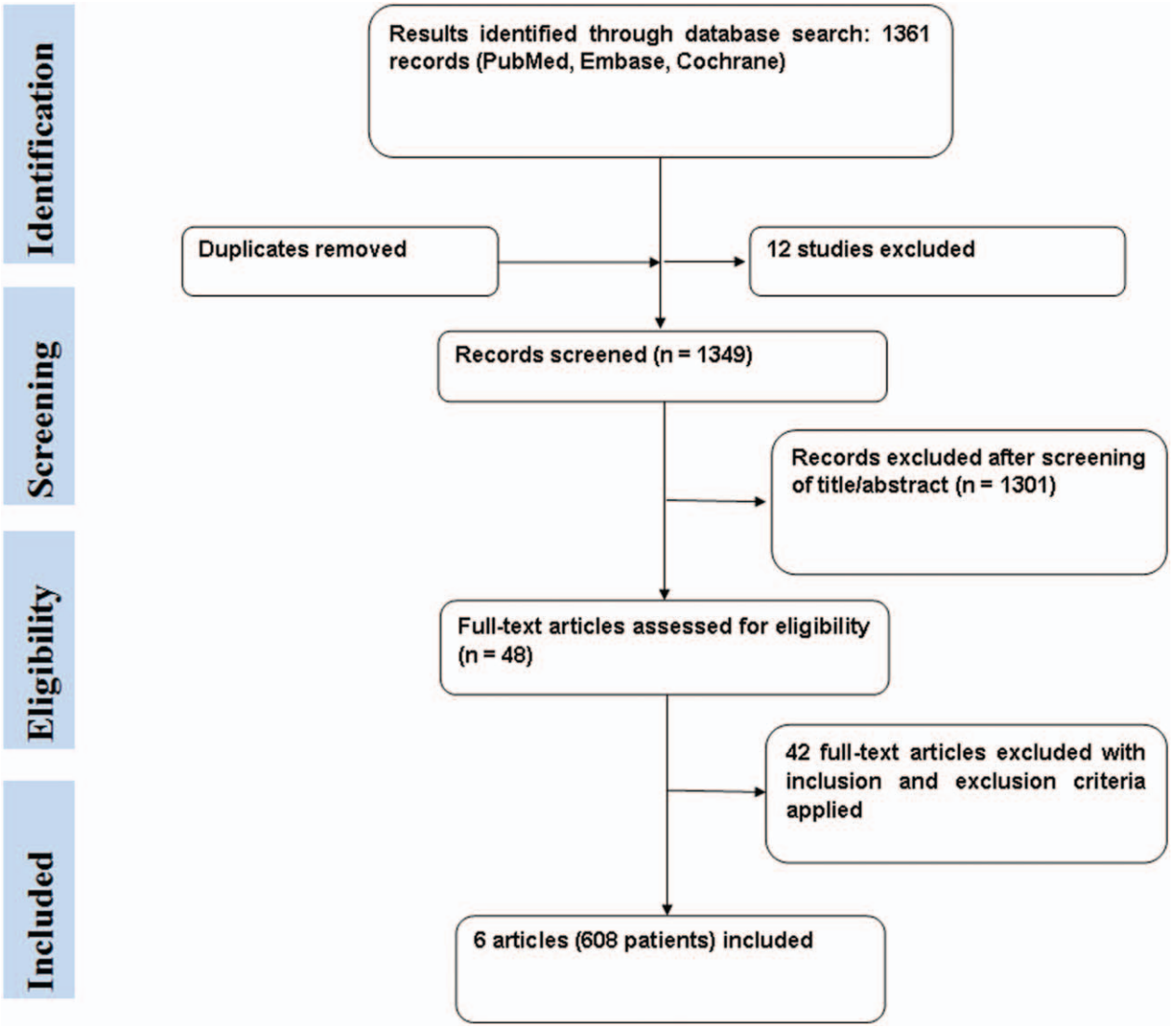


**Figure 1.** Flow chart of the literature search process.

**Table 1**

**Study characteristics.**

| Study | Study design | No. of patients | Age, yr | Sex ratio (M/F), n | Follow-up, mo | Jadad/NOS score |
|---|---|---|---|---|---|---|
| Peart et al[22] (2004) | RCS | OD: 46<br>AD: 29 | OD: 45<br>AD:45 | N/A | OD: 37<br>AD: 26 | 8 |
| Rubenthaler et al[17] (2005) | RCS | OD: 10<br>AD: 20 | OD: 54.2<br>AD: 46.8 | OD: 7/3<br>AD: 11/9 | OD: 91.5<br>AD: 93.6 | 8 |
| Szabo et al[18] (2006) | RCS | OD: 38<br>AD: 41 | OD: 46.1<br>AD: 45.5 | OD: 21/16<br>AD: 29/12 | OD: 53.5<br>AD: 47.3 | 8 |
| Solheim et al[21] (2013) | CCS | OD: 75<br>AD: 220 | OD: 46<br>AD: 46 | N/A | OD: 49<br>AD: 50 | 9 |
| Clark et al[20] (2018) | RCT | OD: 29<br>AD: 32 | OD: 46.9<br>AD: 45.6 | OD: 18/19<br>AD: 16/22 | OD: 12<br>AD: 12 | 3 |
| Kim et al[19] (2018) | RCT | OD: 34<br>AD: 34 | OD: 48<br>AD: 49 | OD: 16/18<br>AD: 12/22 | OD: 24<br>AD: 24 | 3 |

AD = arthroscopic debridement, CCS = case–control study, OD = open debridement, RCT = randomized controlled trials, RCS = retrospective cohort study.

**Table 2**

**Patient outcomes.**

| Study | Failure rate | VAS | DASH | Time of RTW, wk | Time of surgery, min | Complication rate |
|---|---|---|---|---|---|---|
| Peart et al[22] (2004) | OD: 9%<br>AD: 7% | N/A | N/A | OD: 10<br>AD: 6.8 | N/A | OD: 0<br>AD: 3.4% |
| Rubenthaler et al[17] (2005) | OD: 10%<br>AD: 5% | OD: 2.6†<br>AD: 1.95 | N/A | OD: 3<br>AD: 3.3 | OD: 27<br>AD: 36 | OD: 0<br>AD: 10% |
| Szabo et al[18] (2006) | OD: 5.3%<br>AD: 2.4% | OD: 1.2<br>AD: 1 | N/A | N/A | N/A | N/A |
| Solheim et al[21] (2013) | OD: 7%<br>AD: 4% | N/A | OD: 17.8<br>AD: 11.6 | N/A | N/A | OD: 0<br>AD: 0 |
| Clark et al[20] (2018) | N/A | OD: 30.6*<br>AD: 26.9 | OD: 22.2<br>AD: 23.5 | N/A | OD: 22.5<br>AD: 34 | N/A |
| Kim et al[19] (2018) | N/A | OD: 0.9<br>AD:1.0 | OD: 29.1<br>AD: 30.3 | OD: 5<br>AD: 3 | N/A | OD: 3%<br>AD: 0 |

AD = arthroscopic debridement, DASH = disabilities of the arm, shoulder, and hand scores, N/A = not applicable, OD = open debridement, RTW = return to work, VAS = visual analog scale.

* VAS was defined with a 5-question questionnaire with 50 items in total.

† VAS was defined with 1 for total loss of pain and 6 for intolerable pain.

risk ratio for failure was 0.89 in favor of OD (95% confidence interval [CI], 0.38–2.08; $P = .79$; $I^2 = 0$) (Fig. 2).

### 3.3. VAS pain score

Postoperative VAS pain scores were reported in 4 studies. It should be noted that different score scales were used in different studies. Rubenthaler et al[17] defined VAS with 1 for total loss of pain and 6 for intolerable pain. Szabo et al[18] and Kim et al[19] defined 0 as no pain, and 10 as worst pain reportable. Clark et al[20] defined VAS with a 5-question questionnaire with 50 items in total. All of them reported there was also no significant difference between groups. As only one study reported the mean and standard deviation, the pooled estimated mean for the postoperative VAS was not calculated.

### 3.4. DASH score

QuickDASH or DASH scores were reported in 3 studies,[19–21] which consisted of 146 patients in OD group and 292 patients in arthroscopic group. In the study by Solheim et al,[21] it was observed that the mean QuickDASH score was significantly better in the arthroscopic group (11.6 ± 15.6) than that in the open group (17.8 ± 19.4) at the median 4-year follow-up. However, the study by Clark et al[20] found that there was no significant difference of DASH score between the arthroscopic group (23.5 ± 4.1) and the open group (22.2 ± 3.8) at 1-year follow-up. Kim et al[19] found that there was also no significant difference of DASH score between the arthroscopic group (30.3 ± 4.1) and the open group (29.1 ± 18.9) at 2 years follow-up. Only the DASH results from Clark et al[20] and Kim et al[19] were pooled for analysis. The analysis showed that there was no significant difference between the OD group and the AD group (mean difference [MD], –1.29; 95% CI, –3.19 to 0.60; $P = .18$) (Fig. 3).

### 3.5. Return to work

The time of RTW after surgery was reported in 3 studies. Peart et al[22] reported that the mean time of RTW was 2.5 months for the open group vs 1.7 months for the arthroscopic group. Rubenthaler et al[17] reported that the time off work was 3.3 weeks for the endoscopic group and 3 weeks for the open treated group. Kim et al[19] reported that the mean time to RTW was 5 weeks for the open group vs 3 weeks for the arthroscopic group.

### 3.6. Time of surgery

The surgical time was reported in 2 studies. Rubenthaler et al[17] reported that the average surgery time was 36 minutes (range, 17–58 minutes) for the AD group and 27 minutes (range, 13–43 minutes) for the OD group. Clark et al[20] reported that the duration time of surgery of the AD group (34.0 ± 2.9 minutes) was significantly longer than the OD group (22.5 ± 1.3 minutes).

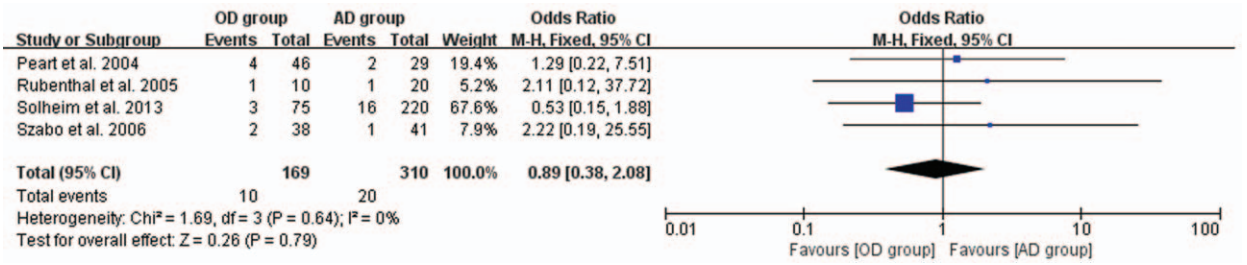


**Figure 2.** Results of aggregate analysis for comparison of failure rate between arthroscopic and open debridement of extensor carpi radialis brevis (ECRB). Numbers for "events" refers to failure; numbers for "total" refers to total participants. CI = confidence interval, M-H = Mantel–Haenszel method.

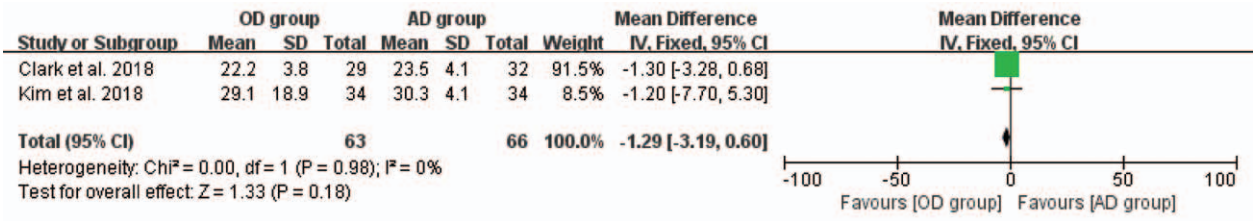


**Figure 3.** Results of aggregate analysis for comparison of disabilities of the arm, shoulder and hand score between arthroscopic debridement and open debridement of extensor carpi radialis brevis (ECRB). CI = confidence interval, IV = inverse variance.

There was a statistically significant difference of surgical time in favor of the OD group (MD; –11.45, 95% CI, –12.45 to –10.44, $I^2 = 0\%$, $P < .001$) (Fig. 4).

### 3.7. Complication

The overall complication rate was reported in 4 studies. Peart et al[22] reported 1 patient in the arthroscopic group developed a postoperative infection. Rubenthaler et al[17] reported the arthroscopic group had 1 postoperative hematoma and 1 superficial subcutaneous infection. Solheim et al[21] did not report any major complications. Kim et al[19] reported that the OD group had 1 patient with a superficial infection of the surgical wound. The analysis showed that there was no significant difference of complication rate between the OD group (0.6%) and the AD group (1.0%) (MD, 0.62; 95% CI, 0.12–3.06; $P = .55$) (Fig. 5).

## 4. Discussion

Treatment of recurrent lateral epicondylitis or tennis elbow remains challenging, which may require surgery in order to achieve pain relief and improve function. The purpose of this study was to determine whether there was a difference in outcomes between OD and AD of the ECRB by performing a systematic review of all comparative studies. The most important finding from the current study was that the arthroscopic surgery had a longer surgical time than the open surgery. In addition, there was no difference between the 2 operative techniques when examining the failure rate, VAS score, or DASH. Additionally, it was found that the complication rates were similar between the arthroscopic and the open procedure.

Previously, Cummins[23] reported that residual microscopic tendinopathy is often present after AD and residual microscopic tendinopathy. Microscopic tendinopathy correlated with poorer surgical outcomes in regard to patient's rating of their worst level of pain. Thus, there is a concern if the arthroscopic group has a poorer result compared with the open group. In this meta-analysis, we noted no significant difference of failure rate between the OD group (5.9%) and the AD group (6.4%). Here, cases with poor results were defined as failure cases. This finding indicated that the poor outcomes might not be related with the surgical modalities. There might be other factors resulting in poor outcomes.

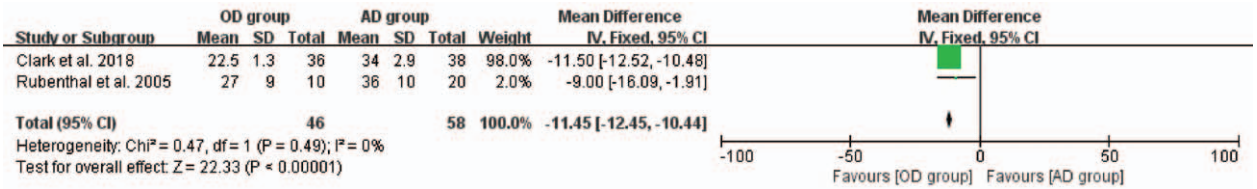


**Figure 4.** Results of aggregate analysis for comparison of surgical time between arthroscopic debridement and open debridement of extensor carpi radialis brevis (ECRB). CI = confidence interval, IV = inverse variance.

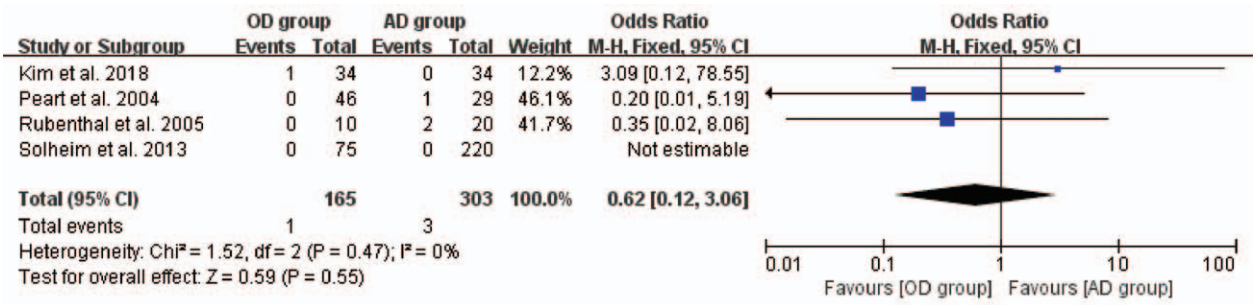


**Figure 5.** Results of aggregate analysis for comparison of complication rate between arthroscopic debridement and open debridement of extensor carpi radialis brevis (ECRB). CI = confidence interval, M-H = Mantel–Haenszel method.

Szabo et al[18] reported that failures were related to dystrophy or complex regional pain syndrome. Previously, Solheim et al[24] found that high baseline disability, sudden occurrence of symptoms, long duration of symptoms, female gender, and young age were found to be weak predictors of poor outcome. Yoon et al[25] reported that preoperative tendon status and sex were associated with dissatisfaction and poor postoperative outcomes after the arthroscopic release procedure. Recently, Guillou et al[26] analyzed the prognostic factors for lateral epicondylitis treated by arthroscopy, and they found that smoking was statistically related to a poor result and a longer follow-up time was statistically related to a good result.

The present systematic review found that there was also no significant difference of VAS between groups in each study. Moreover, the pooled analysis of DASH score showed that there was no significant difference of the DASH score between the 2 groups. In the study by Solheim et al,[21] it was observed that the mean QuickDASH score was statistically significantly better in the arthroscopic group compared with that in the open group at the median 4-year follow-up. They presumed that the possible explanation for the improved clinical outcome in the arthroscopic group (compared with the open group) was due to the large number of patients included in their study. However, the studies by Clark et al[20] and Kim et al[19] found that there was no significant difference of DASH score between groups at 1 to 2 years follow-up. As both the traditional open technique and the arthroscopic approach resulted in a good or excellent functional outcome,[27–31] it might be difficult to detect a significant difference between the 2 groups because of a ceiling effect.[21]

Regarding satisfaction, Kim et al[19] reported that the satisfaction rate was 100% in the OD group and 88% in the AD group. They presumed that unsatisfied patients might be instead unsatisfied with workers' compensation. Although results were similar for the compensated patients and noncompensated patients in the study by Peart et al,[22] it was indeed noted that the noncompenstaed patients had 18% poor rate while the compensated patients had 0% poor rate. Interestingly in the study by Szabo et al,[18] 4 patients underwent open surgery on 1 side and arthroscopic surgery on the other side and they stated that they were more satisfied with the arthroscopic procedure despite similar overall scores comparing the 2 sides. The arthroscopic group had a much smaller incision compared with the open group, which made patients feel more comfortable.

In the present review, the complication rate was very low in both groups. There was no statistically significant difference in the total complication rate between arthroscopic and open approaches. A concern raised in an arthroscopic study acknowledged the possibility of neurologic injury that may be inadvertently caused during the arthroscopic procedures.[32] In the included 6 studies, no nerve injury was reported. In a recent review documenting complications of lateral epicondylar release, Pomerantz[33] reported that the complication rate was 4.3% for open procedure and 1.1% for arthroscopic procedure. In case of higher-level studies, the complication rates were 1.3% for open procedure and 1.2% for arthroscopic procedure. In a large database with 2106 surgical cases for the treatment of lateral epicondylitis, it was found that there was no difference in overall self-reported complication rates between open (4.4%) and arthroscopic (5.5%) procedures.[34]

This study has several limitations. Firstly, the publication time of the included studies ranged from 2004 to 2018. Particularly for the arthroscopic technique, the technology can vary greatly from time to time. Considering that the ECRB is a relatively superficial extra-articular structure, technical requirements for arthroscopy are not very high. Thus, this technique difference may have a very tiny influence on patient-reported outcomes. Furthermore, there were differences in mean follow-up times among the included studies ranging from 12 to 93.6 months. Since a longer follow-up time was statistically related to a good result,[26] one could question whether outcomes would be influenced with different follow-up times. However in the study with 12 months' follow-up by Clark et al,[20] the patients had already recovered and no significant difference of functional scores was found. Thus, the influence of follow-up time may be relatively small. Finally, most of the included studies had a low level of evidence and were retrospectively conducted, thus making selection bias a possibility.

## 5. Conclusion

In this meta-analysis, we found a similar effectiveness of both AD and OD of ECRB in relieving pain and improving self-reported function in the treatment of lateral epicondylitis. There was no significant difference between arthroscopic and open surgery with regards to failure rate, functional outcome scores, and complication rate. The current meta-analysis found that arthroscopic surgery had a longer surgical time than the open surgery for lateral epicondylitis.

## Author contributions

**Conceptualization:** Weikai Wang, Guohong Xu.
**Data curation:** Weikai Wang, Jun Chen.
**Investigation:** Weikai Wang, Guojian Shentu.
**Methodology:** Jun Chen, Juexiang Lou.
**Project administration:** Weikai Wang, Guohong Xu.
**Validation:** Weikai Wang.
**Visualization:** Weikai Wang.
**Writing – original draft:** Weikai Wang.
**Writing – review & editing:** Weikai Wang, Guohong Xu.

## References

[1] Baker CLJr, Murphy KP, Gottlob CA, et al. Arthroscopic classification and treatment of lateral epicondylitis: two-year clinical results. J Shoulder Elbow Surg 2000;9:475–82.
[2] Savoie FH3rd, O'Brien MJ. Arthroscopic tennis elbow release. Instr Course Lect 2015;64:225–30.
[3] Nirschl RP, Ashman ES. Elbow tendinopathy: tennis elbow. Clin Sports Med 2003;22:813–36.
[4] Sanders TLJr, Maradit Kremers H, Bryan AJ, et al. The epidemiology and health care burden of tennis elbow: a population-based study. Am J Sports Med 2015;43:1066–71.
[5] Riff AJ, Saltzman BM, Cvetanovich G, et al. Open vs percutaneous vs arthroscopic surgical treatment of lateral epicondylitis: an updated systematic review. Am J Orthop (Belle Mead NJ) 2018;47:1–5.
[6] Burke NG, Mullett H. Arthroscopic tennis elbow release. Ann R Coll Surg Engl 2011;93:435–6.
[7] Lo MY, Safran MR. Surgical treatment of lateral epicondylitis: a systematic review. Clin Orthop Relat Res 2007;463:98–106.
[8] Burn MB, Mitchell RJ, Liberman SR, et al. Open, arthroscopic, and percutaneous surgical treatment of lateral epicondylitis: a systematic review. Hand (N Y) 2017;1558944717701244.
[9] Pierce TP, Issa K, Gilbert BT, et al. A systematic review of tennis elbow surgery: open versus arthroscopic versus percutaneous release of the common extensor origin. Arthroscopy 2017;33:1260–8.
[10] Lai WC, Erickson BJ, Mlynarek RA, et al. Chronic lateral epicondylitis: challenges and solutions. Open Access J Sports Med 2018;9:243–51.

[11] Liberati A, Altman DG, Tetzlaff J, et al. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate healthcare interventions: explanation and elaboration. BMJ 2009;339:b2700.
[12] Jadad AR, Moore RA, Carroll D, et al. Assessing the quality of reports of randomized clinical trials: is blinding necessary? Control Clin Trials 1996;17:1–2.
[13] Hurley ET, Lim Fat D, Farrington SK, et al. Open versus arthroscopic latarjet procedure for anterior shoulder instability: a systematic review and meta-analysis. Am J Sports Med 2018;47:1248–53.
[14] Xie X, Liu X, Chen Z, et al. A meta-analysis of bone-patellar tendon-bone autograft versus four-strand hamstring tendon autograft for anterior cruciate ligament reconstruction. Knee 2015;22:100–10.
[15] Higgins JP, Thompson SG, Deeks JJ, et al. Measuring inconsistency in meta-analyses. BMJ 2003;327:557–60.
[16] Hozo SP, Djulbegovic B, Hozo I. Estimating the mean and variance from the median, range, and the size of a sample. BMC Med Res Methodol 2005;5:13.
[17] Rubenthaler F, Wiese M, Senge A, et al. Long-term follow-up of open and endoscopic Hohmann procedures for lateral epicondylitis. Arthroscopy 2005;21:684–90.
[18] Szabo SJ, Savoie FH3rd, Field LD, et al. Tendinosis of the extensor carpi radialis brevis: an evaluation of three methods of operative treatment. J Shoulder Elbow Surg 2006;15:721–7.
[19] Kim DS, Chung HJ, Yi CH, et al. Comparison of the clinical outcomes of open surgery versus arthroscopic surgery for chronic refractory lateral epicondylitis of the elbow. Orthopedics 2018;41:237–47.
[20] Clark T, McRae S, Leiter J, et al. Arthroscopic versus open lateral release for the treatment of lateral epicondylitis: a prospective randomized controlled trial. Arthroscopy 2018;34:3177–84.
[21] Solheim E, Hegna J, Oyen J. Arthroscopic versus open tennis elbow release: 3- to 6-year results of a case-control series of 305 elbows. Arthroscopy 2013;29:854–9.
[22] Peart RE, Strickler SS, Schweitzer KM Jr. Lateral epicondylitis: a comparative study of open and arthroscopic lateral release. Am J Orthop (Belle Mead NJ) 2004;33:565–7.
[23] Cummins CA. Lateral epicondylitis: in vivo assessment of arthroscopic debridement and correlation with patient outcomes. Am J Sports Med 2006;34:1486–91.
[24] Solheim E, Hegna J, Oyen J. Extensor tendon release in tennis elbow: results and prognostic factors in 80 elbows. Knee Surg Sports Traumatol Arthrosc 2011;19:1023–7.
[25] Yoon JP, Chung SW, Yi JH, et al. Prognostic factors of arthroscopic extensor carpi radialis brevis release for lateral epicondylitis. Arthroscopy 2015;31:1232–7.
[26] Guillou J, Pouges C, Limousin M, et al. Arthroscopic treatment of work-related lateral epicondylitis - prognostic factors. Hand Surg Rehabil 2019;38:24–7.
[27] Oki G, Iba K, Sasaki K, et al. Time to functional recovery after arthroscopic surgery for tennis elbow. J Shoulder Elbow Surg 2014;23:1527–31.
[28] Ruch DS, Orr SB, Richard MJ, et al. A comparison of debridement with and without anconeus muscle flap for treatment of refractory lateral epicondylitis. J Shoulder Elbow Surg 2015;24:236–41.
[29] Hamlin K, Munro C, Barker SL, et al. Open release versus radio-frequency microtenotomy in the treatment of lateral epicondylitis: a prospective randomized controlled trial. Shoulder Elbow 2018;10:45–51.
[30] Baker CLJr, Baker CL3rd. Long-term follow-up of arthroscopic treatment of lateral epicondylitis. Am J Sports Med 2008;36:254–60.
[31] Coleman B, Quinlan JF, Matheson JA. Surgical treatment for lateral epicondylitis: a long-term follow-up of results. J Shoulder Elbow Surg 2010;19:363–7.
[32] Stetson WB, Vogeli K, Chung B, et al. Avoiding neurological complications of elbow arthroscopy. Arthrosc Tech 2018;7:e717–24.
[33] Pomerantz ML. Complications of lateral epicondylar release. Orthop Clin North Am 2016;47:445–69.
[34] Wang D, Degen RM, Camp CL, et al. Trends in surgical practices for lateral epicondylitis among newly trained orthopaedic surgeons. Orthop J Sports Med 2017;5:2325967117730570.