

Systematic Review

A Systematic Review of Tennis Elbow Surgery: Open Versus Arthroscopic Versus Percutaneous Release of the Common Extensor Origin

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Purpose: To compare complications, function, pain, and patient satisfaction after conventional open, percutaneous, or arthroscopic release of the extensor origin for the treatment of lateral epicondylitis. **Methods:** A thorough review of 4 databases—PubMed, EBSCOhost, CINAHL (Cumulative Index to Nursing and Allied Health Literature) Plus, and Scopus—was performed to identify all studies that addressed surgical management of lateral epicondylitis. We included (1) studies published between 2000 and 2015 and (2) studies with clearly defined surgical techniques. We excluded (1) non-English-language manuscripts, (2) isolated case reports, (3) studies with fewer than 10 subjects, (4) animal studies, (5) studies with additional adjunctive procedures aside from release of the extensor origin, (6) clinical or systematic review manuscripts, (7) studies with a follow-up period of 6 months or less, and (8) studies in which less than 80% of patients completed follow-up. Each study was analyzed for complication rates, functional outcomes, pain, and patient satisfaction. **Results:** Thirty reports were identified that included 848 open, 578 arthroscopic, and 178 percutaneous releases. Patients within each release group had a similar age (46 years vs 46 years vs 48 years; $P = .9$ and $P = .4$, respectively), whereas there was a longer follow-up time in patients who underwent surgery by an open technique (49.4 months vs 42.6 months vs 23 months, $P < .001$). There were no differences in complication rates among these techniques (3.8% vs 2.9% vs 3.9%; $P = .5$ and $P = .9$, respectively). However, open techniques were correlated with higher surgical-site infection rates than arthroscopic techniques (0.7% vs 0%, $P = .04$). Mean Disabilities of the Arm, Shoulder and Hand scores were substantially better with both open and arthroscopic techniques than with percutaneous release (19.9 points vs 21.3 points vs 29 points, $P < .001$). In addition, there was less pain reported in the arthroscopic and percutaneous release groups as opposed to their open counterparts (1.9 points vs 1.4 points vs 1.3 points, $P < .0001$). There were no differences among the techniques in patient satisfaction rate (93.7% vs 89% vs 88%; $P = .08$ and $P = .07$, respectively). **Conclusions:** Functional outcomes of open and arthroscopic releases may be superior to those of percutaneous release. In addition, patients may report less pain with arthroscopic and percutaneous techniques. Although the risk of complications is similar regardless of technique, patients may be counseled that their risk of infectious complications may be slightly higher with open releases. However, it is important to note that this statistical difference may not necessarily portend noticeable clinical differences. **Level of Evidence:** Level IV, systematic review of Level III and IV evidence.

The pathophysiology of lateral epicondylitis, commonly referred to as “tennis elbow,” is not completely understood, but histologic studies have

suggested it is caused by a failure of the inflammatory reparative mechanism of the extensor carpi radialis brevis (ECRB) due to overuse and repetitive stress activities.^{1,2} It has been reported to have a 1% to 3% prevalence rate and is most often seen in active patients aged between 35 and 50 years.³ The treatment of this condition has been highly controversial, and it has even been recommended that only patient counseling should be done for patients with this condition.⁴ The condition can often be managed with nonoperative treatment modalities such as rest, bracing, nonsteroidal anti-inflammatory drugs, physical therapy, and injections.^{1,5-7} In addition, even newer technologies that use ultrasound waves and radiofrequency probes to alleviate pain and improve function have been explored.^{1,8-10} However, patients who do not improve over a 6-month course of

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conservative therapy may benefit from surgical intervention; one method is the release of the ECRB origin.

Various techniques have been proposed to release the common extensor origin. Initially, it was performed by an open approach, first described by Nirschl and Pettrone¹¹ in 1979. Baumgard and Schwartz¹² in 1982 were the first authors to describe a percutaneous release with the patient under local anesthesia for the treatment of lateral epicondylitis. With the recent rise in the popularity of elbow arthroscopy, the use of arthroscopic techniques has also been explored for the treatment of refractory lateral epicondylitis.¹³ This was first described by Baker et al.³ in 2000 in a small case series (42 releases). Since that time, there have been a number of studies that have established this is a viable option for conditions that are chronic or refractory to nonoperative treatment.¹⁴⁻¹⁷ Furthermore, there is a great deal of controversy regarding these surgical treatment options because of not only potential outcome differences but also higher costs associated with open and arthroscopic releases as opposed to percutaneous releases.^{18,19}

There have been a number of reviews that have attempted to compare conventional open and arthroscopic releases and have reported neither technique as being clearly superior.^{20,21} In fact, there was one well-performed Cochrane review published in 2011 that was unable to show any difference in surgical treatment options.²² However, given the increase in the number of studies on ECRB release since that time, there remains a need for an updated review that will compare and analyze the outcomes of open, arthroscopic, and percutaneous releases.

Therefore, our purpose was to compare complications, function, pain, and patient satisfaction after conventional open, percutaneous, or arthroscopic release of the extensor origin for the treatment of lateral epicondylitis. We hypothesized that each surgical technique would have satisfactory outcomes and there would be no differences in these outcome measures when comparing each surgical release.

Methods

A thorough review of 4 databases—PubMed, EBS-COhost, CINAHL (Cumulative Index to Nursing and Allied Health Literature) Plus, and Scopus—was undertaken by 2 of the coauthors (T.P.P. and K.I.) to identify all studies that addressed the surgical management of lateral epicondylitis. All disputes were resolved by a third author (A.J.S.). By use of a Boolean search string, all articles published from January 2000 to December 2015 regarding this topic were identified (Table 1). Given the evolution that surgical techniques go through over time, we chose to limit the potential of this confounder by narrowing our search between 2000 and 2015. These searches yielded a total of 115 reports.

Table 1. Search Strings Used and Total Articles Found for Review

Search Strings Used	No. of Reports Found
lateral[title] AND epicondylitis[title]	115
arthroscop*[title] AND lateral[title] AND epicondylitis[title]	
lateral[title] AND epicondylitis[title] AND surgery [title] OR surgical[title] AND management[title]	
percutaneous[title] AND lateral[title] AND epicondylitis[title]	
tennis[title] AND elbow[title] AND surgery[title]	
common[title] AND extensor[title] AND release [title]	

This study was exempt from institutional review board approval.

We included (1) studies detailing outcomes of a release of the common extensor origin published between 2000 and 2015 and (2) studies with a clearly defined surgical technique for release. We excluded (1) non-English-language manuscripts, (2) isolated case reports, (3) studies with fewer than 10 subjects, (4) animal studies, (5) studies with additional adjunctive procedures aside from release of the extensor origin, (6) clinical or systematic review manuscripts, (7) studies with a follow-up period of 6 months or less, and (8) studies in which less than 80% of patients completed follow-up. On application of the exclusion criteria, 45 reports were eliminated; thus 70 remained. After review of the remaining reports, a total of 29 reports were deemed relevant for this review. Cross-referencing yielded 1 additional source (Table 2, Fig 1).

We thoroughly analyzed each report for outcome metrics of interest. We examined each study for the functional outcome questionnaire used. Among the studies, we found the Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire was the most commonly used across each technique; thus we chose to use DASH scores for analysis of differences in function. The numerical pain score used in the vast majority of studies was the visual analog scale (VAS) score; however, 1 study used the Numeric Pain Scale. However, given that this is also a 10-point pain scale, we included it for analysis. A number of studies asked their subjects if they were satisfied with the outcome of their surgical procedure, and we included these data for analysis in our outcomes.

Statistical Analysis

All of the outcome metrics of interest were pooled and tabulated in an Excel spreadsheet (Excel; Microsoft, Redmond, WA) for statistical analysis. The mean DASH and VAS scores were calculated and compared within this spreadsheet as well. GraphPad Prism statistical software (version 5.01; GraphPad Software, La Jolla, CA)

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