Clinical Outcomes of Arthroscopic Debridement for Lateral Epicondylitis with Partial Injury of the Lateral Collateral Ligament Complex

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Background: Lateral collateral ligament injuries may occur in patients with chronic lateral epicondylitis. The present study aimed to compare the clinical outcomes of arthroscopic debridement between patients with chronic lateral epicondylitis combined with a partial ligament injury and those without a ligament injury.

Methods: Between 2016 and 2018, patients who underwent arthroscopic debridement for lateral epicondylitis were evaluated. Partial injury to the lateral collateral ligament was defined as discontinuity or thinning with increased signal of the lateral ligament on magnetic resonance imaging and laxity with a firm endpoint in the varus or posterolateral rotatory stress test. Arthroscopic debridement was performed when there was no apparent instability in the stress test under fluoroscopic guidance after anesthesia. Patients with a ligament injury were compared with those without a ligament injury in terms of physical examination (varus stress test and posterolateral rotatory drawer test), pain visual analog scale, Mayo elbow performance score, and quick disabilities of the arm, shoulder and hand score.

Results: There were 38 patients in the intact ligament group and 15 patients in the partial ligament injury group. There were 23 men and 30 women, and the mean patient age was 50 years (range, 27–77 years). The mean follow-up period was 30 months (range, 24–49 months). Instability was not observed in both groups at the last follow-up, and clinical scores improved significantly after surgery. Postoperative results did not show significant difference between the two groups. One patient in the partial injury group underwent revision open debridement owing to persistent pain.

Conclusions: The clinical outcomes of arthroscopic debridement for lateral epicondylitis did not show significant differences between patients with a partial ligament injury and those without a ligament injury.

Keywords: *Elbow, Tendinopathy, Lateral epicondylitis, Instability, Arthroscopy*

Degeneration of the common extensor tendon, especially the extensor carpi radialis brevis (ECRB), is thought to be associated with symptoms of lateral epicondylitis.[1] The origin of the lateral collateral ligament and that of the ECRB are located close to each other anatomically.[2,3] Patients experiencing chronic lateral epicondylitis (CLE) may also have a ligament injury.[4,5] If a patient has risk factors for a ligament injury, such as multiple steroid injections, then ligament stability should be checked before surgery.[6]

If CLE is accompanied by apparent instability, then simultaneous ligament repair or reconstruction is required apart from debridement.[6] For CLE with an intact ligament, arthroscopic debridement can be performed.[7-9] Magnetic resonance imaging (MRI) findings suggestive of a ligament injury are often seen in CLE.[10,11] However, if there are MRI findings suggestive of instability while

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it is not apparent clinically, it remains unclear whether surgery for the ligament is necessary. Several studies have reported this ambiguous instability. Arrigoni et al.[12,13] defined this as symptomatic minor instability and performed arthroscopic ligament plication. Kniesel et al.[14] performed arthroscopic evaluation of instability, and patients with slight instability underwent ligament repair. To the best of our knowledge, no study has compared the results of arthroscopic debridement between patients with a partial ligament tear and those with an intact ligament.

The present study aimed to compare the clinical outcomes of arthroscopic debridement between CLE patients with a partial ligament injury and those without a ligament injury. We hypothesized that if CLE patients with a partial ligament injury have no apparent instability, then arthroscopic debridement alone can help achieve results comparable to those of patients without a ligament injury.

METHODS

Patient Selection
This retrospective, non-randomized, comparative study was approved by the Institutional Review Board of Samsung Medical Center (IRB No. 2020-09-062), and the need for informed consent was waived. We included consecutive patients who underwent surgery for CLE at our center between January 2016 and December 2018. Patients were diagnosed with lateral epicondylitis by clinical examination, including tenderness on the lateral epicondyle and pain with resisted wrist extension. Surgery was performed when conservative treatment such as brace and physical therapy failed to show improvement in symptoms for more than 1 year. Patients who had major instability, osteoarthritis, and history of operation in the same elbow were excluded from the study. Patients who did not undergo MRI, those who underwent open debridement, and those who were followed up for < 2 years were also excluded.

Treatment Strategy and Group Classification
Our treatment strategies are shown in Fig. 1. All patients were evaluated for a ligament injury by physical examination and MRI before surgery. We performed the varus stress test and posterolateral rotatory drawer test.[15,16] We defined normal as no difference with the other side, mild instability as mild widening (difference of ≤ 10° in varus stress test) with firm endpoint, and severe instability as apparent widening (difference of > 10° in varus stress test) or subluxation (clunk sensation in posterolateral rotatory drawer test) without an endpoint. MRI findings were evaluated in the fat-suppressed T2-weighted image of the coronal plane. Most of the patients underwent MRI 1–2 months before surgery, and 63% of the patients underwent it at our hospital. We defined ligament injury as increased signal intensity with ligament thinning or discontinuity. When a ligament injury was detected by physical examination or on MRI, the stress test was performed under anesthesia as a confirmative study. Varus stress and posterolateral rotation stress were applied under anesthesia, and fluoroscopy was performed on both the normal and affected sides. If there was a difference of ≥ 10° in the varus stress or apparent radiocapitellar joint subluxation (> 2 mm) in posterolateral stress, open debridement with ligament repair or reconstruction was performed.[6]

Physical examinations and MRI interpretations of all patients were performed the day before surgery by the surgeon (MJP). Stress test evaluation under anesthesia was also performed by the surgeon. The patients were divided into the intact ligament and partial ligament injury groups depending on the findings of physical examination, MRI, and stress test under anesthesia. The partial ligament injury group was defined as follows: (1) mild instability on physical examination, (2) ligament injury on MRI, and (3) no apparent instability in the stress test under anesthesia (Fig. 2). The intact ligament group was defined as follows:
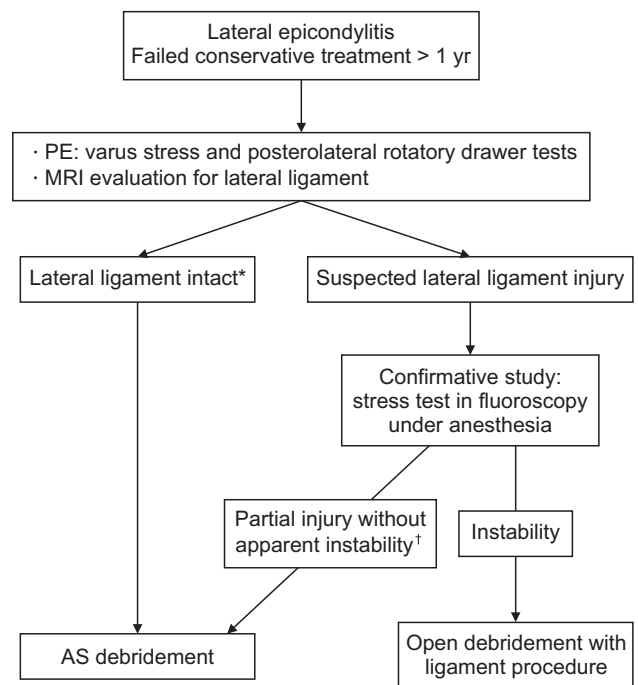

Fig. 1. Treatment strategy. PE: physical examination, MRI: magnetic resonance imaging, AS: arthroscopic. *Intact ligament group. †Partial ligament injury group.

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(1) normal findings on physical examination, (2) no ligament injury on MRI, and (3) no instability in the stress test under anesthesia (Fig. 3). Patients with only abnormal physical examination or abnormal MRI findings were not classified into either group and were excluded from the analysis in this study.

Surgical Procedure and Postoperative Rehabilitation
All surgical procedures were performed by a single surgeon (MJP). After general anesthesia induction, the stress test was performed in patients with a suspected ligament injury. When there was no apparent instability, arthroscopic debridement was performed. To perform surgery, the patient was placed in the lateral decubitus position with the arm over a bolster. After saline solution was injected through the soft spot, a proximal anteromedial portal was made. The proximal anterolateral portal was made near the origin of the ECRB. A 30° arthroscope was first introduced through the proximal anteromedial portal, and an arthroscopic shaver was then inserted through the proximal anterolateral portal. The articular capsule was removed using the shaver to expose the tendon structures. The degenerated portion of the ECRB tendon was removed using a 2.4-mm radiofrequency ablator at the bone–tendon attachment interface till healthy tendon tissue was observed, while taking care not to damage the lateral ligament.

The CLE may involve the synovial fold and induce hypertrophic changes.[17] The posterior compartment was visualized from the posterolateral portal, and debridement of the synovial plica was performed from a soft-spot portal with a motorized shaver.

The same rehabilitation protocol was used for all patients. A long-arm thermoplastic brace was used for 1–2 weeks after surgery, while active motion with tolerable pain was allowed. Two weeks postoperatively, patients were allowed to perform daily activities without a brace, as well as stretching exercises. Three months after the surgery, they were allowed to perform all other activities.

Clinical Evaluation
Preoperative and postoperative data of pain visual analog scale (pVAS), Mayo elbow performance scale, and quick disabilities of the arm, shoulder and hand (QuickDASH) score were analyzed. The clinical scores were collected by a hand fellow who was blinded to this study (NHJ). Range of motion (ROM; passive extension and flexion) was measured, and the varus stress test and posterolateral rotatory drawer test[15,16] were performed at regular follow-ups (3, 6, 12, and 24 months postoperatively) by the surgeon who performed the surgery.

Statistical Analysis
The sample size was calculated a priori as 16 patients per group based on 80% power, two-tailed significance level of 0.05, and effect size of 1.03, which had been previously
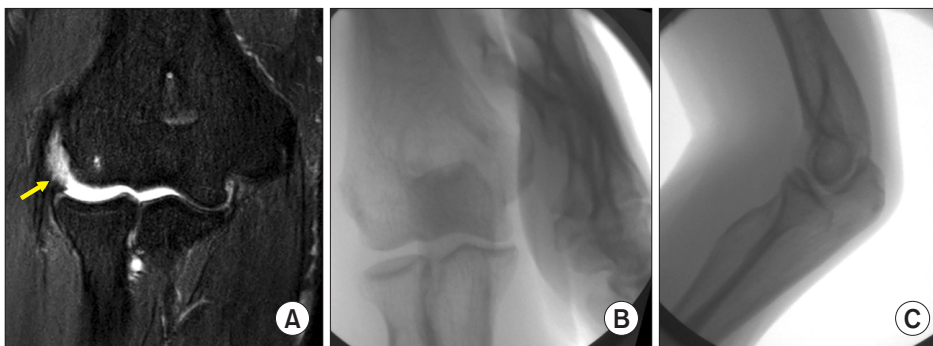

Fig. 2. (A) Fat-suppressed T2-weighted magnetic resonance imaging of a 42-year-old male patient's right elbow, showing discontinuity and signal change in the lateral ligament complex (arrow). (B, C) Mild laxity with firm endpoint was observed on physical examination, but there was no apparent instability on the stress test (B: varus stress, C: posterolateral stress) under anesthesia. The patient was included in the partial ligament injury group.
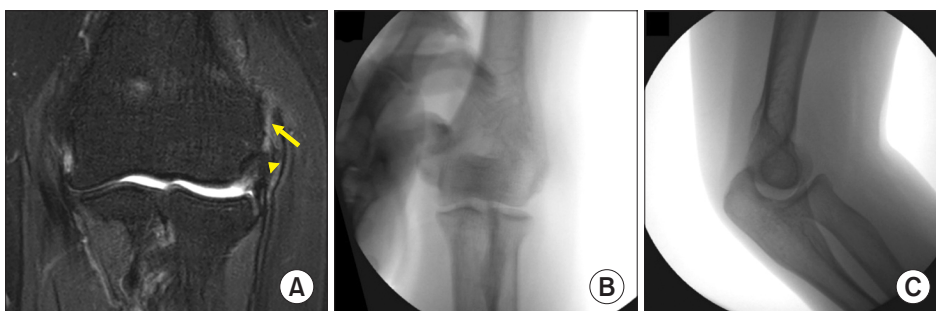

Fig. 3. (A) Fat-suppressed T2-weighted magnetic resonance imaging of a 57-year-old female patient's left elbow. Increased signal in the common extensor tendon attachment site was observed (arrow), while intact lateral ligament complex was observed (arrowhead). (B, C) There was no apparent instability on the stress test (B: varus stress, C: posterolateral stress) under anesthesia. The patient was included in the ligament intact group.

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observed with the DASH questionnaire.[18] The preoperative and postoperative values were analyzed using the Wilcoxon signed-rank test. Comparisons between the two groups were performed using independent-samples t-test or Wilcoxon rank-sum test for continuous variables and using chi-square test or Fisher's exact test for categorical variables. Sufficient statistical power (greater than 0.80)

Fig. 4. Flowchart for patient selection in the study. AS: arthroscopic, ECRB: extensor carpi radialis brevis, MRI: magnetic resonance imaging.

was required for the above comparisons. A $p < 0.05$ was considered to indicate significant difference.

RESULTS

Thirty-eight patients were included in the intact ligament group, and 15 patients were included in the partial ligament injury group (Fig. 4). Of the 53 patients, 23 were men and 30 were women. Their mean age was 50 years (range, 27–77 years), and the mean follow-up period was 30 months (range, 24–49 months). The mean radiocapitellar angle in varus stress was 4.4° (range, 2°–10°), and joint congruency was maintained in all cases in the posterolateral rotatory drawer test. Demographic characteristics of all patients are summarized in Table 1. The follow-up period of the patients in the intact ligament group was significantly longer than that of the partial ligament injury group ($p = 0.004$).

Clinical Outcomes
The preoperative and postoperative clinical scores of patients in each group are summarized in Table 2. The clinical scores improved significantly after surgery in both groups. There were no significant differences in the preoperative and postoperative clinical scores between the two groups. Data on postoperative instability and complications are summarized in Table 3. There were no instability and stiffness after surgery in both groups. In the partial ligament injury group, 1 patient underwent revision open debridement 1 year after surgery due to persistent pain.

DISCUSSION

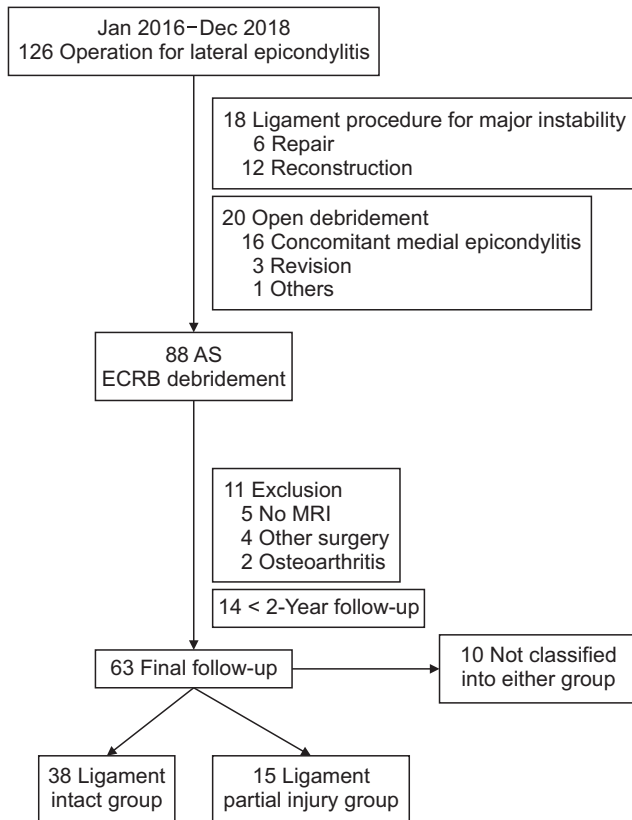Our study showed that arthroscopic debridement alone for CLE patients with a partial ligament injury obtained

Table 1. Patients' Demographic Data			
Variable	Ligament intact group (n = 38)	Ligament partial injury group (n = 15)	p-value
Sex (male : female)	16 : 22	7 : 8	> 0.999
Age (yr)	49 ± 10	54 ± 6	0.090
Follow-up period (mo)	32 ± 7	26 ± 5	0.004*
Dominant arm involvement	22 (58)	11 (73)	0.465
Symptom duration (mo)	23 ± 16	26 ± 14	0.375
Heavy labor worker	8 (21)	1 (7)	0.418

Values are presented as mean ± standard deviation or number (%).
*Statistically significant.

Table 2. Preoperative and Postoperative Clinical Data for Both Groups

Variable	Ligament intact group (n = 38)	Ligament partial injury group (n = 15)	*p*-value
pVAS			
Preoperative	6.1 ± 1.4	6.8 ± 1.4	0.137
Postoperative	1.5 ± 1.4	2.1 ± 2.0	0.236
p-value	< 0.001*	0.001*	
MEPS			
Preoperative	62 ± 10	63 ± 10	0.670
Postoperative	90 ± 10	84 ± 15	0.135
p-value	< 0.001*	0.005*	
QuickDASH score			
Preoperative	52.1 ± 19.0	58.4 ± 16.1	0.281
Postoperative	9.2 ± 8.1	18.1 ± 21.6	0.104
p-value	< 0.001*	0.002*	

Values are presented as mean ± standard deviation.
pVAS: pain visual analog scale, MEPS: Mayo elbow performance scale, QuickDASH: quick disabilities of the arm, shoulder and hand.
*Statistically significant.

Table 3. Preoperative and Postoperative Clinical Data for Both Groups

Variable	Ligament intact group (n = 38)	Ligament partial injury group (n = 15)
Postoperative instability	0	0
Revision surgery	0	1*
Postoperative stiffness (ROM decreased ≥ 10°)	0	0
Persistent pain (pVAS ≥ 4), n (%)	4 (11)	2 (13)

ROM: range of motion, pVAS: pain visual analog scale.
*Open debridement performed for persistent pain.

clinical results that were comparable to those of patients without a ligament injury. This study also showed that arthroscopic debridement without a ligament procedure did not increase instability, even with a partial ligament injury.

Instability combined with CLE may be a factor for the failure of surgical treatment for recalcitrant CLE.[19] Cha et al.[10] reported that MRI findings suggestive of a ligament injury were observed in 40% of CLE patients. Arrigoni et al.[12] reported that ligamentous patholaxity was observed in 50% of CLE patients. As findings suggestive of a ligament injury are commonly observed in CLE, the effect of ligament injury on surgical results should be evalu-

ated. Kwak et al.[11] reported that subtle instability could be detected through an examination under anesthesia. We performed a confirmative study through the stress test under anesthesia before surgery. Only those patients with instability confirmed by this study had ligament surgery. Some authors[13,14] checked instability with arthroscopic findings; however, we evaluated instability before the surgery and decided whether to perform open debridement or arthroscopic surgery.

Arthroscopic debridement has the advantage of being less invasive.[20] Soft tissues such as capsule and aponeurosis may also provide elbow stability.[21,22] This advantage of the arthroscopic method may be helpful in patients with a partial ligament injury. In a cadaveric study of Cohen et al.,[2] the extensor aponeurosis was intact and the collateral ligament origin was not violated after arthroscopic debridement. We performed debridement for the degenerative ECRB origin as much as possible until the midline of the radiocapitellar joint was reached to avoid ligament damage. Postoperative instability did not occur in the partial ligament injury group.

In our study, the partial ligament injury group showed successful results in 87% of the patients. The average pVAS and QuickDASH scores after surgery were 2.1 and 18.1, respectively. Other studies showed similar results of arthroscopic debridement for CLE without instability.[7,19,20] Clark et al.[7] reported that the average postopera-

tive pVAS and QuickDASH scores in the arthroscopic group were 2.7 and 23.5, respectively. Yoon et al.[19] reported that 82.2% of the patients were satisfied, and the average pVAS score was 0.9. In other studies[13,14], the partial ligament injury group was defined differently, and ligament surgery was performed. Arrigoni et al.[12,13] defined ligament laxity using arthroscopic findings and performed arthroscopic plication for these patients. They showed successful results in 96.3% postoperatively, and the average QuickDASH score was 9.1. However, a decrease in ROM was reported in 59% of the patients. Kniesel et al.[14] defined slight instability based on arthroscopic findings and performed open repair. They showed an improvement of 77%. We performed only arthroscopic debridement without ligament surgery for minor instability and obtained comparable results.

Preoperative tendon status and combined ligament injuries are associated with the severity of pain and postoperative outcomes.[10,19] In our study, pre- and postoperative pVAS and QuickDASH scores of the partial ligament injury group showed inferior results compared to the intact ligament group, although the difference was not significant. Previously reported minimal clinically important difference for the DASH score was 18.[18] The difference in the postoperative QuickDASH score between the two groups in our study was 9 and was thought to be not clinically meaningful. The patients in the partial ligament injury group probably had more extensive tendinosis. We might not completely remove tendinosis to protect the ligaments. Previous studies reported successful results with only simple debridement or capsule resection.[23,24] Therefore, incomplete removal of tendinosis may not be an important factor for clinical outcomes.

We performed reoperation in one female patient in the partial ligament injury group. She was 58 years old and left-handed. She had left elbow pain for 1.5 years. Preoperative pVAS and QuickDASH scores were 8 and 65.9, respectively. We performed arthroscopic debridement. At 1 year and 3 months postoperatively, the pVAS and QuickDASH scores were 6 and 77.3, respectively, and the patient continued to complain of pain. Postoperative MRI findings showed slight signal change in the ligament. No instability was observed on physical examination and stress test under anesthesia. The cause of persistent pain after surgery remains unclear. We re-opened the debridement. The final pVAS and QuickDASH scores were 3 and 20.5, respectively.

Our study has several limitations. First, it was designed as a retrospective study. Second, the number of included cases was small, which might have increased the probability of a type II error. Third, there was no long-term follow-up. Fourth, there may have been a bias in the MRI measurements. In our study, the patients were classified based on MRI findings and physical examination. MRI findings are an important factor, and other studies have reported that MRI has excellent reliability.[10] In our study, the surgeon discussed the MRI readings with the radiology department several times in case of disagreement with the radiology department readings. Fifth, the physical examination was subjective. To reduce this bias, we tried to objectively evaluate physical examination with a clear definition. For the stress test under anesthesia, the image data were objectively analyzed using fluoroscopy. Finally, there was no objective stability evaluation after surgery. We evaluated instability under anesthesia before surgery, but it was difficult to perform after surgery.

The clinical outcomes of arthroscopic debridement for lateral epicondylitis did not show significant differences between patients with a partial ligament injury and those without a ligament injury. If there is no apparent instability in patients with lateral epicondylitis combined with a partial ligament injury, comparable clinical results can be expected with arthroscopic debridement.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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