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Research Article

JOURNAL OF SURGERY AND RESEARCH

ISSN: 2640-1002

Arthroscopic Outerbridge-Kashiwagi Procedure with Endoscopic Cubital Tunnel Release: Comparison with Arthroscopic Osteocapsular Arthroplasty with Open Cubital Tunnel Release

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Abstract

Objective: The purpose of this study was to compare and analyze the clinical outcomes of arthroscopic osteocapsular arthroplasty with open cubital tunnel release and arthroscopic Outerbridge-Kashiwagi procedure with endoscopic cubital tunnel release.

Methods: The study conducted a retrospective comparative analysis of 53 cases who underwent arthroscopic elbow surgery due to elbow joint osteoarthritis. The patients were followed up for more than 1 year for observation and comparison of outcomes. Among them, the initial 35 cases underwent arthroscopic osteocapsular arthroplasty with open cubital tunnel release, while the subsequent 18 cases underwent the arthroscopic OK procedure with endoscopic cubital tunnel release. Mayo Elbow Performance Score (MEPS), Visual Analog Scale (VAS) pain scores, and range of motion (ROM). Complications such as transient nerve injury, heterotopic ossification, infection, and recurrence of stiffness were also confirmed.

Results: There was a statistically significant difference in the mean surgical time between the osteocapsular arthroplasty group (101.3 ± 34.2 min) and the arthroscopic OK procedure group (75.6 ± 27.9 min, $p<0.0001$). However, there was no statistically significant difference between the two groups in these outcome measures. After surgery, there was no statistically significant difference between the two groups in terms of complications, including transient nerve injury, heterotopic ossification, infection, and recurrence of stiffness.

Conclusion: The Arthroscopic OK procedure with endoscopic cubital tunnel release were able to reduce surgical time when compared to Arthroscopic osteocapsular arthroplasty with open cubital tunnel release.

Keywords: Elbow; Osteoarthritis; Arthroscopy; Complication

Introduction

The elbow is not a weight-bearing joint, so it is not commonly affected by osteoarthritis (OA). However, it can be observed in individuals who are hard workers, engage in repetitive arm movements, athletes involved in activities stressing the elbow joint, wheelchair users, or those who have experienced trauma resulting in post-traumatic sequelae. [1-4]. Patients with elbow OA often complain of terminal pain during elbow flexion and extension. They may also experience symptoms such as locking, stiffness, and ulnar neuropathy [5].

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Citation: Sung-Hyun Yoon, Joong-Bae Seo, Jae-Wook Jung, Jae-Sung Yoo. Arthroscopic Outerbridge-Kashiwagi Procedure with Endoscopic Cubital Tunnel Release: Comparison with Arthroscopic Osteocapsular Arthroplasty with Open Cubital Tunnel Release. Journal of Surgery and Research.7 (2024): 363-368.

Received: August 11, 2024
Accepted: July 20, 2024
Published: August 27, 2024

Yoon S, et al., J Surg Res 2024
DOI:10.26502/jsr.10020382

Osteocapsular arthroplasty is a surgical procedure performed to improve pain and range of motion (ROM) by removing loose bodies and osteophytes within the joint, along with capsular release and synovectomy. Recently, arthroscopic techniques have been employed, taking advantage of the benefits of minimally invasive approach [6-8].

Outerbridge-Kashiwagi (OK) procedure was reported in 1978, and it involves creating a hole in the olecranon fossa to remove osteophytes from the anterior and posterior aspects. Satisfactory long-term results have been reported with this technique for elbow arthroplasty [9-11]. Recently, favorable results have been reported for the OK procedure using the mini-open technique to minimize soft tissue damage [12,13]. However, There is still limited research reporting the comparison of clinical outcomes between arthroscopic osteocapsular arthroplasty and arthroscopic OK procedure.

In cases of elbow osteoarthritis, it is well-documented that there is a higher likelihood of concurrent cubital tunnel syndrome [14,15] Various surgical procedures for ulnar nerve decompression have been introduced, and recently, the endoscopic minimally invasive technique has been gaining attention for its reported satisfactory outcomes [16-18]. The endoscopic method is advantageous due to its safety, simplicity, and minimal skin incision, which can lead to a reduced surgical duration.

Therefore, the purpose of this study was to compare and analyze the clinical outcomes of arthroscopic osteocapsular arthroplasty with open cubital tunnel release and arthroscopic OK procedure with endoscopic cubital tunnel release. The hypothesis was set that arthroscopic OK procedure with endoscopic cubital tunnel release would reduce surgical time and have advantages in terms of ROM recovery.

Method

The study conducted a retrospective comparative analysis of 53 cases who underwent arthroscopic elbow surgery due to limited range of motion (ROM) caused by elbow joint OA and loose bodies. The patients were followed up for more than 2 year for observation and comparison of outcomes. Among them, the initial 35 cases underwent arthroscopic osteocapsular arthroplasty with open cubital tunnel release, while the subsequent 18 cases underwent the arthroscopic OK procedure with endoscopic cubital tunnel release. The study excluded cases with neuromuscular disease, deformation of elbow joint, infections. These cases were not included in the analysis.

Operative Technique and Rehabilitation

All surgeries were performed in the lateral decubitus position under brachial plexus block. In cases of pre-existing ulnar nerve neuropathy and when active resection of ulna side ulnohumeral joint spur is deemed necessary, endoscopic ulnar nerve decompression was performed for protection. After making a 1.5cm incision, the ulnar nerve was identified, and a tunnel entrance was created. Subsequently, decompression was carried out using the Linvatec nerve decompression kit (Linvatec, FL, USA), while visualizing the procedure through an arthroscope (Figure 1).

The anterior compartment work was initiated using the anteromedial and anterolateral portals. Anterior capsule release was performed, followed by the removal of loose bodies and spurs on the coronoid process. Protruding osteophytes on the humerus were excised. However, osteophytes within the coronoid fossa and radial fossa were left untouched, and the procedure was concluded.

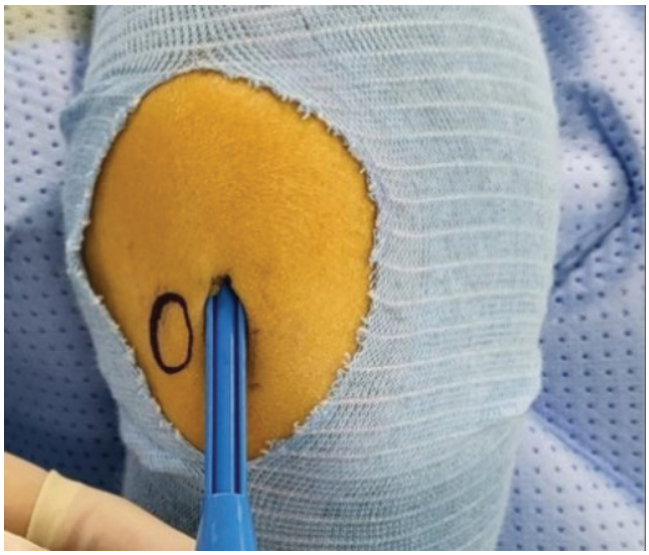

Figure 1A: The ulnar nerve was identified through a 1.5cm incision, and a tunnel entrance was created.

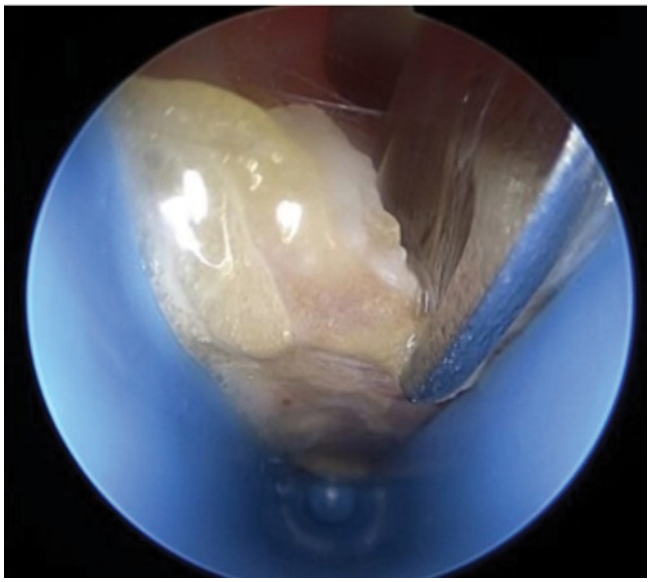

Figure 1B: Arthroscopic view of the cubital tunnel being released using the Linvatec nerve decompression kit.

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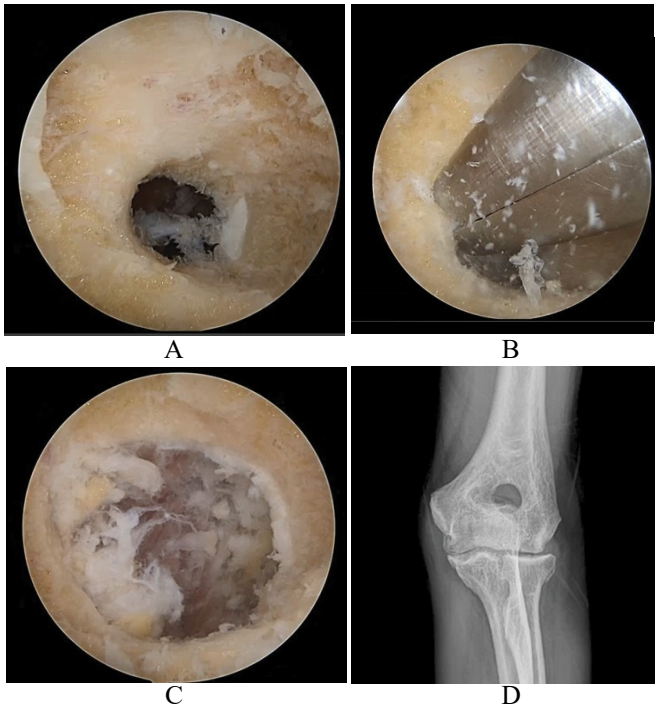

Figure 2A: A hole connecting the anterior compartment through the olecranon fossa was created using a burr. (B, C) Outerbridge-Kashiwagi procedure was performed by expanding the hole using a Kerrison rongeur. (D) Plain radiography after Arthroscopic Outerbridge-Kashiwagi procedure

For the posterior compartment work, the posterolateral portal was used as the viewing portal, while the posterior portal served as the working portal. Using a burr, the osteophyte on the olecranon was removed. A hole was then created in the center of the olecranon fossa using the burr, followed by expansion of the hole using a Kerrison rongeur, and the OK procedure was carried out (Figure 2). Range of motion (ROM) was assessed, and if flexion limitation was observed, a release of the posterior band of medial collateral ligament was performed. Once complete restoration of ROM was confirmed, the procedure was concluded (Figure 3).

Following surgery, a long arm splint was applied for one week. Subsequently, if there were no specific issues, active range of motion (ROM) exercises were initiated.

Evaluation of Results

Before the surgery and at one year post-surgery, the researchers assessed the patients' Mayo Elbow Performance Score (MEPS), Visual Analog Scale (VAS) pain scores, and range of motion (ROM). The presence or absence of ulnar nerve symptoms was assessed before surgery and two year post-surgery. Complications such as transient nerve injury, heterotopic ossification, infection, and recurrence of stiffness were also monitored and confirmed with physical exam, Nerve conduction velocity, plain radiography and CT (computed tomography).

Statistical analysis was conducted using SPSS version 25. Significance was defined as a p-value of 0.05 or less, determined through the Shapiro-Wilk test and Wilcoxon signed-rank test for the purpose of statistical evaluation.

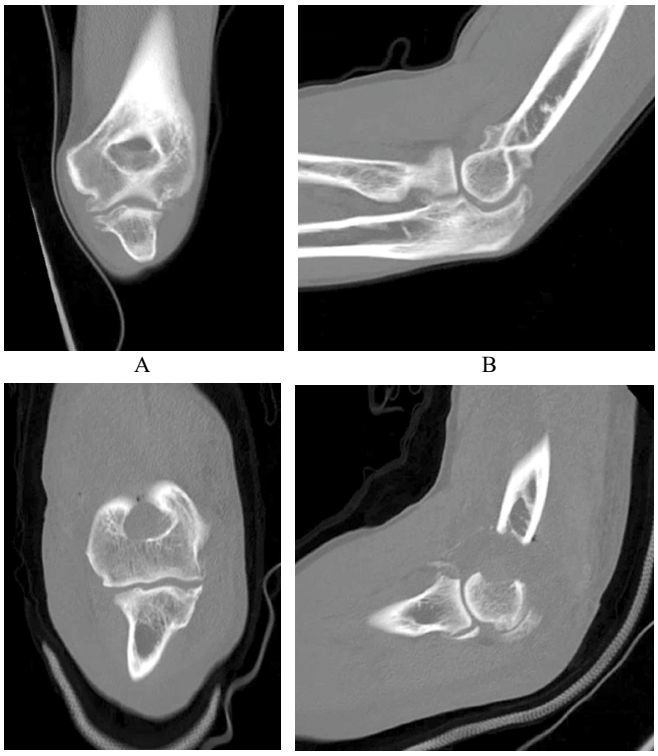

Figure 3: Satisfactory debridement results can be observed through the preoperative and postoperative CT comparisons. (A) Preoperative coronal CT view, (B) Preoperative sagittal CT view, (C) Postoperative coronal CT view, (D) Postoperative sagittal CT view.

Results

In the demographic data, there was no statistically significant difference in the prevalence of preoperative ulna nerve neuropathy between the osteocapsular arthroplasty group (37.1%) and the arthroscopic OK procedure group (33.3%). Additionally, the rates of ulna nerve decompression were not statistically significantly different between the two groups, with rates of 60.0% and 55.6%, respectively. However, there was a statistically significant difference in the mean surgical time between the osteocapsular arthroplasty group (101.3 ± 34.2 minutes) and the arthroscopic OK procedure group (75.6 ± 27.9 minutes) ($p<0.0001$, Table 1).

In both groups, there was a statistically significant improvement in VAS score, MEPS, and ROM from before to after surgery. However, there was no statistically significant difference between the two groups in these outcome measures. (Table 2)

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DOI:10.26502/jsr.10020382

After surgery, there was no statistically significant difference between the two groups in terms of complications, including transient nerve injury, heterotopic ossification, infection, and recurrence of stiffness (Table 2).

Discussion

In our research findings, the Arthroscopic Outerbridge-Kashiwagi procedure group demonstrated a statistically significant reduction in surgical time compared to the Arthroscopic osteocapsular arthroplasty group, aligning with the authors' hypothesis. However, there were no statistically significant differences observed between the two groups in terms of ROM, clinical outcomes, and complications.

Arthroscopic osteocapsular arthroplasty is widely used as an effective surgical procedure for the treatment of elbow osteoarthritis, known for its safety and its ability to improve clinical outcomes such as ROM [19-22]. However, arthroscopic osteocapsular arthroplasty requires a significant learning curve due to the need for tasks such as complete osteophyte and loose body removal, as well as contracture

Table 1: Demographic data

Variable	Arthroscopic osteocapsular arthroplasty (n=35)	Arthroscopic OK procedure (n=18)	p-value
Mean age	53.1 ± 10.4	55.6 ± 8.9	0.21
Gender (Male: Female)	31:04:00	16:02	0.18
Dominant arm: Non-dominant arm	30:05:00	15:03	0.81
Height (cm)	168.1 ± 7.2	164.8 ± 8.4	0.65
Weight (kg)	73.4 ± 10.0	72.4 ± 11.1	0.81
Body mass index	25.9 ± 2.4	26.5 ± 2.7	0.62
Smoking: Non-smoking	12:23	07:11	0.78
Preoperative ulna nerve neuropathy	13 (37.1%)	6/18 (33.3%)	0.11
Ulna nerve decompression	21 (60.0%)	10 (55.6%)	0.64
Surgical time (min)	101.3 ± 34.2	75.6 ± 27.9	<0.0001
Mean follow-up (month)	30.7 ± 5.7	29.9 ± 6.5	0.81

OK: Outerbridge-Kashiwagi

Table 2: Clinical and Radiologic outcomes

Variable	Arthroscopic Osteocapsular Arthroplasty (n=35)	Arthroscopic OK procedure (n=18)	p-value
VAS pain			
Preoperative	8.1 ± 2.3	7.9 ± 2.1	0.25
Postoperative	1.3 ± 1.0	1.4 ± 1.1	0.26
p-value	<0.0001	<0.0001	
MEPS			
Preoperative	53.2 ± 9.6	55.2 ± 8.9	0.22
Postoperative	82.9 ± 7.5	82.3 ± 8.1	0.27
p-value	<0.0001	<0.0001	
Flexion			
Preoperative	106.6 ± 22.1	104.2 ± 28.4	0.19
Postoperative	127.4 ± 13.4	126.1 ± 15.2	0.28
p-value	<0.0001	<0.0001	
Extension			
Preoperative	31.8 ± 18.2	28.1 ± 16.5	0.39
Postoperative	9.3 ± 7.2	10.1 ± 6.6	0.37
p-value	0.04	0.02	
Arc of motion			

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Preoperative	74.8 ± 29.4	76.1 ± 31.2	0.37
Postoperative	118.1 ± 10.4	116.0 ± 9.5	0.88
p-value	<0.0001	<0.0001	
Transient nerve injury (n,%)	3 (8.6%)	1 (5.6%)	0.79
Heterotopic ossification (n,%)	0	0	-
Infection (n,%)	0	0	-
recurrence of stiffness (n,%)	4 (11.4%)	1 (5.6%)	0.25

OK: Outerbridge-Kashiwagi, VAS: Visual Analog Scales, MEPS: Mayo Elbow Performance Score

release. Blonna et al. performed 502 elbow arthroscopic contracture releases, and they reported nerve injury in 5% of cases. They attributed the cause of nerve injury to prolonged surgical time [8,23,24]. Elbow arthroscopy is known as one of the surgical techniques with a long learning curve, and to minimize complications and improve clinical outcomes after surgery, achieving sufficient ROM recovery and reducing surgical time are crucial factors [8,21,25]. Kim et al. [26] reported through a systematic review of 18 studies, comprising a total of 634 cases, that the arthroscopic osteocapsular arthroplasty technique, when compared to the open technique, resulted in a less favorable ROM recovery. However, it was observed that this technique led to lower rates of postoperative complications such as stiffness due to its minimally invasive nature and contributed to a reduced need for revision surgery.

Assessing the complete debridement of the coronoid fossa, radial fossa, and olecranon fossa during arthroscopic osteocapsular arthroplasty can be challenging with the arthroscopic view alone. Even with the assistance of fluoroscopy, evaluating debridement within these fossae is difficult. The arthroscopic OK procedure offers an advantage as it connects the coronoid fossa and radial fossa through the olecranon fossa, reducing the likelihood of incomplete debridement. Furthermore, the OK procedure allows for the omission of time-consuming coronoid fossa and radial fossa debridement in the anterior compartment during the procedure. This advantage can lead to a reduction in surgical time, which is closely related to perioperative complications. Thus, it can help prevent complications associated with prolonged surgical time. Moreover, the authors were able to reduce the debridement time without the risk of iatrogenic injury by performing endoscopic ulna nerve decompression and protecting it, not only in cases of preoperative ulna neuropathy but also when osteophytes or loose bodies were present on the olecranon ulna side. We also achieved additional time savings by using small incisions.

In our research findings, both the Arthroscopic OK procedure and endoscopic cubital tunnel release contributed to a reduction in surgical time, but there were no significant differences observed in terms of ROM and complication rates between the two groups. It is important to note that the possibility of a type II error cannot be completely ruled out due to the limited number of cases for both the Arthroscopic OK procedure and endoscopic cubital tunnel release. Therefore, additional studies based on a larger sample size are warranted to further investigate these findings.

This study has several limitations. Firstly, it is a non-randomized retrospective study. Secondly, the relatively short follow-up period of one year makes it difficult to accurately evaluate complications such as stiffness recurrence. Thirdly, the limited number of cases increases the possibility of type II errors. Nonetheless, this study holds significance as it compares and analyzes the Arthroscopic OK procedure and endoscopic cubital tunnel release against the backdrop of Arthroscopic osteocapsular arthroplasty and open cubital tunnel release.

Conclusion

The Arthroscopic OK procedure with endoscopic cubital tunnel release were able to reduce surgical time when compared to Arthroscopic osteocapsular arthroplasty with open cubital tunnel release. The authors believe that these procedures facilitated easier debridement and that the reduction in surgical time is a significant result with implications for reducing perioperative complications.

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