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Open Arthrolysis for Severe Elbow Stiffness Secondary to Primary Elbow Osteoarthritis: A Retrospective Case Series of 60 Patients

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Abstract

Background

Open arthrolysis remains an important option for advanced elbow stiffness, but evidence addressing severe stiffness secondary to primary elbow osteoarthritis is limited. This study aimed to evaluate the short-term clinical outcomes and safety of open arthrolysis in this selected patient population.

Methods

This retrospective case series included 60 patients with severe elbow stiffness (flexion-extension arc 31°–60°) secondary to primary elbow osteoarthritis, treated between May 2022 and August 2025. All patients underwent open arthrolysis with osteocapsular debridement and concomitant anterior transposition of the ulnar nerve. Operative time, blood loss, drainage, hospital stay, complications, and ulnar nerve symptoms were recorded. Elbow range of motion (ROM), visual analogue scale (VAS) score, and Mayo Elbow Performance Score (MEPS) were evaluated preoperatively and at final follow-up.

Results

All patients completed follow-up, with a median follow-up duration of 8.5 months (7–11 months). The median operative time was 106 minutes (93.5–122.3 minutes), and the median intraoperative blood loss was 100 mL (50–127.5 mL). At the final follow-up, the extension deficit improved from 31.8° ± 4.0° to 6.7° ± 4.0°, flexion increased from 83.5° ± 7.0° to 112.6° ± 7.7°, and the flexion-extension arc increased from 51.7° ± 5.1° to 105.9° ± 7.6° ($P < .01$). The MEPS improved from 44.8 ± 10.1 points to 86.8 ± 9.0 points, and the VAS pain score decreased from 3 (2–4) to 1 (0–1) ($P < .01$). Among 46 patients with preoperative ulnar nerve symptoms, 28 achieved complete resolution, 13 partial resolution, and 5 no change. No symptoms worsened. Subcutaneous fluid collection occurred in 2 patients (3.3%) and resolved after conservative management. No deep infection or secondary surgery was observed.

Conclusions

Open arthrolysis with osteocapsular debridement provided favorable short-term improvements in elbow motion, pain, and function in patients with severe elbow stiffness secondary to primary elbow osteoarthritis. Concomitant ulnar nerve decompression and anterior transposition appeared to be a feasible and safe strategy in this cohort. Open arthrolysis may represent a reliable surgical option for this selected patient population.

Introduction

Primary elbow osteoarthritis is an important cause of elbow pain, restricted motion, and functional impairment. Its main pathological features include articular cartilage wear, osteophyte and loose body formation, and capsular contracture. Patients typically present with pain and progressive loss of motion, and some may develop marked elbow stiffness, which can substantially interfere with activities of daily living and upper extremity function [1–3].

In recent years, elbow arthroscopy has been increasingly used for elbow osteoarthritis because of its advantages of less soft-tissue disruption and faster postoperative recovery, and favorable outcomes have been reported in patients with mild to moderate stiffness [4, 5]. However, elbow arthroscopy is technically demanding because of the narrow working space, steep learning curve, and proximity of neurovascular structures. In patients with severe elbow stiffness secondary to primary elbow osteoarthritis, particularly those with severe capsular contracture, extensive osteophyte formation, and distorted intra-articular anatomy, adequate arthroscopic release may be difficult to achieve, and the clinical results remain less predictable [6, 7]. Expert consensus also recommends that arthroscopic treatment should be selected with caution in such cases [8].

Open arthrolysis with osteocapsular debridement allows direct visualization for extensive capsulectomy, removal of impinging osteophytes, and restoration of elbow motion. In addition, the open approach facilitates adequate exposure, decompression, and protection of the ulnar nerve throughout the procedure, which may help reduce nerve-related complications. Therefore, open arthrolysis remains a reliable surgical option for selected patients with advanced stiffness [9–11]. However, most available evidence has focused on patients with mild to moderate stiffness, and reports specifically addressing severe stiffness secondary to primary elbow osteoarthritis remain limited [12, 13]. Therefore, the purpose of this study was to evaluate the short-term clinical outcomes and safety of open arthrolysis in patients with severe elbow stiffness secondary to primary elbow osteoarthritis.

Materials and Methods

Inclusion and Exclusion Criteria

The inclusion criteria were as follows: (1) patients aged > 16 years; (2) patients with a clinical and radiographic diagnosis of primary elbow osteoarthritis with severe elbow stiffness; (3) severe stiffness defined as a flexion-extension arc of 31°–60° according to the Morrey classification of elbow stiffness [6]; (4) patients who underwent open arthrolysis and had complete follow-up data.

The exclusion criteria were as follows: (1) marked narrowing of the elbow joint space or severe osseous destruction requiring preoperative consideration of total elbow arthroplasty; (2) inflammatory or immune-mediated arthritis involving the elbow, such as rheumatoid arthritis; (3) post-traumatic elbow stiffness; (4) previous elbow fracture, dislocation, or surgery involving the affected elbow.

Patient Demographics

This was a retrospective study. According to the inclusion and exclusion criteria, 72 patients who underwent surgery between May 2022 and August 2025 were initially identified. Twelve patients were excluded because of incomplete follow-up data, leaving 60 patients for final analysis. There were 41 men and 19 women, with a mean age of 58.3 ± 7.4 years (range, 37–70 years). The right elbow was involved in 49 patients and the left elbow in 11 patients. The dominant extremity was affected in 54 patients. The median duration of symptoms was 8.0 months (interquartile range, 4–12 months). Forty patients (67%) were heavy manual laborers, 16 (27%) were skilled manual workers, and 4 (6%) were athletes.

Preoperative ulnar nerve-related symptoms were recorded, including numbness of the little and ring fingers, intrinsic muscle weakness, and muscle atrophy. In this cohort, 46 patients had preoperative ulnar nerve-related symptoms, including 1 patient who also had symptoms of median nerve compression at the wrist. These patients underwent preoperative electromyography and ultrasonography to evaluate nerve involvement and the site of compression. The baseline characteristics of the patients are shown in Table 1.

Table 1
Patient Demographics and Baseline Characteristics

Characteristics	**Value (n = 60)**
Age (years)	58.3 ± 7.4
Sex, n (%)	
Male	41 (68%)
Female	19 (32%)
Affected side, n (%)	
Right	49 (82%)
Left	11 (18%)
Dominant arm affected, n (%)	54 (90%)
Duration of symptoms (months)	8.0 (4, 12)
Ulnar nerve symptoms, n (%)	
Present	46 (77%)
Absent	14 (23%)
Follow-up duration (months)	8.5 (7, 11)

This study was approved by the Ethics Committee of Fuzhou Second General Hospital (approval No. 2026010). Written informed consent was obtained from all patients.

Surgical Technique

After anesthesia was induced, the patient was placed in the supine position, with the ipsilateral shoulder slightly elevated and the affected limb positioned across the chest. Routine skin preparation and sterile draping were performed. A tourniquet was applied to the upper arm and inflated.

A medial incision was made first. A curvilinear incision approximately 8–10 cm in length was made along the course of the ulnar nerve, centered over the medial epicondyle. The skin, subcutaneous tissue, and deep fascia were incised layer by layer. The ulnar nerve was identified at the proximal intermuscular septum, carefully released, and protected throughout the procedure. The nerve was decompressed proximally to the arcade of Struthers and distally to the Osborne ligament. The ulnar nerve was then gently retracted anteriorly. The thickened and contracted posterior and transverse bundles of the medial collateral ligament were excised. Posterior dissection was continued by elevating the triceps from the posterior capsule. The posterior capsule was excised to expose the olecranon fossa and olecranon tip, and impinging osteophytes around the olecranon fossa and olecranon tip were removed with an osteotome.

A lateral incision approximately 6–8 cm in length was then made, centered over the lateral epicondyle. After layer-by-layer dissection, the anterior compartment was accessed through a split in the common extensor origin. The anterior capsule was exposed, released, and completely excised. Osteophytes around the coronoid tip and coronoid fossa were removed with an osteotome. Through the same incision, posterolateral exposure was further developed to remove the residual posterolateral capsule and osteophytes on the lateral aspect of the olecranon. A high-speed burr was used to reshape the radial fossa, coronoid fossa, and olecranon fossa, remove residual osteophytes, and smooth the bony surfaces.

The elbow was then moved through flexion and extension to evaluate the release effect and confirm that the bony impingement had been adequately eliminated. After satisfactory release was achieved, the joint was thoroughly irrigated with normal saline. The tourniquet was deflated, and meticulous hemostasis was performed. The ulnar nerve was transposed anteriorly into a subcutaneous bed anterior to the medial epicondyle, and a new tension-free and spacious pathway was created. The nerve was confirmed to be free of twisting and tension.

Two drainage tubes were placed: the medial drain was positioned posterior to the elbow joint, and the lateral drain was positioned anterior to the elbow joint. The medial and lateral incisions were closed layer by layer, and sterile dressings were applied.

Postoperative Management and Follow-up

Postoperatively, pain control, infection prophylaxis, and measures to reduce soft-tissue swelling were routinely implemented. A systematic rehabilitation program was initiated on the first postoperative day.

Under the guidance of a rehabilitation therapist and with adequate analgesic support, patients performed active and passive elbow flexion-extension exercises several times per day. Active wrist and hand exercises were also encouraged.

Drainage volume was closely monitored, and the drainage tubes were removed when the daily drainage volume was < 30 mL. Patients were scheduled for outpatient follow-up at 1, 2, 3, 6, and 12 months postoperatively. At each follow-up, elbow range of motion, functional scores, and complications were assessed. Changes in ulnar nerve-related symptoms were recorded and classified as complete resolution, partial resolution, unchanged, or worsened.

Before discharge and during outpatient follow-up, patients were instructed to perform elbow rehabilitation exercises and self-assessment of elbow range of motion, including standardized limb positioning and angle measurement. These instructions were provided to facilitate subsequent telephone follow-up for range-of-motion recording and functional assessment.

Outcome Measures

Outcome Measures
Operative time, intraoperative blood loss, postoperative drainage volume, duration of drainage, and length of hospital stay were recorded. Perioperative complications and reoperations, such as wound infection and secondary surgery, were also documented.

Functional outcomes were evaluated preoperatively and at the final follow-up. The assessed parameters included the visual analogue scale (VAS) for pain, elbow flexion-extension range of motion, including extension deficit, flexion, and flexion-extension arc, the Mayo Elbow Performance Score (MEPS), and subjective improvement in ulnar nerve-related symptoms. Ulnar nerve-related symptoms were classified as complete resolution, partial resolution, unchanged, or worsened.

Statistical Analysis

All statistical analyses were performed using SPSS software, version 26.0 (IBM, Armonk, NY, USA). The Shapiro-Wilk test was used to assess the normality of continuous variables. Normally distributed continuous variables are presented as means ± standard deviations, and preoperative and postoperative values were compared using the paired-samples t test. Non-normally distributed continuous variables are presented as medians with interquartile ranges, M (Q1, Q3), and preoperative and postoperative values were compared using the nonparametric Wilcoxon signed-rank test. Categorical variables are expressed as numbers and percentages, n (%). All tests were two-sided, and a P value < .05 was considered statistically significant.

Results

All patients underwent surgery successfully and completed follow-up. The median follow-up duration was 8.5 months (7–11 months). Regarding perioperative data, the median operative time was 106 minutes (93.5–122.3 minutes), and the median intraoperative blood loss was 100 mL (50–127.5 mL). Anterior transposition of the ulnar nerve was performed in all patients (60 patients, 100%). The median postoperative drainage volume was 152 mL (94–210 mL), the median drainage duration was 4 days (3–5 days), and the median length of hospital stay was 7 days (6–9 days).

At the final follow-up, elbow motion and function had significantly improved compared with preoperative values. The extension deficit improved from 31.8° ± 4.0° preoperatively to 6.7° ± 4.0° at the final follow-up, flexion increased from 83.5° ± 7.0° to 112.6° ± 7.7°, and the flexion-extension arc increased from 51.7° ± 5.1° to 105.9° ± 7.6° ($P < .01$). The MEPS improved from 44.8 ± 10.1 points to 86.8 ± 9.0 points, and the VAS pain score decreased from 3 (2–4) to 1 (0–1) ($P < .01$).

At the final follow-up, among patients with preoperative ulnar nerve-related symptoms, complete resolution was observed in 28 patients, partial resolution in 13 patients, and no change in 5 patients. No patient experienced worsening of ulnar nerve-related symptoms. In the patient with both preoperative ulnar nerve symptoms and median nerve compression symptoms at the wrist, partial resolution of symptoms at both sites was observed at the final follow-up.

Regarding complications, subcutaneous fluid collection occurred in 2 patients (3.3%) and resolved after conservative management. No deep infection or secondary surgery was observed (Tables 2 and 3).

Table 2
Perioperative Data and Surgical Outcomes

Variables	Value
Operative time (min)	106 (93.5, 122.3)
Intraoperative blood loss (mL)	100 (50, 127.5)
Anterior transposition of ulnar nerve, n (%)	60 (100%)
Changes in ulnar nerve symptoms, n (%) (n = 46)	
Complete resolution	28 (60.9%)
Partial resolution	13 (28.3%)
No change	5 (10.9%)
Worsening	0 (0%)
Postoperative drainage volume (mL)	152 (94, 210)
Drainage duration (days)	4 (3, 5)
Length of hospital stay (days)	7 (6, 9)
Complications, n (%)	
Subcutaneous fluid collection	2 (3.3%)
Deep infection	0 (0%)
Revision surgery	0 (0%)

Table 3
Comparison of Preoperative and Last Follow-up Clinical Outcomes

Clinical Variables	Preoperative	Last Follow-up	t / Z value	P value
Extension deficit (°)	31.8 ± 4.0	6.7 ± 4.0	34.909	< 0.01
Flexion angle (°)	83.5 ± 7.0	112.6 ± 7.7	-26.304	< 0.01
Range of motion (ROM, °)	51.7 ± 5.1	105.9 ± 7.6	-51.635	< 0.01
MEPS score	44.8 ± 10.1	86.8 ± 9.0	-38.652	< 0.01
VAS score	3 (2, 4)	1 (0, 1)	-6.788	< 0.01
Note: Continuous variables with normal distribution (Extension deficit, Flexion angle, ROM, and MEPS) were compared using the paired-samples t-test (t value). Non-normally distributed variables (VAS score) were compared using the Wilcoxon signed-rank test (Z value).				

Discussion

The present study showed that open arthrolysis improved elbow motion, relieved pain, and enhanced elbow function in patients with severe elbow stiffness secondary to primary elbow osteoarthritis. In this cohort of 60 patients, the flexion-extension arc increased from 51.7° preoperatively to 105.9° at the final follow-up, with a mean improvement of 54.2°. The MEPS improved from 44.8 to 86.8 points, and the VAS pain score decreased from 3 (2–4) to 1 (0–1). Meanwhile, severe perioperative complications were uncommon. Only 2 patients developed subcutaneous fluid collection, which resolved after conservative management, and no deep infection or secondary surgery was observed. These findings suggest that open arthrolysis may be an effective and safe short-term treatment option for patients with severe elbow stiffness secondary to primary elbow osteoarthritis.

The mean preoperative flexion-extension arc in the present study was only 51.7°, indicating severe stiffness. In such patients, extensive osteophyte formation around the olecranon fossa, coronoid fossa, and radial fossa often causes marked mechanical impingement. Open arthrolysis allows thorough removal of osteophytes and contracted soft tissues under direct visualization. In addition, the osteophytes around the olecranon fossa, coronoid fossa, and radial fossa can be precisely reshaped or contoured, thereby more completely eliminating bony impingement. Furthermore, open arthrolysis is a well-established and reproducible procedure. Xiao et al. [14] reported arthroscopic arthrolysis in 50 patients with elbow osteoarthritis and severe elbow stiffness. In their study, the mean preoperative motion arc was 36.5°, which improved to approximately 113° at the final follow-up, and the mean MEPS was approximately 87.5 points. However, the mean operative time was 222 minutes, and complications included 1 case of brachial vein injury and 2 cases of fluid extravasation. In contrast, the median operative time in the present study was 106 minutes, suggesting that the open technique may provide acceptable procedural efficiency in this cohort.

Elbow arthroscopy has the advantages of less soft-tissue disruption and faster recovery, and some studies have reported lower complication rates in selected patients. So et al. [15] reported 56 patients with elbow osteoarthritis who underwent arthroscopic osteophyte removal and capsular release. The mean elbow motion arc improved from 89.4° preoperatively to 111.7° at the final follow-up, with a mean gain of 22.3°, indicating that arthroscopy can effectively remove osteophytes, release the contracted capsule, and improve elbow function. However, previous review studies have shown that the mean preoperative motion arc in arthroscopic cohorts was approximately 97.2°, which was generally greater than that in open cohorts, approximately 73.3° [16]. This finding suggests that patients included in previous arthroscopic studies often had relatively milder motion restriction. In patients with primary elbow osteoarthritis and severe elbow stiffness, marked bony impingement, limited working space, and extensive capsular adhesion may substantially increase the technical difficulty of achieving adequate arthroscopic release. Therefore, the indications for arthroscopic treatment should be carefully selected in this patient population [17, 18].

Patients with elbow osteoarthritis commonly present with medial osteophyte formation, local narrowing of the cubital tunnel, and perineural soft-tissue scarring, which may result in compression or restricted gliding of the ulnar nerve. In patients with severe elbow stiffness, postoperative improvement in motion

is usually substantial. As a result, the ulnar nerve, which has adapted to the preoperative contracted position, may suddenly be subjected to greater traction and gliding demands after surgery, potentially inducing or aggravating nerve irritation. Therefore, some authors have recommended concomitant ulnar nerve decompression, and transposition when necessary, in patients with preoperative ulnar nerve symptoms or in those expected to have a large postoperative gain in motion, to reduce the risk of delayed-onset ulnar nerve irritation [19, 20]. In the present study, 46 of 60 patients (76.7%) had preoperative ulnar nerve-related symptoms, and all patients underwent concomitant anterior transposition of the ulnar nerve. At the final follow-up, complete resolution was observed in 28 patients, partial resolution in 13 patients, and no change in 5 patients; no patient experienced symptom worsening. In addition, no patient required secondary surgery for ulnar nerve-related symptoms. These findings suggest that concomitant ulnar nerve decompression and anterior transposition is a feasible and safe strategy for patients with primary elbow osteoarthritis and severe elbow stiffness.

Limitations

This study has several limitations. First, no arthroscopic control group was included; therefore, direct comparisons between open and arthroscopic procedures in terms of clinical outcomes and complications could not be performed. Second, this was a single-center retrospective study without randomization, and selection bias may have been present. Third, the sample size was relatively small, which limited the statistical power for detecting low-incidence complications. In addition, the follow-up duration may not have been sufficient to fully evaluate long-term outcomes, such as recurrence of stiffness, progression of heterotopic ossification, and delayed-onset ulnar nerve symptoms. Future multicenter, prospective comparative studies with longer follow-up and standardized rehabilitation protocols are needed to further validate the effectiveness of open arthrolysis in this patient population.

Conclusion

In conclusion, open arthrolysis with osteocapsular debridement provided favorable short-term outcomes in patients with severe elbow stiffness secondary to primary elbow osteoarthritis. Its clinical value lies in allowing sufficient removal of impinging osteophytes and excision of the contracted capsule under direct visualization, while also enabling concomitant ulnar nerve decompression and anterior transposition. These procedures can significantly improve elbow motion, relieve pain, and restore elbow function. Therefore, open arthrolysis may represent a reliable surgical option for this patient population.

Declarations

Ethics approval and consent to participate

Institutional Review Board approval was received from the ethics committee of Fuzhou Second General Hospital (approval No. 2026010) and all consents were signed to participate and publish.

Consent for publication

Written informed consent for publication of the clinical data and images was obtained from the patients.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare no competing interests.

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Author contributions

GF contributed to study design, data interpretation, and manuscript drafting. SW, XH, BJ, and QL contributed to data collection and analysis. RL and FL contributed to surgical treatment, study supervision, and manuscript revision. All authors read and approved the final manuscript.

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Figures



Figure 1

A 60-year-old male logger presented with recurrent right elbow pain and restricted mobility for 14 months. Preoperative radiographs (A, B) and computed tomography (CT) images (C–F) demonstrated osteoarthritic changes of the right elbow with extensive osteophyte formation and bony impingement in the olecranon, coronoid, and radial fossae. Preoperative clinical photographs (G, H) showed severe elbow stiffness: extension deficit, 51°; flexion, 105°; and total range of motion (ROM), 54°. The

preoperative MEPS was 50, and the VAS score was 4. Open arthrolysis was performed to debride the osteophytes and contracted joint capsule (I), followed by burring of the radial, coronoid, and olecranon fossae to eliminate the bony blocks (J–N). Clinical photographs at the 3-month follow-up (O, P) demonstrated restored elbow ROM: extension, 13°; flexion, 122°; and total ROM, 109°. The postoperative MEPS and VAS score improved to 100 and 0, respectively.



Figure 2

A 63-year-old male quarry worker presented with recurrent right elbow pain and restricted mobility for 6 months. Preoperative radiographs (A, B) and computed tomography (CT) images (C–E) demonstrated osteoarthritic changes of the right elbow with extensive osteophyte formation and bony impingement in the olecranon, coronoid, and radial fossae. Preoperative clinical photographs (F, G) showed severe elbow stiffness: extension deficit, 36°; flexion, 74°; and total range of motion (ROM), 38°. The preoperative MEPS was 55, and the VAS score was 3. Open arthrolysis was performed to debride the osteophytes and contracted joint capsule (H), followed by burring of the radial, coronoid, and olecranon fossae to eliminate the bony blocks (I–N). Clinical photographs at the 6-month follow-up (O, P) demonstrated restored elbow ROM: extension, 0°; flexion, 125°; and total ROM, 125°. The postoperative MEPS and VAS score improved to 100 and 0, respectively.