Journal of Arthritis
ISSN: 2167-7921

Nobuta et al., J Arthritis 2016, 5:2
DOI: 10.4172/2167-7921.1000196

Research Article Open access

Long-term Results of Ulnohumeral Arthroplasty for Symptomatic Elbow Osteoarthritis

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Rec date: March 14, 2016; **Acc date:** April 07, 2016; **Pub date:** April 16, 2016

Abstract

Objective: Symptomatic elbow osteoarthritis with painful limitation of motion requires surgical treatment. The purpose of this retrospective study was to assess the long-term results of open ulnohumeral arthroplasty (UHA) and to investigate the factors influencing results.

Methods: Twenty-two elbows from 20 patients were evaluated after a mean follow-up of 82 months. The patients included 19 men and a woman with a mean age of 56 years. All patients had been complaining of motion pain and loss of flexion-extension arc of the elbow before surgery. The preoperative radiographs were graded with a point system, and preoperative evaluations and the outcomes at follow-up were assessed using the Mayo Elbow Performance Score (MEPS).

Results: At the final follow-up evaluation, ten elbows had no motion pain and 11 others had decreased pain. The average preoperative flexion-extension arc improved from 89° to 104° postoperatively ($p<0.001$). MEPS improved from 69 to 85 ($p<0.001$). The results were excellent in 10 elbows, good in 10, fair in two and there were no poor cases. Patients' satisfaction showed that 17 elbows had a satisfactory result, and 5 had an unsatisfactory result. The preoperative radiographic score and flexion-extension arc were factors for predicting postoperative results.

Conclusions: The UHA was effective in reducing pain and increasing the range of motion for symptomatic elbow osteoarthritis after a mean follow-up of 82 months.

Keywords: Arthroplasty; Elbow; Osteoarthritis; Ulnohumeral joint; Functional result; Long-term; Radiohumeral joint

Introduction

Elbow osteoarthritis is most commonly caused by hard use of the arm. When patients are dissatisfied with conservative treatments including anti-inflammatory drugs, physical therapy, and splinting, surgical treatment is indicated. The authors began to employ ulnohumeral arthroplasty (UHA, Outerbridge-Kashiwagi's method) [1] for symptomatic elbow osteoarthritis, and reported that 23 of 28 patients had satisfactory results at a mean follow-up of 18 months [2]. The purpose of the present retrospective study was to assess the long-term functional results and to determine the factors influencing the outcome.

Patients and Methods

Between 1999 and 2010, 174 elbows from 160 patients with primary osteoarthritis underwent open ulnohumeral arthroplasty, and twenty-two elbows from 20 patients were followed up for 60–160 months (mean, 82 months). A number of patients were lost to follow-up because of the inability to locate them (128), and 12 patients refused participation. Nineteen patients (2 bilateral) were men and one was woman. Their average age was 56 years (26 to 73 years old) at the time of surgery. Demographic data of these patients are shown in Table 1.

Characteristic		Data
Number		22 elbows from 20 patients
Mean age (range)		56 yrs (26-73 yrs)
Gender (M/F)		19/1
Employment	Manual worker	15 (75%)
	Office worker	4 (20%)
	Unemployed	1 (5%)
Mean duration of symptom (range) (SD)		71 mos (4-280 mos) (72)
Follow up period (range) (SD)		82 mos (60-160 mos) (30)
yrs = years, mos = months, SD = standard deviation.		

Table 1: Demographic data.

Fifteen patients with 17 elbows (2 bilateral) were employed in jobs involving hard use of the arm (manual workers including 6 farmers, 4 carpenters, 2 mechanics, one pipe fitter, seaman, and truck driver), 4 patients were office workers and one was unemployed. Twenty elbows involved the dominant arm, and 2 involved the non-dominant arm.

Before surgery, 14 elbows had pain at terminal range of motion and 8 elbows had continuous elbow pain regardless of motion. The mean duration of symptoms was 71 months (range, 4–280 months). Extension, flexion, pronation, and supination were measured by a goniometer. One of the authors (Nobuta) and the other orthopaedist measured the range of motion. Twenty elbows had a more than 10 loss of extension, and 18 had flexion limited to less than 120°. The average arc of flexion-extension before surgery was 19° to 108° (Table 2).

Finding	Preoperative	Postoperative	p Value
Mean MEPS (range) (SD)	69 (55-75) (7)	85 (60-100) (11)	< 0.001
Flexion-extension arc	19° -108°	17°-121°	< 0.001
Radiograph score (range) (SD)	6.1 (4-8) (1.1)		
SD = Standard deviation.			

Table 2: Preoperative and postoperative clinical findings.

Informed consent was obtained from all patients. The Mayo Elbow Performance Score (MEPS) [3] was used to evaluate elbow condition. MEPS use a 100-point rating system. The MEPS composed of 4 categories: pain (45 points), motion (20 points), stability (10 points) and function (25 points). Evaluation of elbow function is classified as excellent (>90 points), good (75 to 89 points), fair (60 to 74 points) or poor (<60 points). The mean preoperative MEPS score was 69 points (range, 55-75). The patients' satisfaction was assessed by asking them how they felt at the time of follow-up compared with how they felt before surgery, and was graded as "much better or better" (satisfactory), or "unchanged or worse" (unsatisfactory) [4]. One of the authors (S. Nobuta) and the other orthopaedist evaluated elbow condition and assessed the patients' satisfaction.

The preoperative radiographs were graded with a point system, with scores ranging from 0 (normal) to 9 (very severe) [5]. Points were allocated as follows: olecranon osteophyte, coronoid osteophyte (lateral radiograph), or loose body present (1 point for each) and presence of ulnohumeral or radiohumeral joint narrowing (antero-posterior radiograph) (>2 mm = 1 point, 1-2 mm = 2 points, and <1 mm = 3 points). One of the authors (S. Nobuta) and the other orthopaedist evaluated radiographs. Before surgery, olecranon and coronoid osteophytes were seen in all 22 elbows, loose bodies in 16 (73%), narrowing of the ulnohumeral joint in 22, and narrowing of the radiohumeral joint in 21. The mean preoperative radiographic score was 6.1 (range, 4-8) (Table 2).

The surgical technique of ulnohumeral arthroplasty is the same as the original technique [1]. A mid-posterior longitudinal skin incision was made from the olecranon to the distal arm, the triceps muscle and posterior joint capsule were split (Figure 1A), loose bodies were removed, the tip and osteophytes of the olecranon were excised, and a hole 15 to 17 mm in diameter was created through the olecranon fossa and the coronoid fossa using an air drill. The osteophytes of the coronoid process were removed with a chisel through the opened hole with the elbow flexed (Figure 1B). The arc of flexion-extension of the elbow was confirmed to be at least 10° to 125° after surgery. Twelve elbows from 10 patients, which had ulnar nerve symptoms with intrinsic paralysis, also had the surgery of anterior transposition of the ulnar nerve (5 elbows) or simple decompression of the ulnar nerve (7 elbows). A suction drain was kept in place, and the triceps and the skin were closed. A plaster splint kept the elbow at 90° of flexion for one day after which the suction drain was removed and active exercise was started. Active and assisted flexion-extension exercises of the elbow were begun under the supervision of a physiotherapist, and discontinued when the patient was discharged from the hospital in 10 days. Outpatient's rehabilitation was continued twice a week for more 4 weeks.

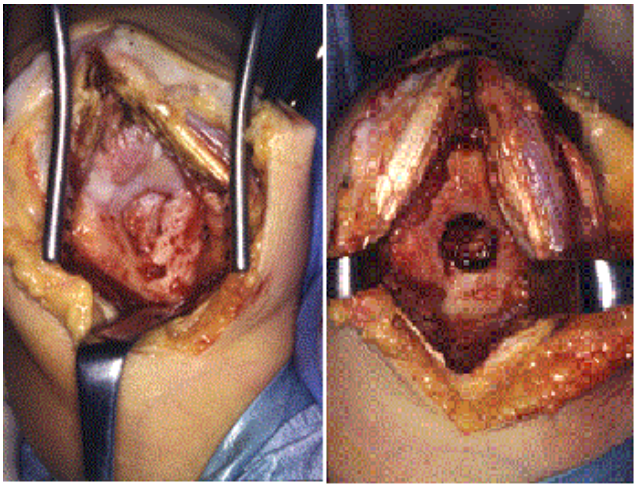

Figure 1: Intra-operative view. Osteophytes on the olecranon fossa and olecranon (A), hole through the olecranon fossa to the coronoid fossa (B).

The differences between the pre- and post-operative outcome for the range of motion and evaluation scale were analyzed with the Student's t-test for paired samples. A P-value less than 0.05 were considered statistically significant.

Results

At the final follow-up evaluation, there was no pain in 10 elbows and decreased pain in 12 elbows compared to preoperative pain. The average postoperative MEPS pain score was 35 points, which was an improvement of 7 points compared to the preoperative score. Flexion improved in 19 elbows, remained unchanged in 2, and decreased in one with a mean improvement of 13°. Extension improved in 11 elbows, remained unchanged in 7, and decreased in 4 with a mean improvement of 2°. The average postoperative flexion-extension arc was 17° to 121° ($p<0.001$, Table 2). The average preoperative pronation-supination arc 81° to 84° became 83° to 86° postoperatively without any significant improvement. MEPS's average postoperative function score was 23 points and improvement was 7 points compared to the preoperative score. MEPS's total score improved from 69 (range, 55-75) to 85 (range, 60-100) ($p<0.001$). MEPS's objective result was excellent in 10 elbows (45%), good in 10 (45%), fair in 2 (10%) and there were no poor cases.

Of 15 manual workers and 4 office workers, 11 (58%) returned to their previous job or an equivalent job within a mean of 2 months after the surgery. Patients' satisfaction showed that 17 elbows from 16 patients (77%, 10 excellent and 7 good) had a satisfactory result, and 5 elbows from 4 patients (23%, 3 good and 2 fair) had an unsatisfactory result because of residual pain or limited range of motion. We did not have infections, distal humerus fracture, ulnar nerve or vascular complications in this series.

Age, duration of symptoms, and follow-up period had no correlation with patients' satisfaction (Table 3). The mean preoperative radiographic score for elbows with satisfactory results was 5.8, while that for unsatisfactory elbows was 7.2 ($p<0.01$). For elbows with unsatisfactory results, preoperative radiographic scores were large because of marked narrowing of the ulnohumeral and radiohumeral joints. The mean preoperative flexion-extension arc in the satisfactory group was 93°, while that in the unsatisfactory group was 75°, which revealed a significant difference ($p<0.05$, Table 3). Radiographs showed recurrence of coronoid osteophytes in 9 elbows, and olecranon osteophytes in 17 elbows. The criterion of recurrence of osteophytes was bone spur protrusion by 5 mm or more in the lateral radiographs compared with the radiographs at immediately after the surgery.

Factor		Satisfactory (N = 17)	Unsatisfactory (N = 5)	Significant difference
Age (yrs)		57	50	N.S.
Duration of symptom (mos)		75	56	N.S.
Follow-up period (mos)		85	74	N.S.
Preop. radiograph score (SD)		5.8 (1.0)	7.2 (0.8)	p < 0.01*
MEPS	Preop. (SD)	70 (7)	68 (8)	N.S.
	Postop. (SD)	91 (6)	69 (8)	p < 0.001*
Flexion-extension arc	Preop. (SD)	93° (13)	75° (17)	p < 0.05*
	Postop. (SD)	110° (7)	86° (7)	p < 0.001*
N = number, yrs = years, mos = months, N.S. = no significance, SD = standard deviation, preop. = before surgery, postop. = at final follow up.				

Table 3: Patients' satisfaction related to certain factors.

The mean flexion in 9 elbows with recurrent coronoid osteophytes was 117°, and that in 13 elbows without coronoid osteophytes was 124°, which revealed no significant difference. The mean diameter for the holes in radiographs was 15 mm at immediately after the surgery and decreased to 9 mm at the time of follow-up.

Illustrative Cases

A 26-year-old designer man presented with painful limitation of motion on his right elbow. Flexion-extension arc was 15° to 105°, MEPS scores were 75, and radiograph score was 4. Immediate postoperative radiograph showed a hole 14 mm in diameter (Figure 2A), and eight years after operation, a hole decreased to 7 mm in diameter (Figure 2B). He had no pain, flexion-extension arc improved to 10° to 135°. A 61-year-old pipe fitter man had motion pain and limitation of motion in his right elbow. Flexion-extension arc was 30° to 90°, MEPS score was 65, and radiograph score was 8. Preoperative radiograph revealed osteophytes and marked narrowing in the ulno- and radiohumeral joint (Figure 3A).

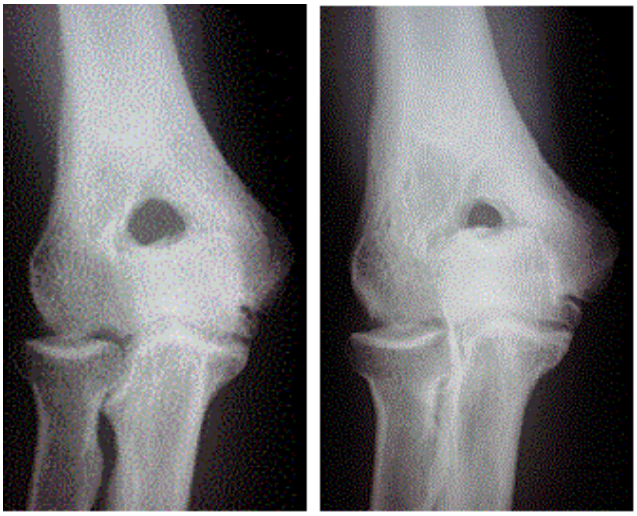

Figure 2: A 26-year-old man, immediate postoperative radiograph (A) showed a hole 14 mm in diameter, and eight years after operation (B), a hole decreased to 7 mm in diameter.

Five years after operation, he had residual motion pain, flexion-extension arc was 20° to 110°, MEPS was 70 with unsatisfactory result. Postoperative radiograph showed narrowing of the hole (Figure 3B).

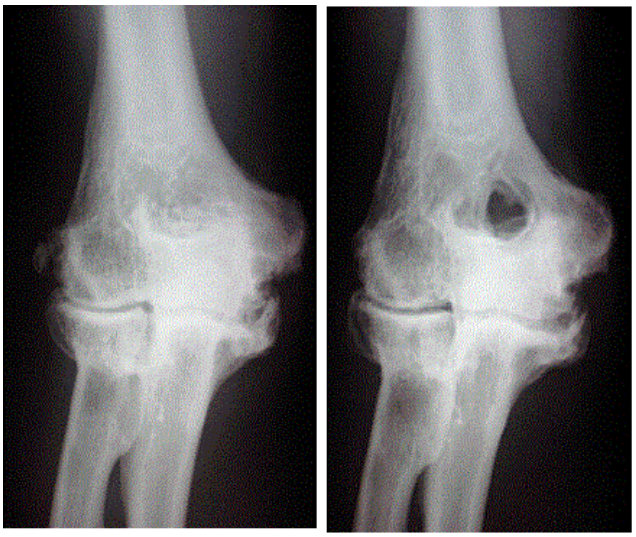

Figure 3: A 61-year-old man, preoperative (A) AP radiographs of right elbow show osteophytes and marked joint space narrowing in the ulnohumeral and radiohumeral joint. Five years after operation, postoperative (B) AP radiographs reveal narrowing of the hole with unsatisfactory result.

Discussion

The main advantages of the UHA are the accessibility to both posterior and anterior parts of the elbow joint without extensive soft

tissue dissection [5], simple and safe surgical technique, and easy-to-perform postoperative rehabilitation [6].

Among the 22 elbows from 20 patients in our series, 10 (45%) had complete relief of pain, 12 (55%) had partial relief, and the average improvement in flexion-extension arc was 15°. These results were almost similar to the previous reports [4-12]. We had 5 elbows in 4 patients with unsatisfactory results because of residual pain or limited range of motion. For these elbows with unsatisfactory results, preoperative radiographic scores were large because of marked narrowing of the ulnohumeral and radiohumeral joints, involving osteophytes in the radial head, the radial fossa, and the posterior edge of the capitellum [13], Forster et al. [5] mentioned that the radiographic scores did not predict outcome, whereas the range of movement decreased with increasing radiographic scores. We believe that the preoperative radiographic score can predict of postoperative outcome after UHA. There was a significant difference in the mean preoperative flexion-extension arc between the two groups ($p<0.02$). Thus, we consider that the flexion-extension arc seem to be effective factors for predicting postoperative outcome.

UHA does not access to the radiohumeral joint. Open debridement using a medial, lateral, or combined approach has been reported [13-15], and this approach allows management of all components of the elbow including the radiohumeral joint. However, this approach requires an extensive soft tissue dissection. Nevertheless, we consider that the lateral approach is useful in approaching the radiohumeral joint lesions for our series of elbows with unsatisfactory results. We agree with Morrey's [6] and Sarris's [10] statements that UHA is indicated with pain at terminal range of motion, osteophytes located in the olecranon or coronoid process, and ossification of the olecranon fossa, and that this procedure is contraindicated when pain is continuous during motion severely involving the radiohumeral joint.

There were several reports concerning the long-term results of UHA Antuna et al. [8] reported on 44 elbows treated with UHA. After a mean follow up of 80 months, 73% (32/44) had an excellent or good results according to the MEPS. Tashjian et al. [11] evaluated 17 patients (18 elbows) at a mean of 85 months after UHA, and stated that the mean elbow flexion arc improved by 16° and the mean MEPS was 83. Minami et al. [7] reported on 44 elbows with UHA at a mean of 10 years 7 months, the flexion-extension arc improved by 17° on average, and 55% of patients had no or minimal pain, and described recurrence of radiographic changes in most patients after 10 years. In our series, radiographs showed recurrence of coronoid osteophytes in 9 elbows and olecranon osteophytes in 17 elbows, and the mean diameter for the holes in radiographs was 15 mm at immediately after the surgery and decreased to 9 mm at the time of follow-up. But recurrent coronoid osteophytes did not influence the range of flexion. Phillips et al. [9] reported that 13 of 20 patients (65%) had good or excellent results according to the MEPS, and a mean improvement in flexion arc of 20° at a mean follow up of 75 months, furthermore there is no relationship between the recurrence of bone formation and the range of flexion. Minami et al. [7] warn that recurrence of pain and a decrease in the arc of motion may develop in some cases over time.

Concerning arthroscopic surgery, O'Driscoll and Morrey [16] recommended arthroscopy to treat milder case of osteoarthritis, reserving open debridement for more advanced cases. The arthroscopic procedure is limited to removing osteophytes from the tip of the olecranon fossa, leading to a lesser improvement in the range of motion. Redden et al. [17] reported good results with arthroscopic osseous and capsular debridement. Savoie et al. [18] described that arthroscopic UHA is an effective technique and that complication rate was 13%. Nevertheless, it is a technically demanding procedure and requires the skill of an experienced arthroscopist. Cohen et al. [19] compared arthroscopic UHA with the open technique, and concluded that the arthroscopic procedure was better for relief from pain, but worse for improving range of motion. DeGreef et al. [20] described that arthroscopic UHA is good surgical option in mild to moderate elbow arthritis. In comparison with arthroscopic procedure, the advantages of the open UHA are the accessibility to the elbow joint without extensive soft tissue dissection, simple and safe technique without serious complications.

This study has several limitations. First, various conservative treatments were performed before surgery, for example, application of anti-inflammatory drugs, physical therapy, and splinting. We did not take these treatments into consideration. Second, this was a retrospective study. Third, statistical analyses were performed mainly according to subjective results data.

Conclusion

The ulnohumeral arthroplasty is effective for reducing pain and increasing the range of movement for symptomatic elbow osteoarthritis after a mean follow-up of 82 months.

Acknowledgements

The authors wish to thank Ms. Yumi Watabe and Ms. Hiromi Takeda, Tohoku Rosai Hospital, for assisting in the manuscript preparation.

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