Anconeus Interposition Arthroplasty: Mid- to Long-term Results

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Abstract

Background Radiocapitellar arthritis and/or proximal radioulnar impingement can be difficult to treat. Interposition of the anconeus muscle has been described in the past as an alternative option in managing arthritis, but there are little published data about relief of pain and restoration of function over the long term in patients treated with this approach.

Questions/purposes We sought (1) to determine whether interposition of the anconeus muscle in the radiocapitellar and/or proximal radioulnar joint relieves pain and restores elbow function; and (2) to identify complications and reoperations after anconeus interposition arthroplasty.

Methods Between 1992 and 2012, we surgically treated 39 patients having radiocapitellar arthritis and/or proximal radioulnar impingement with an anconeus interposition arthroplasty. These were performed for situations in which capitellar and/or radial head pathology was deemed not amenable to implant replacement. We had complete

followup on 29 of them (74%) at a minimum of 1 year (mean, 10 years; range, 1–20 years). These 29 patients (21 males, eight females) had interposition of the anconeus muscle at the radiocapitellar joint (10 elbows), the proximal radioulnar joint (two elbows), or both (17 elbows). Their mean age at the time of surgery was 39 years (range, 14–58 years). The reasons for the previous determination or the indications included lateral-side elbow symptoms after radial head resection (eight elbows), failed internal fixation of radial head fracture (two elbows), failed radial head replacement with or without capitellar replacement (four elbows), osteoarthritis and Essex-Lopresti injury (six elbows), failed internal fixation of distal humeral fracture involving the capitellum (two elbows), posttraumatic osteoarthritis involving the lateral compartment (one elbow), lateral compartment osteoarthritis associated with chondropathies (three elbows), and primary osteoarthritis affecting the lateral compartment (three elbows). Patient-reported outcome tools included the quick-Disabilities of the Arm, Shoulder and Hand (quick-DASH) and the Mayo Elbow Performance Score (MEPS); we also performed a chart review for complications and reoperations.

Results During the followup duration, the mean MEPS was significantly improved from (mean $\pm$ SD) 64 ± 17 points before surgery to 82 ± 14 points after surgery ($p < 0.001$) with 21 elbows (72%) graded as excellent or good at most recent followup. The mean quick-DASH score was 24 ± 17 points ($n = 25$) at latest evaluation. Two patients (7%) had perioperative complications, including wound dehiscence (one elbow) and transient posterior interosseous nerve palsy (one elbow). Seven patients (24%) underwent additional surgery.

Conclusions Anconeus arthroplasty provides a reasonable surgical alternative in the armamentarium of procedures to address pathology at the radiocapitellar and/

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Each author certifies that his or her institution approved the human protocol for this investigation, that all investigations were conducted in conformity with ethical principles of research, and that informed consent for participation in the study was obtained.

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or proximal radioulnar joint. This procedure is especially attractive when other alternatives such as radial head replacement may be problematic secondary to capitellar erosion or marked proximal radius bone loss.

Level of Evidence Level IV, therapeutic study. See Guidelines for Authors for a complete description of levels of evidence.

Introduction

Radiocapitellar arthritis and/or proximal radioulnar impingement can result from degenerative or inflammatory arthritis predominantly affecting the lateral side of the elbow and may lead to pain and dysfunction. Progressive arthritis with marked involvement of the radiocapitellar joint frequently results after traumatic conditions or can be associated with chondropathy involving the articulation surface. Proximal radioulnar impingement often results from bone flecks or even bridges (heterotrophic ossifications) after surgical treatment for traumatic elbow injury as seen in failed internal fixation of radial head fractures or radial head resections.

Radial head replacement oftentimes is considered in these circumstances [2, 11]. However, implantation of a radial head prosthesis may be problematic in patients with a damaged capitellar articular surface, marked proximal radius bone loss, or inability to obtain adequate tracking of the radial implant over the capitellum midpoint during both extension to flexion and pronation to supination at the time of surgery. In addition, little is known about recommended restrictions or long-term mechanical failure of radial head replacement in the young, active patient [9]. Radial head excision or removal of failed implants does not restore the tensioning cam effect of the radial head on the lateral collateral ligament complex and may lead to painful impingement between the proximal radius stump and the distal humerus and/or proximal ulna [4]. Capitellar implants coupled with a radial head implant (so-called radiocapitellar unicompartmental arthroplasty) are another potentially attractive alternative but one that has very little support in the literature and some concerns about implant longevity, especially on the radial side [8–10].

Interposition of the anconeus muscle at the radiocapitellar joint, proximal radioulnar joint, or both was first described by Morrey and Schneeberger in 2002 [6]. Interposition of the vascularized anconeus muscle provides a viable soft tissue cushion to mitigate bone impingement; in addition, rerouting of the anconeus underneath the lateral collateral ligament complex may increase the ligament tension and overall elbow stability [6]. However, the interposed anconeus muscle is unlikely to restore any load-bearing on the lateral compartment of the elbow, and the

mid- to long-term results of this procedure are largely unknown. The purposes of this study therefore were (1) to determine whether interposition of the anconeus muscle in the radiocapitellar and/or proximal radioulnar joint relieves pain and restores elbow function; and (2) to identify complications and reoperations after anconeus interposition arthroplasty.

Patients and Methods

This study was approved by our institutional review board. The surgical and medical databases were queried and retrieved all patients undergoing anconeus interposition arthroplasty. Between 1992 and 2012, 45 patients (45 consecutive elbows) underwent anconeus interposition arthroplasty at our institution. We exclude from the current report patients who had interposition with one bone fusion procedure for the forearm and patients undergoing interposition with underlying inflammatory arthritis, congenital or dysplastic elbow conditions. This left us a total of 39 patients (39 elbows) who had been treated surgically with anconeus interposition arthroplasty for radiocapitellar arthritis and/or radioulnar impingement in which capitellar and/or radial head pathology was deemed not feasible to implant replacement. All patients routinely were scheduled for followup after the procedure at our institution. Additional efforts were also carried out to reach all patients and update their followup through an elbow evaluation questionnaire. We did not ask them to return for examination at our institution or to send elbow radiographs. Of the 39 patients, five patients did not respond despite multiple attempts, two patients failed to be reached by us, one patient refused to participate, and two died of unrelated conditions. These patients did not have a minimum of 1-year followup in medical records and were excluded from the rest of the current investigation. Thus, the final cohort consisted of 29 patients (74%) who received an anconeus interposition between 1992 and 2012 and formed the basis of this study. Minimum followup was 1 year (mean, 10 years; range, 1–20 years).

There were different indications having very different pathomechanics. Patients had the arthritis (radiocapitellar arthritis and/or proximal radioulnar impingement) in which capitellar and/or radial head pathology was deemed not amenable to implant replacement. The reason for this determination included lateral-side elbow symptoms after radial head resection (eight elbows), failed internal fixation of radial head fracture (two elbows), failed radial head replacement with or without capitellar replacement (four elbows), osteoarthritis and Essex-Lopresti injury (six elbows), failed internal fixation of a distal humeral fracture involving the capitellum (two elbows), posttraumatic

Table 1. Radiographic evaluation for associated pathology or bone deficiency involving the elbow before interposition

Description	Number of elbows
Proximal radius (head, neck)	22
Fracture or defect	4
Resection	13
Replaced with an implant	5
Distal humerus	
Capitellum	
Fracture defect or resection	12
Replaced with an implant	2
Trochlea	1
Medial condyle	1
Supracondylar	2
Proximal ulna	
Coronoid process	4
Olecranon	1

osteoarthritis involving the lateral compartment (one elbow), lateral compartment osteoarthritis associated with chondropathies (three elbows), and primary osteoarthritis affecting the lateral compartment (three elbows). A pathologic process involving the proximal radius (replaced, damaged, or absent radial head) was demonstrated in 22 patients (76%) (Table 1). Of the 22 patients, 13 patients had an absent or resected radial head before surgery. Four patients had resections associated with Essex-Lopresti injury and one associated with chondropathy affecting the lateral compartment. Their mean extension to flexion was 10° (range, 0°–40°) to 136° (range, 110°–150°). Their mean pronation to supination was 58° (range, 0°–90°) to 51° (range, 0°–90°). Their preoperative Mayo Elbow Performance Score (MEPS) was 66 ± 17 points.

The cohort included 21 males (72%) and eight females (28%) with a mean age of 39 years (range, 14–58 years) at the time of anconeus interposition. Nineteen right and 10 left elbows underwent the procedure and in 19 of the 29 patients (66%), the elbow on the dominant side was involved. All patients except one had undergone at least one elbow surgical procedure before the index interposition arthroplasty (Table 2).

The anconeus muscle was interposed in three different ways, between the radius and ulna (Type III, surrounding the proximal radius stump) in two elbows, between the radius and capitellum (Type I) in 10 elbows, and at both locations (Type II) in 17 elbows (Fig. 1). For the interposition at both locations, the anconeus muscle was passed under the lateral collateral ligament complex after being released distally. Then, the flap substance was interposed between the radius and capitellum and between the radius and ulna. The proximal portion of the anconeus was fixed

to the capitellum and the distal portion was fixed with sutures passing drill holes through the proximal radius. Additional procedures were also performed at the time of the interposition to address an undergoing pathologic process causing patient symptoms and disability. These were performed according to the surgeon's judgment and experience in performing similar forms of elbow reconstruction (Table 3).

A retrospective review of the medical records was completed to collect patients' demographics as well as pain, range of motion (ROM), stability, any details of previous surgical procedures, the operative report, complications, and reoperations. At most recent followup, three patients had been evaluated by an orthopaedic surgeon and the remaining 26 patients were evaluated through questionnaires that included questions about additional procedures, if performed and the components of the MEPS [5] and the quick-Disabilities of the Arm, Shoulder and Hand (quick-DASH) score [1, 3]. AP and lateral radiographs of the elbow were assessed before surgery and at the most recent followup to determine the severity of osteoarthritis as well as valgus angulation of the elbow and proximal migration of the radius. Of the 29 patients, 24 patients (83%) had completed elbow radiographs in their records after the procedure (mean, 2 years; range, 1 month–11 years). Outcomes were measured using MEPS [5] and quick-DASH [1, 3] at the latest evaluation.

Unless otherwise specified, data are expressed as mean ± SD for continuous variables and number (percentage) for categorical variables. Paired t-tests were used to compare the preoperative values (baseline) of MEPS to its corresponding values obtained at latest followup. The statistical test was two-sided and p value < 0.05 was considered statistically significant. The analysis was performed using JMP® 9.0.1 (© SAS Institute Inc, Cary, NC, USA).

Results

During the followup duration (mean, 10 years; range, 1–20 years), interposition of the anconeus muscle resulted in substantial improvements in pain and overall upper extremity function. The MEPS (possible range is 0–100 points with higher scores indicating better results) was significantly improved from 64 ± 17 points preoperatively to 82 ± 14 points postoperatively (p < 0.001). The pain subscore (total 45 points) had most of the improvement (from 17 ± 14 points to 31 ± 12 points; p < 0.001). Based on the MEPS, 21 elbows (72%) rated as excellent or good result. The most recent quick-DASH score (possible range is 0–100 points with lower scores indicating better results) was 24 ± 17 points (n = 25) (Table 3).

Perioperative complications occurred in two elbows (7%), including a hematoma requiring aspiration and one

Table 2. Patients' characteristics and their preoperative assessment details

Patient number	Sex	Affected side*	Age (years)	Indication	Radiographic evaluation†	Summary of any prior elbow interventions or previous related procedures	Pain level	Instability‡	Extension	Flexion	Pronation	Supination
1	M	Left	45	Lateral-side pain after RH resection	Proximal radius (resection)	RH resection	Moderate		10°	130°	20°	20°
2	M	Right*	28	Lateral-side pain after RH resection	Proximal radius (resection), coronoid process, olecranon	RH resection, ORIF of olecranon, distraction arthroplasty using external fixator	Mild		40°	130°	15°	0°
3	F	Right*	45	Lateral-side pain after RH resection	Proximal radius (resection), coronoid process	ORIF of RH, RH resection	Severe	+	0°	140°	80°	80°
4	F	Left	58	Lateral-side pain after RH resection	Proximal radius (resection), capitellum	RH resection	Mild	+	0°	150°	90°	90°
5	M	Right*	49	Lateral-side pain after RH resection	Proximal radius (resection), capitellum	Joint debridement, RH resection	Moderate	+	0°	150°	90°	90°
6	F	Left*	41	Lateral-side pain after RH resection	Proximal radius (resection), capitellum	Joint debridement, RH resection	Severe	+	0°	140°	80°	80°
7	M	Right*	33	Lateral-side pain after RH resection	Proximal radius (resection)	RH resection, capsulectomy	Moderate	+	0°	150°	60°	50°
8	M	Left*	50	Lateral-side pain after RH resection	Valgus angulation, proximal radius (resection), capitellum	Joint debridement, RH resection	None		10°	135°	0°	0°
9	F	Right*	20	Failed internal fixation of a RH fracture	Proximal radius, coronoid process	ORIF of ulna, ORIF of RH	None		20°	135°	65°	10°
10	M	Left	40	Failed internal fixation of a RH fracture	Proximal radius	ORIF of RH, joint debridement	Mild		65°	135°	20°	0°
11	M	Right	56	Essex-Lopresti injury	Proximal radius (resection), capitellum	RH resection, capsulectomy	Severe	+	10°	135°	90°	45°
12	F	Right*	40	Essex-Lopresti injury	Valgus angulation, proximal radius (resection)	ORIF of ulna (shortening osteotomy), RH resection, RH replacement, RH implant revision, RH implant removal, LCLC and MCL reconstruction using autografts	Mild	+	10°	140°	75°	40°

Table 2. continued

Patient number	Sex	Affected side*	Age (years)	Indication	Radiographic evaluation†	Summary of any prior elbow interventions or previous related procedures	Pain level	Instability‡	Extension	Flexion	Pronation	Supination
13	M	Right*	20	Essex-Lopresti injury	Proximal radius (resection), capitellum	Joint debridement, RH resection, synovectomy, ORIF of ulna (shortening osteotomy)	Moderate	+	20°	120°	20°	0°
14	M	Right*	32	Essex-Lopresti injury	Proximal radius, capitellum	ORIF of ulna (shortening osteotomy)	Mild	+	30°	110°	60°	90°
15	M	Right	37	Essex-Lopresti injury	Proximal radius (resection)	Joint debridement, RH resection	Mild	+	20°	110°	70°	80°
16	M	Right*	29	Essex-Lopresti injury, failed RH replacement	Fracture silicone RH implant	RH replacement, ORIF of ulna (shortening osteotomy)	Mild		10°	140°	50°	50°
17	M	Left	41	Primary osteoarthritis			Severe	+	0°	150°	90°	90°
18	M	Right*	58	Primary osteoarthritis		Osteocapsular arthroplasty	Severe		10°	130°	85°	70°
19	M	Left*	42	Primary osteoarthritis		Joint debridement, distal humerus chondroplasty or bone grafting, ulnar nerve decompression	Moderate		30°	120°	80°	80°
20	M	Right	14	Osteoarthritis associated with chondropathy (osteocondritis dissecans)	Proximal radius (resection), capitellum, supracondylar of humerus	Joint debridement, distal humerus chondroplasty or bone grafting, RH resection, capsulectomy	Moderate		5°	140°	70°	90°
21	M	Right*	27	Osteoarthritis associated with chondropathy (Panner's disease or capitellum osteochondrosis)	Capitellum	Joint debridement, synovectomy, capsulectomy	Moderate		15°	115°	65°	85°
22	M	Left	14	Osteoarthritis associated with chondropathy (Panner's disease or capitellum osteochondrosis)	Proximal radius, capitellum	Joint debridement	Severe		35°	130°	50°	80°
23	M	Left*	34	Failed internal fixation of a distal humerus fracture involving the capitellum	Capitellum, supracondylar of humerus	ORIF of distal humerus, ulnar nerve transposition	Mild		90°	130°	80°	80°
24	F	Right	33	Failed internal fixation of a distal humerus fracture involving the capitellum	Capitellum, trochlea	ORIF of capitellum	Moderate	+	25°	125°	80°	80°

Table 2. continued

Patient number	Sex	Affected side*	Age (years)	Indication	Radiographic evaluation†	Summary of any prior elbow interventions or previous related procedures	Pain level	Instability‡	Extension	Flexion	Pronation	Supination
25	F	Right*	52	Posttraumatic osteoarthritis involving the elbow lateral compartment	Capitellum, medial condyle of humerus	Capitellar excision, joint debridement	Severe		55°	130°	60°	80°
26	M	Right*	57	Failed RH replacement	Loose prosthetic RH implant	RH replacement	Severe	+	10°	135°	80°	80°
27	M	Right*	56	Failed RH replacement	Loose prosthetic RH implant, prosthetic capitellum replacement	ORIF of RH, RH replacement, capsular release, RH implant revision, and capitellum replacement	Mild		30°	150°	90°	90°
28	M	Right*	28	Failed RH replacement	Stuffed prosthetic RH implant, coronoid process	RH replacement, RH implant revision, ulnar nerve transposition	Moderate		70°	110°	80°	80°
29	F	Left	47	Failed RH replacement	Loose prosthetic RH implant, prosthetic capitellum replacement	Osteocapsular arthroplasty, RH and capitellum replacement	Severe	+	10°	130°	90°	45°

* Affected dominant arm. † radiographic evaluation for valgus angulation, any degree of bone deficiency (defect), and/or any compartment replacement; ‡ any grade of instability (mechanical symptoms, subjective instability, or profound instability); M = male; F = female; RH = radial head; ORIF = open reduction and internal fixation; LCLC = lateral collateral ligament complex; MCL = medial collateral ligament. Proximal radius includes head and/or neck. Joint debridement includes removal of loose body, bone fragment, osteophyte, and/or heterotopic ossification.

Fig. 1A–D (A) The anconeus muscle is elevated subperiosteally under the fascia from distal to proximal. (B–C) Rerouting of the anconeus under the lateral collateral ligament complex tensions the

ligament fibers. (D) The anconeus is then anchored in the lateral compartment of the elbow using heavy nonabsorbable suture.

instance of transient palsy of the posterior interosseous nerve. Seven patients (24%) underwent further surgery, including surgical exploration of the anconeus muscle in one elbow (Table 3). At a mean of 2 years (range, 1 month–11 years), in the 24 patients (83%) for whom radiographs were available, progression of osteoarthritis was noted in four elbows (17%) [four of the 24 patients], valgus angulation in one elbow, and proximal migration of the radius in one elbow (Fig. 2).

Discussion

Elbow conditions affecting the lateral compartment of the elbow are relatively common. The radiocapitellar joint may become symptomatic as a result of radial head fractures, capitellum fractures, inflammatory osteoarthritis or primary osteoarthritis. In addition, painful proximal radioulnar impingement may result from aggressive resections involving fractions beyond the head and neck of the proximal radius.

This study had a number of limitations. Foremost, this is a retrospective review for a limited number of patients with heterogeneous associated pathologies. Second, the anconeus interposition arthroplasty was barely performed as an isolated intervention for a specific diagnosis. Most patients underwent additional procedures involving other elbow

compartments and addressing an undergoing pathology process; these procedures could substantially influence our cohort results. Thus, improvements might not be necessarily attributed to the interposing anconeus muscle flap in isolation from the other procedures. However, all patients with marked osteoarthritis affecting the lateral compartment (radiocapitellar and/or proximal radioulnar joints) in which radial head and/or capitellar replacement was not feasible consistently received the anconeus muscle flap during the study period. Third, the latest evaluation was not available at a minimum of 1-year followup for 10 of the 39 patients (26%) who were initially qualified for the review. Because patients who do not return or respond generally tend to have worse health status than those who do, the clinical results might not be as good as noted in the study and the reoperation rate can be much higher than observed. On the same venue, the radiographic followup was apparently short and radiographs were either unavailable or incomplete in a group of patients at the latest evaluation; thus, we might substantially underestimate late complications and the proportion of patients with arthritis. Lastly, patients were largely evaluated through questionnaires rather than in person during the clinic visit; therefore, important measures including stability and ROM were not possible to gauge during our review. However, we used accepted assessment tools, MEPS and quick-DASH, during our evaluation of patients' results.

Table 3. Patients' surgical details, complications, and their most recent assessment details

Patient number	Interposition technique	Additional procedures at the time of interposition	Perioperative complication, if any	Followup (years)*	Pain level	MEPS grade	MEPS score	quick-DASH score	Additional operations	Radiographic evaluation, † if any
1	II	Revision of RH resection		20	No pain	100	Excellent	0		
2	II	Revision of RH resection, HW removal	Posterior interosseous nerve palsy (resolved)	20	No pain	95	Excellent	11		Severe osteoarthritis
3	II	Ulnar nerve transposition, LCLC reconstruction using autograft		15	Moderate	65	Fair	50	First: MCL reconstruction using allograft (instability due to trauma), second: revision of MCL reconstruction using autograft and ulnar nerve decompression (as a result of persistent instability)	Mild osteoarthritis
4	II	Ulnar nerve transposition, MCL reconstruction using allograft, capitulum prosthesis replacement†		2	Mild	85	Good	30		
5	II			13	Moderate	60	Fair	25		
6	II	Ulnar nerve decompression, LCLC reconstruction using allograft		11	Moderate	65	Fair	43	Ulnar nerve transposition and MCL reconstruction using allograft (instability resulting from trauma)	
7	II	ORIF of ulna (shortening osteotomy), revision of RH resection, joint debridement, LCLC reconstruction using autograft		20	Moderate	60	Fair	34	First: ulnar plate hardware removal, second: joint debridement and ulnar nerve transposition (as a result of neuropathy), third: submuscular ulnar nerve transfer (resulting from persistent neuropathy)	Moderate osteoarthritis
8	III			19	No pain	100	Excellent	25		NA
9	II	HW removal		16	No pain	100	Excellent	5		
10	III	Capsular release, RH resection		17	No pain	95	Excellent	27		Proximal RH migration, no osteoarthritis
11	I	ORIF of ulna (shortening osteotomy)		17	Mild	85	Good	39		
12	II	Revision of RH resection, ORIF of ulna (shortening osteotomy), revision MCL reconstruction using allograft		2	Mild	85	Good	27	Ulnar plate hardware removal	

Table 3. continued

Patient number	Interposition technique	Additional procedures at the time of interposition	Perioperative complication, if any	Followup (years)*	Pain level	MEPS grade	MEPS score	quick-DASH score	Additional operations	Radiographic evaluation, † if any
13	II	Revision RH resection		8	No pain	100	Excellent	2		
14	II	RH resection, annular ligament repair		17	Mild	85	Good	23	First: joint debridement, second: ulnar nerve transposition (as a result of neuropathy)	Moderate osteoarthritis
15	II	Ulnar nerve transposition		2*	No pain	100	Excellent	NA	First: ORIF of ulna (shortening osteotomy due to carpal bones impaction), second: bone graft for ulna nonunion at site of osteotomy, third: ulnar plate hardware removal	
16	II	Synovectomy, silicone RH removal		13	Moderate	60	Fair	41		NA
17	I	Joint debridement, synovectomy		6	Mild	80	Good	11		
18	II	Ulnar nerve decompression, RH resection, capitellum prosthesis replacement†		2	Mild	85	Good	5		
19	I	Ulnar nerve decompression, joint debridement		10	Moderate	50	Poor	59		NA
20	I		Wound complication—hematoma collection	10	Mild	80	Good	20		
21	I	Joint debridement		7	Mild	80	Good	5		NA
22	I	RH resection, joint debridement, external fixator was applied		5*	No pain	95	Excellent	NA	Achilles allograft interposition, RH resurfacing, external fixator was applied (as a result of persistent elbow symptoms), the anconeus muscle substance was viable and healed on exploration	
23	I	Capsular release, HW removal, joint debridement		1*	Moderate	70	Fair	NA		
24	I	Joint debridement, HW removal, LCLC reconstruction using allograft		10	Moderate	80	Good	32		
25	I	Capsular release, joint debridement		19	No pain	100	Excellent	2		
26	II	Prosthesis RH removal		5	Mild	85	Good	7		Increased valgus angulation
27	I	Prosthesis RH removal		2	Moderate	70	Fair	NA		NA

Table 3. continued

Patient number	Interposition technique	Additional procedures of interposition	Procedures at the time	Perioperative complication, if any	Followup (years)*	Pain level	MEPS	MEPS grade	quick-DASH score	Additional operations	Radiographic evaluation, † if any
28	II	Capsular release, prosthesis removal	RH		1	Mild	80	Good	36		
29	II	Prosthesis RH removal			3	Mild	85	Good	36		

* Followup obtained in person during the clinic visit; † radiographic evaluation for the osteoarthritis, valgus angulation, and proximal migration of the radius; ‡ implant from Avanta Orthopaedics Inc. (San Diego, CA, USA); MEPS = Mayo Elbow Performance Score; quick-DASH = quick-Disabilities of the Arm, Shoulder and Hand; RH = radial head; HW = hardware removal; LCLC = lateral collateral ligament complex; MCL = medial collateral ligament; ORIF = open reduction and internal fixation; NA = not evaluated. Joint debridement includes removal of loose body, bone fragment, osteophyte, and/or heterotopic ossification.

Fig. 2A–D (A) Preoperative AP and (B) lateral radiographs of a patient with lateral-side elbow pain and stiffness after radial head replacement with progressive capitellar erosion are shown. (C–D) Postoperative radiographs after contracture release, implant removal, and anconeus interposition showed no evidence of progressive valgus angulation, proximal radius migration, or progressive osteoarthritis.

Interposition of the anconeus muscle was first described by Morrey and Schneeberger [6]. They reported on 14 elbows with a mean followup of 6.1 years. The mean MEPS was 89 points with 13 elbows graded as good or excellent; 12 of the 14 patients (86%) had subjective satisfactory outcomes. Other authors have reported additional studies about using the anconeus muscle for interposition in a very small number of elbows. Nishida et al. [7] described outcomes in six patients at a mean followup of 4.25 years. The mean MEPS was 90 points, and all six elbows were graded as good or excellent. In current series, we reported results of the interposition in larger cohort (29 patients) with longer followup duration (mean, 10 years). The mean MEPS was 82 points with 21 elbows (72%) rated as excellent or good result.

Reoperations and progression of arthritis were relatively frequent in this series, at 24% (seven of 29 patients) and 17% (four of 24 patients), respectively. Morrey and Schneeberger [6] reported additional operations in seven of the 14 patients, including anconeus exploration in one patient and they also reported progressive arthritis in one patient of their series (mean radiographic followup, 2.5 years). Nishida et al. [7] reported

reoperations in one of their six patients and also noted on radiographs that the proximal radius was neither migrated nor unstable after the procedure.

In conclusion, anconeus arthroplasty can alleviate pain and improve function in patients with conditions affecting the radiocapitellar and/or proximal radioulnar joint. These patients can be complicated with higher rates of reoperation and arthritis progression; however, the interposition procedure provides a surgical treatment option for these patients, particularly in situations in which capitellar and/or radial head pathology was deemed not amenable to prosthetic replacement. Although the interposed anconeus does not provide much stability against valgus stress or proximal migration of the radius, it does seem to tighten the lateral collateral ligament complex. This procedure is particularly attractive for those patients with a resected or damaged radial head when replacement with a prosthesis would be problematic as a result of marked proximal radius bone loss, capitellar damage, or other reasons. Improvements in pain and function appear to be maintained in the long term.

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