Total elbow arthroplasty after previous resection of the radial head and synovectomy

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We examined the effects of previous resection of the radial head and synovectomy on the outcome of subsequent total elbow arthroplasty in patients with rheumatoid arthritis.

Fifteen elbows with a history of resection and synovectomy were compared with a control group of patients who had elbow arthroplasty with an implant of the same design. The mean age in both groups was 63 years. In the study group, resection of the radial head and synovectomy had been undertaken at a mean of 8.9 years before arthroplasty. The mean radiological follow-up for the 13 available patients in the study group was 5.89 years (0.3 to 11.0) and in the control group was 6.6 years (2.2 to 12.6). There were no revisions in either group. The mean Mayo elbow performance score improved from 29 to 96 in the study group, with similar improvement in the control group (28 to 87). The study group had excellent results in 13 elbows and good results in two. The control group had excellent results in seven and good results in six.

Our experience indicates that previous resection of the radial head and synovectomy are not associated with an increased rate of revision following subsequent arthroplasty of the elbow. However, there was a higher rate of complication in the study group compared with the control group.

The challenge for orthopaedic surgeons treating patients with rheumatoid arthritis of the elbow is to achieve a painless, stable, and functional elbow. The initial management consists of medical treatment to control synovitis. If this fails, various surgical options can be considered. Several reports have shown good results following resection of the radial head and synovectomy.¹⁻¹³ The results of total elbow arthroplasty in these patients have also been good.¹⁴⁻²¹ Data are limited on the effect of a previous resection of the radial head and synovectomy on subsequent total elbow arthroplasty.²² Our aim, therefore, was to compare the outcome of total elbow arthroplasty with and without a history of previous surgery.

Patients and Methods

We used the joint replacement computer database at our institution to identify those patients with rheumatoid arthritis who had been treated by total elbow arthroplasty (Coonrad Morrey; Zimmer, Warsaw, Indiana) and who had a previous excision of the radial head and synovectomy. To detect more accurately the effect, if any, of the previous surgery, a control group was identified. This was developed from

a database of patients with rheumatoid arthritis who had been treated using the same prosthesis during the same period of time. None had a previous resection of the radial head and synovectomy and they were matched by gender, side of involvement, and age. There was a minimum follow-up of two years for both groups. We retrospectively reviewed the records and radiographs of both groups. Additional contact was attempted in all patients. The Mayo elbow performance score (MEPS) was used to assess pain, movement, stability, and daily function as has been described previously.^{18,21,23,24} A result was considered to be satisfactory if an excellent or good rating was attained with the MEPS. The pre-operative radiographs were reviewed and categorised in accordance with the Mayo classification of rheumatoid involvement of the elbow.¹⁸ The post-operative and latest radiographs were reviewed in order to identify radiolucent lines and evidence of loosening.

A total of 16 elbows was identified in 15 patients who had undergone a total elbow arthroplasty having previously undergone a resection of the radial head and synovectomy. We excluded one patient with an elbow arthroplasty who died 88 days after the operation of

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Fig. 1a

Fig. 1b

Fig. 1c

Radiographs (AP and lateral) showing a periprosthetic fracture of the ulna four years after total elbow arthroplasty (a). Subsequent radiographs, b) AP and c) lateral showing union after fixation

Table I. Details of the radiological findings in the study group

Case	Radiological follow-up (yrs)	Mayo classification of rheumatoid arthritis ¹⁸	Radiolucency		
			Humeral component	Ulnar component	Bone graft anterior flange
1	0.3	3A	None	None	Incorporated bone graft
2	2.3	4	None	None	Incorporated bone graft
3	7.6	2	None	None	Incorporated bone graft
4	1.4	4	None	None	Incorporated bone graft
5	5.3	3A	None	1 mm lucency proximal 1/3 ulna	Incorporated bone graft
6	None	4	Deceased	Deceased	Deceased
7	3.6	4	None	None	Incorporated bone graft
8	6.0	3A	None	1 mm lucency proximal 1/3 ulna	Incorporated bone graft
9	10.0	2	None	None	Incorporated bone graft
10	8.9	2	None	None	Incorporated bone graft
11	11.0	2	None, bushing wear	None	Incorporated bone graft
12	5.4	4	None	Lysis at precoat only	Incorporated bone graft
13	5.3	2	None	Lysis at tip and around precoat proximally	Incorporated bone graft
14	None	3A	Refused	Refused	Refused
15	9.3	3B	None	None	Incorporated bone graft

causes unrelated to the elbow surgery. Thus, there were 15 elbows in 14 patients in the study group.

The involved side was the right in seven, the left in six and one patient had undergone bilateral elbow arthroplasties. The mean age at the time of arthroplasty was 62.8 years (47 to 74). Only five of the 15 elbows had undergone previous resection of the radial head and synovectomy at our institution at a mean of 8.5 years (0.6 to 30.9) before the replacement. The remaining ten elbows had the initial surgery elsewhere at a mean of 9.1 years (1 to 24). Altogether, the resection of the radial head and synovectomy had been undertaken at a mean of 8.9 years (0.6 to 30.9) before the total elbow arthroplasty. The indication for elbow arthro-

plasty was progression of the disease in all patients with pain and limitation of function. One patient died of unrelated causes. The elbows were in place and functioning at the time of death.

The control group of 15 elbows was identified from a series of consecutive procedures performed for the same condition during the same period. This group was also matched by gender and duration of surveillance and comprised of 11 women and four men. The involved side was the right in eight and the left in seven patients. The mean age of the time of arthroplasty for this group was 63.6 years (44 to 81). The indication for total elbow arthroplasty was progression of disease in all patients with pain and limita-

Fig. 2a

Fig. 2b

Fig. 2c

Radiographs a) and b) AP and c) lateral 8.5 years after a two-stage bushing exchange and rearticulation for acute deep infection.

Table II. Details of the clinical outcome in both groups showing range of movement in degrees (°), pain and stability

Group	Extension		Flexion		Pronation		Supination		Pain		Stability	
	Pre-op	Post-op	Pre-op	Post-op	Pre-op	Post-op	Pre-op	Post-op	Pre-op	Post-op	Pre-op*	Post-op
Study												
1	20	20	140	145	60	85	70	85	Severe	None	Mild	Stable
2	45	60	130	110	0	30	70	30	Moderate	None	Moderate	Stable
3	30	0	130	110	60	70	70	70	Mod-sev	None	Mild	Stable
4	0	30	80	130	80	0	90	0	Severe	None	Severe ML lax	Stable
5	25	60	125	130	20	90	70	0	Severe	Mild, rare	Mild ML lax	Stable
6	30	0	130	120	60	90	70	90	Severe	None	Severe lax	Stable
7	0	0	130	120	50	90	50	90	Severe	None	Unstable	Stable
8	40	30	90	120	60	90	50	90	Severe	None	Mild	Stable
9	30	30	115	120	60	90	60	90	Severe	None	Moderate	Stable
10	20	30	130	130	30	90	30	90	Severe	Mild, rare	Mild	Stable
11	30	20	120	130	70	90	70	90	Severe	None	Moderate	Stable
12	0	45	140	130	80	90	80	60	Severe	None	Severe	Stable
13	70	30	110	130	75	90	75	90	Severe	None	Stable	Stable
14	30	30	120	120	60	90	60	60	Severe	None	Stable	Stable
Control												
1	40	0	120	130	40	90	30	90	Severe	None	Mild	Stable
2	40	30	120	130	65	90	70	90	Severe	Mild	Stable	Stable
3	45	30	130	130	60	60	70	60	Severe	Mild	Stable	Stable
4	70	30	120	130	30	60	30	60	Moderate	None	Stable	Stable
5	75	60	95	130	10	30	10	30	Severe	Mild	Stable	Stable
6	35	60	125	90	60	30	70	30	Severe	Mild	Mild	Stable
7	55	35	130	125	60	60	45	30	Severe	None	Unstable	Stable
8	35	60	115	120	15	60	15	60	Severe	None	Moderate	Stable
9	10	10	135	135	40	40	60	60	Severe	Mild	Mild	Stable
10	25	25	125	135	70	80	70	70	Severe	None	Mild	Stable
11	30	90	100	120	40	90	40	90	Severe	None	Moderate	Stable
12	25	30	120	130	55	90	0	30	Severe	Mild	Mild	Stable
13	10	30	135	120	50	90	60	90	Severe	Mild	Stable	Stable
14	10	40	120	110	70	45	70	45	Severe	None	Mild	Stable
15	50	30	115	130	50	90	60	90	Severe	None	Stable	Stable

* ML, mediolateral

Table III. Details of the radiological results in the control group

Case	Radiological follow-up (yrs)	Time from TEA* to death (yrs)	Mayo classification of rheumatoid arthritis ¹⁸	Radiolucency		Bone graft anterior-flange
				Humeral component	Ulnar component	
1	5.2		3A	None	None	Incorporated
2	8.8		3A	None	None	Incorporated
3	2.2		2	None	None	Incorporated
4	12.6		3A	None, mild wear of bushing	None	Incorporated
5	2.6		3A	None	None	Incorporated
6	5.2	5.8	3A	None	None	Incorporated
7	10.5		2	None	None	Incorporated
8	11.0		4	None	None	Incorporated
9	3.0	6.6	3A	None	None	Incorporated
10	7.8		2	None	Lucency at tip	Incorporated
11	6.2		3A	None	None	Incorporated
12	2.5		2	None	None	Incorporated
13	5.2		2	None	Proximal ulnar lucency	Incorporated
14	10.0		3A	None, wear of bushing	None	Incorporated
15	7.0		3B	None	None	Incorporated

* TEA, total elbow arthroplasty

tion of function. Two patients had died at 5.8 and 6.6 years respectively after the arthroplasty. Both elbows were in place and functioning at the time of death.

Results

Current information was obtained on all patients until death (Tables I and II). In the study group, one patient refused further radiography but clinical assessment was good. A second patient died (at three months) after the initial procedure but before any follow-up could be carried out. The mean clinical follow-up for the 14 available patients was 6 years (2 to 9.2). In the control group, the mean clinical follow-up was 7.4 years (2.0 to 15.1; Table III). The mean radiological follow-up of the study group was 5.8 years (0.3 to 11.0) compared with that in the control group of 6.6 years (2.2 to 12.6). There were no revisions in either group.

Complications and re-operations. In the study group there were five complications in five arthroplasties (Table IV). One patient had an undisplaced intra-operative fracture of the ulna which was recognised and treated by cerclage wiring. The same patient developed a spontaneous undisplaced fracture of the lateral epicondyle post-operatively which was successfully treated by splinting. This patient did well and had a painless and stable elbow at 4.3 years. A second patient subsequently fell and sustained a periprosthetic fracture of the ulna, which was treated elsewhere by open reduction, internal fixation, and retention of the arthroplasty. This patient was also doing well at 8.6 years (Fig. 1). A third patient developed an acute deep infection which was diagnosed two months after the initial procedure. This patient was successfully treated by acute debridement and a two-stage bushing exchange and articulation. At 8.5 years there was no evidence of loosening or recurrent infection (Fig. 2). A fourth patient sustained an intra-operative fracture of the olecranon when the ulnar trial component was being inserted. This was treated by tension-band fixation.

At 5.4 years a fibrous union was present. At the last clinical follow-up at 8.2 years, extension lacked 45° but the patient had a stable and painless elbow with extension strength of 75%. The fifth patient developed a superficial infection two weeks after the arthroplasty which was settled with oral antibiotics for three weeks and there were no further complications.

In the control group, there were two complications in two arthroplasties (Table IV). One patient developed dehiscence of the wound two weeks after the initial arthroplasty, and was treated by irrigation and debridement and primary closure without further complications. Another sustained an intra-operative fracture of the lateral epicondyle which was minimally displaced. This fracture was deemed to be stable at the time of surgery and was not fixed. This patient was doing well with a painless, fibrous union and a stable elbow 15.1 years later. While there is a numerical difference in the number of complications in the two groups, the difference is not statistically significant (chi-squared test was not significant). Assessment of each complication does not suggest that there is an increased incidence of problems which may be attributable to the previous surgery or absence of the radial head except for the observation of one deep and one superficial infection in the study group.

Radiological findings. The pre-operative radiographs were reviewed by the authors and graded in accordance with the Mayo classification of rheumatoid involvement¹⁸ (Table I). In type 1 there is a normal joint with synovitis and/or osteoporosis. In type 2 there is joint narrowing and in type 3 early (A) or lateral (B) architectural changes in the joint. In type 4 the joint is grossly destroyed (mutilans). In the study group there were no type-1 elbows, five type-2, four type-3A, one type-3B, and five type-4 (Table I). In the control group, there were no type-1, five type-2, eight type-3A, one type-3B, and one type-4 elbows (Table III).

The available radiographs were reviewed for the presence of radiolucencies or evidence of loosening (Table I). In

the study group, no humeral component had a radiolucency. Two elbows had non-progressive radiolucencies around less than 25% of the precoat area of the ulnar component only (Fig. 3). One elbow had an area of lysis, 4 mm wide, at the tip of the ulnar component and one an area, 3 mm wide, at the mid-portion of the precoat; neither patient had pain. All bone grafts had incorporated behind the flange of the implant at the last follow-up. None of these elbows was loose or considered to have failed. In the control group, no humeral components had a radiolucency. One had an area of lysis 3 mm wide, at the tip of the ulnar component and one had an incomplete lucency involving the proximal half of the ulna. Two other elbows in the control group were noted to have bushing wear as defined by Gill and Morrey²¹ which did not affect function (Fig. 4). In all elbows of the control group the bone graft behind the flange had incorporated. Considering all the radiological data of lucency and bushing wear, five events were recorded in the study and four in the control groups. There were no revisions in either group.

The Mayo elbow performance scale (MEPS). The MEPS score for the study group improved from a pre-operative mean of 29 (15 to 65) to a mean of 96 (80 to 100) at the most recent follow-up. For the control group, the score improved from a pre-operative mean of 28 (20 to 45) to a mean of 86 (65 to 100) at the most recent follow-up. Subjectively, there were 13 excellent and two good results in the study group and six excellent, seven good, and two fair results in the control group. Both patients with fair results received this designation because they had limited movement. These two patients otherwise had stable elbows with no pain and had good function.

In both groups, all patients reported that their elbow was stable at the final follow-up and all expressed satisfaction with the procedure. The range of movement improved slightly in both groups. In the study group, two patients reported having mild pain compared with eight in the control group.

Discussion

Resection of the radial head and synovectomy is a well-established surgical procedure used in the management of rheumatoid arthritis which has failed to respond to conservative treatment. The frequency of indications for this procedure are decreasing because of the widespread use and effectiveness of medical treatment. Nonetheless, there are limited studies which have assessed the effect of previous excision of the radial head and synovectomy on the outcome following subsequent total elbow arthroplasty.

The indications for synovectomy and excision of the radial head include uncontrolled, painful synovitis and limitation of elbow function which have failed to respond to medical management.^{1,13} Synovectomy alone does not reliably restore movement, and therefore has few indications in patients with advanced disease. Most results reported in the literature have shown deterioration with time.^{2,5-7} The

Fig. 3

Lateral radiograph showing a subtle non-progressive lucency at the proximal third of the ulnar component five years after arthroplasty.

fact that the mean duration of time in our study group from resection and synovectomy to arthroplasty was 8.9 years correlates with a deterioration of function with time after this procedure. For those patients in whom the disease has progressed after resection and synovectomy, total elbow arthroplasty is the most reliable remaining surgical option.

In several studies¹⁴⁻²⁰ the results of total elbow arthroplasty in patients with rheumatoid arthritis have been satisfactory. Gill and Morrey²¹ reported the long-term results of the use of this same semi-constrained prosthesis (Coonrad-Morrey). In that study, the survivorship of the prosthesis in rheumatoid patients was 94.4% at five and 92.4% at ten years. In the current study there was radiological evidence of wear and bone remodelling in both groups, which is to be expected. However, no patients had a revision of either the humeral or ulnar component at the last follow-up (study group mean 6.2 years, control group mean 9.1 years). Gill and Morrey²¹ reported the MEPS to be good or excellent in 86% of patients. In our study 100% of the study group and 88% of the control group had excellent or good results using the same criteria. There was no difference in the outcome between the two groups.

Fig. 4a

Fig. 4b

Radiographs a) AP and b) lateral showing the outcome after 11 years with some wear of the articulation but no lysis.

Table IV. Details of complications and re-operations in both groups

Group	Complications	Time to follow-up (yrs)
Study		
1	Intra-operative fracture of ulna and lateral epicondyle	4.3
2	Distal ulnar periprosthetic fracture, treated with ORIF* of ulna with retention of components	8.6
3	Acute deep infection, treated by irrigation and debridement with retention of components (except bushings and pin)	8.5
4	Intra-operative olecranon fracture, with later asymptomatic diastasis at the fracture site noted	8.2
5	Superficial wound infection treated with oral antibiotics	1.3
Control		
1	Wound dehiscence at the distal aspect of the wound, treated by irrigation, debridement and primary closure with retention of components (no sign of infection noted)	5.2
2	Intra-operative fracture of the lateral epicondyle	15.1

* ORIF, open reduction and internal fixation

To the best of our knowledge, there has been only one other study published in the English literature which has examined the results of elbow arthroplasty after previous resection of the radial head and synovectomy in patients with rheumatoid arthritis. Using a non-constrained implant, Schemitsch et al²² compared two groups of rheumatoid patients with and without this previous surgery. The mean time from the resection and synovectomy to arthroplasty was six years and the mean follow-up was four years. They concluded that arthroplasty following a previ-

ous resection and synovectomy using a Capitellocondylar (Howmedica, Rutherford, New Jersey) unlinked arthroplasty was technically demanding and the results at two years were inferior compared with those without previous surgery. This difference was primarily due to instability and they recommended that if the stability of the components cannot be accomplished at the time of surgery, a more constrained device should be used. In our study, although there were no problems of stability using a linked implant, there were more complications in the study group.

In summary, radial head resection and synovectomy did not have a measurable detrimental effect on the outcome after subsequent elbow arthroplasty. Our results are similar to those reported by Gill and Morrey²¹ and Morrey and Adams¹⁸ in patients with rheumatoid arthritis using the same prosthesis. There was a higher rate of complications in the study group, but this did not appear adversely to affect the long-term functional outcome.

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