Semi-constrained total elbow arthroplasty for the treatment of rheumatoid arthritis of the elbow

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ABSTRACT

Introduction: We retrospectively reviewed the results of total elbow arthroplasty in patients with rheumatoid arthritis of the elbow followed for a minimum of two years.

Methods: Between September 1999 and March 2001, seven patients with rheumatoid arthritis of the elbow were treated with total elbow arthroplasty using the semi-constrained Coonrad-Morrey elbow replacement prostheses. One patient died 19 months after her surgery and was excluded from the study. Two patients had bilateral total elbow replacements. Eight elbows were thus available for review. The mean age of our patients at the time of surgery was 55.5 years. The indication for surgery was severe pain and stiffness in six elbows, and distal humerus fractures in two elbows.

Results: The mean duration of postoperative hospitalisation stay was 6.6 days. The average length of follow-up was 39.4 months. Six elbows had no pain, while two elbows had mild pain. The mean arc of flexion was 101.3 degrees. The mean Mayo elbow performance score was 93.1 points. Excellent results were achieved in six elbows, while two elbows had good outcome. There was one case of intraoperative lateral condylar fracture treated with internal fixation. One patient developed blisters postoperatively but resolved with dressings and antibiotics.

Conclusion: Our small study revealed good to excellent short-term outcome with the use of semi-constrained total elbow arthroplasty for the treatment of rheumatoid arthritis of the elbow in Asian patients.

Keywords: arthroplasty, elbow, replacement arthroplasty, rheumatoid arthritis

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INTRODUCTION

Rheumatoid arthritis is a disabling disease which, in its advanced stages, can severely impair the functional status of a patient. Operative procedures such as arthrodesis, resection arthroplasty and replacement arthroplasty, have been used in an effort to improve function and relieve pain in patients who have advanced rheumatoid arthritis of the elbows. Arthrodesis of the elbow can predictably relieve pain, but it often results in poor function and is contraindicated when the ipsilateral shoulder or contralateral elbow is involved. Resection and interpositional arthroplasty has produced good functional results in younger patients, but has not predictably restored lost motion of the elbow.

The results of total elbow arthroplasty are improving with increased basic knowledge of elbow mechanics, better implants design, and greater surgical experience. Implants with rigid hinged designs are associated with a high rate of failure and they are now abandoned[1].

Non-constrained, resurfacing devices lessened the rates of loosening[2-7]. However, their use is limited by the need for the presence of adequate bone stock and the ligaments to be intact and functional, which unfortunately is often not the case in advanced diseases. Instability and dislocation remain a major complication in most series[2-4, 8-10].

The semi-constrained Coonrad-Morrey total elbow replacement prosthesis (Zimmer, Warsaw, IN, USA) has a polyethylene-metal loose-hinged device with inherent stability preventing dislocation but yet allows small degrees of physiological varus-valgus motion and axial rotation. This reduces transmission of stress to the bone-cement interface and reduces the risk of loosening. In addition, the distal humeral condyles are not required for its stability, allowing its use in cases with significant bone erosions.

METHODS

Between September 1999 and March 2001, seven patients with rheumatoid arthritis of the elbow were treated with total elbow arthroplasty. One patient

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Table I. Data of the six patients (eight elbows) who underwent total elbow arthroplasty.

Case	Age	Sex	Race	Co-morbidities	Diagnosis	Grade	Operation	Operation time	Discharge
1*	49	F	Chinese	RA x 7 years	Left elbow RA	III	Left TEA	210 min	POD 5
2+	51	F	Chinese	RA x 14 years	Left elbow RA	III	Left TEA	170 min	POD 4
3	53	F	Indian	RA >20 years	Right elbow RA	III	Right TEA	150 min	POD 6
4	66	F	Chinese	RA x 10 years	Left elbow RA	III	Left TEA	145 min	POD 8
5+	52	F	Chinese	RA x 15 years	Right elbow RA	III	Right TEA	145 min	POD 4
6*	50	F	Chinese	RA x 8 years	Right elbow RA	III	Right TEA	215 min	POD 5
7	68	M	Chinese	RA >20 years	Right elbow RA Distal humerus fracture	III	Right TEA	170 min	POD 15
8	55	F	Chinese	RA >20 years Hypt/DM/ old CVA	Left elbow RA Distal humerus fracture	II	Left TEA	160 min	POD 6

*,+: right and left elbows of same patient.

RA: rheumatoid arthritis; Hypt: hypertension; DM: diabetes mellitus; CVA: cerebrovascular accident; TEA: total elbow arthroplasty; POD: post-operative day

had died of perforated duodenal ulcer 19 months after her elbow surgery and was excluded from the study. Two patients had undergone bilateral total elbow arthroplasty, giving eight elbows for evaluation. The mean age of the patients at the time of surgery was 55.5 years (range 49 to 68 years). There were five females and one male. Five of the patients were Chinese (seven elbows), while one patient was an Indian. Four of the patients were housewives, while the other two were retirees. All the patients were right-handed. Four right elbows and four left elbows were operated upon. The indication for surgery was severe pain and stiffness in six elbows, and traumatic distal humerus fractures in two elbows. Using the Mayo classification for rheumatoid elbows, one elbow had grade II disease, while the other seven had grade III radiographical changes (Table I).

We used the semi-constrained Coonrad-Morrey total elbow replacement prosthesis in all the cases (Figs. 1a-d). Because of the small build of the local Asian population, small humeral and ulnar components were used in each case. All the cases were performed by consultants or senior consultants in our department. One surgeon did five of the cases, another surgeon operated on two cases, while a third surgeon did one case. All the patients underwent surgery under general anaesthesia. Bryan's approach[11] was used in all the cases. Postoperatively, intravenous antibiotics were administered for an average of 72 hours. Depending on the surgeon's preference, no physiotherapy or gentle range of motion exercise was started within the first few days.

RESULTS

The average surgical time was 171 minutes (range 145 to 215 minutes). There was inadequate record of tourniquet time and blood loss. The average length of stay postoperatively was 6.6 days (range 4 to 15 days). The average length of follow-up for the eight elbows was 3.3 years or 39.4 months (range 28 to 50 months) (Table II). Six elbows had no pain, while two elbows had mild pain. The average loss of extension was 32.5° (range 20° to 60°), average flexion was 133.8° (range 120° to 140°), and average arc of motion was 101.3 degrees (range 70° to 120°). Supination averaged 63.8° (range 40° to 80°), while average pronation was 67.5° (range 50° to 80°). Clinically, all the elbows were stable at the latest assessment (Table III).

The average Mayo elbow performance score was 93.1 points (range 75 to 100). Six of the elbows achieved excellent results, while the remaining two had good results. Subjectively, two elbows were rated excellent, and five were rated to have a good outcome. One patient had given the surgical outcome a fair rating despite having good range of motion. She was still unable to comb her hair and had difficulty changing clothes by herself. However, her disability was more due to bilateral shoulder arthritis with resultant limitation of motion. The average radiological follow-up was 2.6 years (range five to 45 months). There was no evidence of loosening of the prostheses in all the cases.

Complications included one case of intraoperative lateral condyle fracture, which was treated with screw fixation. The fracture united uneventfully

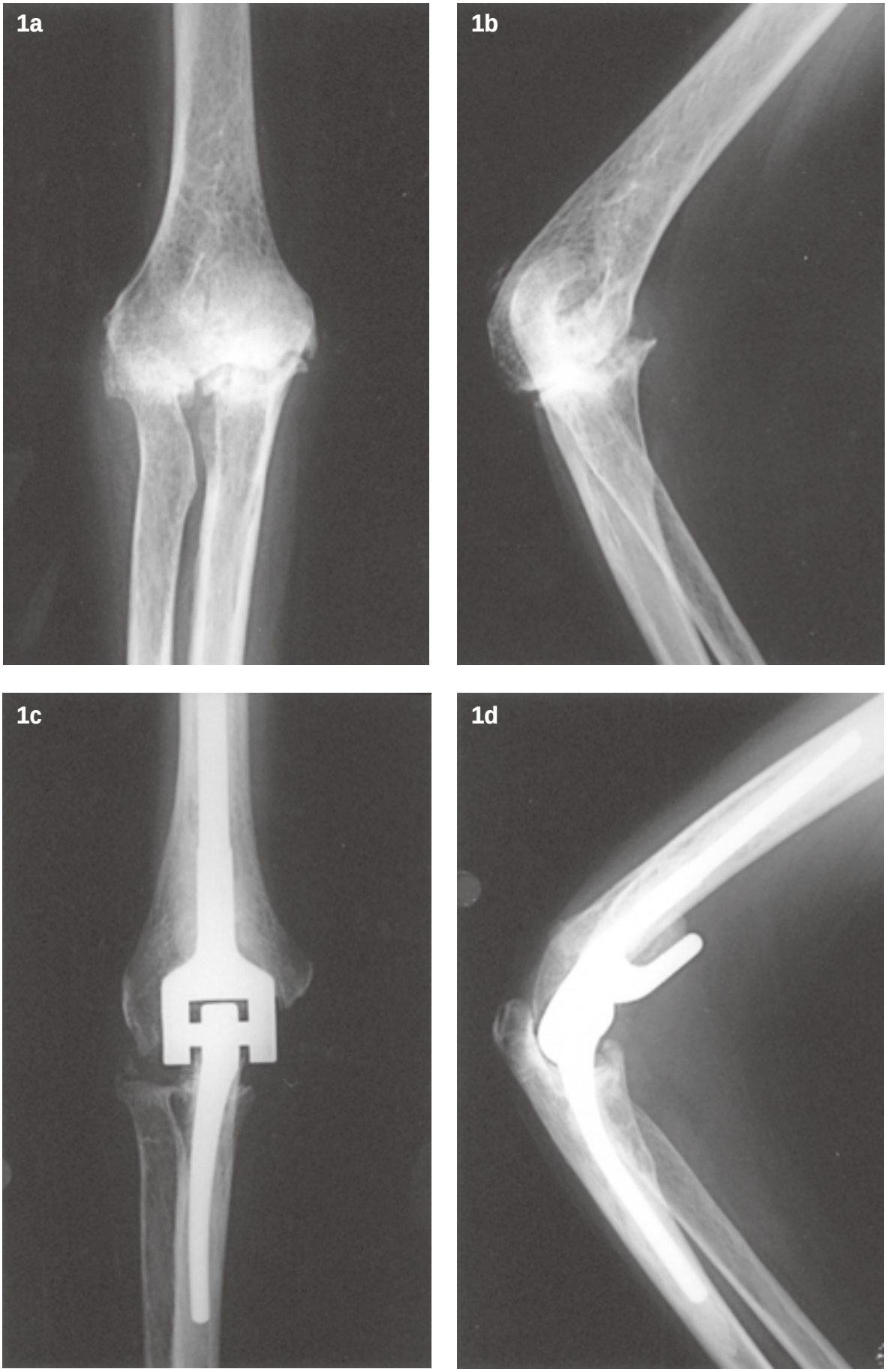

Fig. 1 (a) AP and (b) lateral radiographs of grade III rheumatoid arthritis of the elbow. (c) AP and (d) lateral radiographs of a Coonrad-Morrey total elbow prosthesis 42 months after arthroplasty.

Table II. Results of the eight elbows at the latest follow-up evaluation.

Case	Follow- up duration	Complications	Pain	Ext/flex	Supination/ ROM	Pronation	Stability	Function	MEPS	Outcome	Satisfaction
	Months			*Degrees*	*Degrees*	*Degrees*		*Points*	*Points*	MEPS	*Subjective*
1	50	Nil	No	20 to 140	120	Sup 70/ Pro 50	Stable	25	100	Excellent	Good
2	46	Nil	No	20 to 130	110	Sup 80/ Pro 70	Stable	25	100	Excellent	Excellent
3	44	Nil	No	30 to 140	110	Sup 40/ Pro 80	Stable	25	100	Excellent	Good
4	41	Nil	Mild	20 to 140	120	Sup 80/ Pro 80	Stable	15	75	Good	Fair
5	40	Nil	No	20 to 130	110	Sup 60/ Pro 70	Stable	25	100	Excellent	Excellent
6	38	Lateral condyle #	Mild	30 to 120	90	Sup 50/ Pro 60	Stable	25	80	Good	Good
7	28	Blisters on POD 4	No	60 to 130	70	Sup 50/ Pro 50	Stable	25	95	Excellent	Good
8	28	Nil	No	60 to 140	80	Sup 80/ Pro 80	Stable	25	95	Excellent	Good

#: fracture; POD: post-operative day; Ext/flex: Loss of extension to maximum flexion achieved; ROM: arc of flexion minus loss of extension; Sup/Pro: arc of supination and pronation; MEPS: Mayo elbow performance score.

and the screw was removed four months later. One patient developed blisters around the surgical wound on the fourth postoperative day. He was managed successfully with TG dressings and prophylactic oral antibiotics and was discharged on the 15th postoperative day. There was no incidence of ulnar nerve palsy, triceps weakness or heterotopic ossification in our series.

DISCUSSION

Physiological studies have revealed that there is a continuous and linear change in the carrying angle during flexion and extension of the elbow[12]. In addition, internal axial rotation of the forearm occurs near the beginning and external rotation, towards the end of rotation. Cadaveric studies also showed that normal elbows behave as semi-constrained joints under physiological conditions[13]. Semi-constrained total elbow arthroplasties allow these physiological changes to occur, thereby reducing stress transmission to the prosthesis-bone interface. Morrey et al has also established that most of the activities of daily living can be accomplished with 100 degrees of elbow flexion (from 30 to 130 degrees) and 100 degrees of forearm rotation (50 degrees of pronation and 50 degrees of supination)[14]. Loss of flexion is also more disabling than loss of extension.

Table III. Mayo elbow performance score.

Function	Points	No. of elbows
Pain (maximum 45 points)		
None	45	6
Mild	30	2
Moderate	15	
Severe	0	
Range of motion (maximum 20 points)		
Arc >100°	20	5
Arc 50° to 100°	15	3
Arc <50°	5	
Stability (maximum 10 points)		
Stable	10	8
Moderately unstable	5	
Grossly unstable	0	
Function (maximum 25 points)		
Able to comb hair	5	7
Able to feed oneself	5	8
Able to perform personal hygiene tasks	5	8
Able to put on shirt	5	7
Able to put on shoes	5	8

A review of the literature reveals improving and encouraging short-term results with several semi-constrained designs when they were used in rheumatoid elbows[15-23]. Pain relief ranges from 91 to 100%, with good to excellent results obtained in 87% to 95% of patients. Range of motion in both elbow flexion-extension and forearm rotation increases postoperatively in most series. The revision rate for loosening remains low at 1% to 5% at follow-up of between two and five years. More recently, Gill and Morrey published their results on ten to 15 years of follow-up of 78 elbows, including 69 rheumatoid elbows, which have undergone total elbow arthroplasty[24]. 97% of the patients had no or mild pain. The mean arc of extension-flexion was 28 to 131 degrees, and 86% good or excellent results were reported. The rate of survival of the prosthesis was 92.4% at ten years, comparable to those achieved for hip and knee arthroplasty.

Our institution started the use of Coonrad-Morrey semi-constrained total elbow prosthesis for the treatment of advanced rheumatoid elbows in 1999. In our small study of eight elbows followed-up for an average of 3.3 years, all the patients had no or mild pain. The mean arc of extension-flexion of 32.5° to 133.8° approximated the functional arc of 30° to 130°.

Mean supination and pronation of greater than 60° each was also better than the functional arc of 50°/50°. All the elbows were stable clinically. Good to excellent results were achieved in all the eight elbows. Subjectively, the patients were satisfied with seven of the eight elbows (87.5%). These results were comparable with most series.

In conclusion, our small study of eight cases revealed good to excellent short-term outcome with the use of semi-constrained total elbow arthroplasty for the treatment of rheumatoid arthritis of the elbow in the local population. There was one case of intraoperative lateral condyle fracture and one case of superficial wound complication. We will continue to follow-up these patients to determine the long-term outcome and survivorship of the prosthesis.

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