SHORT-TERM COMPLICATIONS OF THE LATERAL APPROACH FOR NON-CONSTRAINED ELBOW REPLACEMENT

FOLLOW-UP OF 50 RHEUMATOID ELBOWS

PETER LJUNG, KJELL JONSSON, URBAN RYDHOLM

From the University Hospital, Lund, Sweden

We reviewed 50 capitellocondylar elbow replacements performed by the lateral approach in 42 rheumatoid patients, at a median follow-up of three years. There were two major and 17 minor complications; 18 were early and one was late.

Eight elbows required reoperation: soft-tissue surgery was performed in seven and prosthesis removal in one because of a deep infection. There were few problems of instability, but one patient sustained a traumatic dislocation which was stabilised after ligament reconstruction. Wound healing was delayed in two of five elbows which had been immobilised postoperatively for only five days, but healing was rapid in 45 elbows immobilised for 12 days.

There was transient ulnar-nerve palsy postoperatively in 11 patients, with permanent palsy in three. All elbows were painfree or only slightly painful at follow-up; 49 were stable and 43 had a range of motion sufficient for activities of daily living. Radiological loosening of the humeral component was suspected in one asymptomatic elbow.

The lateral approach is recommended for use with the capitellocondylar type of prosthesis in rheumatoid elbows with reasonably well-preserved bone stock.

J Bone Joint Surg [Br] 1995;77-B:937-42.

Received 18 January 1995; Accepted after revision 12 May 1995

Total elbow replacement in rheumatoid arthritis using cemented cobalt-chrome prostheses of non-constrained and semiconstrained types has low medium-term failure rates (Ewald et al 1993; Kraay et al 1994), but complication rates have remained high. Apart from the implant design, the surgical approach may also be an important factor. In the lateral approach to the elbow (Ewald and Jacobs 1984), the medial collateral ligament and the main part of the triceps tendon are preserved and Ewald et al (1993) reported a lower incidence of complications after the use of this approach.

We have made a prospective study of the incidence of complications and the clinical outcome in a consecutive series of rheumatoid patients in whom a lateral approach was used to implant a capitellocondylar total elbow replacement.

PATIENTS AND METHODS

Between May 1989 and April 1993, we performed 50 total elbow replacements with the capitellocondylar elbow prosthesis (Fig. 1) in 42 patients (4 men and 38 women) with a median age of 62 years (25 to 80). The indication for surgery was rheumatoid destruction to radiological stages 3 to 5 (Larsen, Dale and Eek 1977), with pain (44 elbows), restricted elbow mobility (1) or both (5). Sixteen of the elbows had had previous operations (17 synovectomies and two interposition arthroplasties; three elbows had been operated on twice). Thirty-eight patients had rheumatoid arthritis (RA) and four had juvenile chronic arthritis (JCA) with a median disease duration of 22 years (3 to 46).

All elbows were examined pre- and postoperatively, at four months and then annually. Twenty elbows were followed for two years, ten for three years, 11 for four years and nine for five years; the median follow-up was three years. Postoperative complications were recorded as major or minor, and as either early (within the first four months) or late. Major complications were those that threatened the survival of the prosthesis.

Elbow pain on motion and at rest was recorded on a 10-grade visual analogue scale (VAS) from 0 to 9, and elbow examination included range of motion, joint stability, tenderness, swelling and ulnar-nerve function. The range of

P. Ljung, MD, PhD, Consultant
U. Rydholm, MD, PhD, Associate Professor
Department of Orthopaedics
K. Jonsson, MD, PhD, Associate Professor
Department of Radiology
University Hospital, S-221 85 Lund, Sweden.

Correspondence should be sent to Dr P. Ljung at the Department of Orthopaedics, Håssleholm Hospital, S-281 25 Håssleholm, Sweden.

©1995 British Editorial Society of Bone and Joint Surgery
0301-620X/95/61092 \$2.00

Fig. 1

The capitellocondylar elbow prosthesis.

extension, flexion, supination and pronation was measured by goniometer and recorded at 5° intervals. Joint instability was estimated at maximal extension and at semiflexion and noted as absent (<10°) or present (≥10°). Joint tenderness and swelling were recorded. Enquiry was made about paraesthesia of the little finger, and clinical examination of ulnar-nerve function was performed, comparing tactile sensitivity of the little finger and the strength of the abductor digiti minimi with those of the contralateral side. The Swedish version of the Stanford Health Assessment Questionnaire (HAQ) (Ekdahl et al 1988) was used to assess function, and the HAQ index (0 to 3) for activities of daily living was determined.

Radiography. Radiographs were obtained in standard lateral and AP projections, with additional frontal projections at right angles to the forearm and to the upper arm for elbows with an extension deficit. The preoperative radiographs were classified according to Larsen et al (1977). Postoperative radiographs were evaluated for incongruity between the prosthetic components and for any radiolucency at the cement-bone interface either at the shaft of

either component or adjacent to the proximal part of the ulnar component. This was recorded as absent, ≥1 but <2 mm, or as ≥2 mm. It was impossible to evaluate radiolucency adjacent to the distal part of the humeral component, because of its design (Fig. 2). Other signs of prosthetic loosening, such as change of position of components, cement fracture or cortical thinning, were also recorded.

Operative procedure. We used a modified lateral Kocher approach (Ewald and Jacobs 1984) in all elbows. Operation was performed with the patient in a lateral position and under general anaesthesia, usually combined with an interscalene block. Prophylactic antibiotics were given intravenously before tourniquet application.

In 11 patients with preoperative signs of ulnar-nerve neuropathy or with a history of surgery of the ulnar nerve, a separate medial incision was used to divide the fibrous arch of the medial epicondyle and the proximal part of the fascia of the flexor carpi ulnaris, before exposure of the joint.

The lateral skin incision was preferably made between the lateral epicondyle and the olecranon but the scars of previous lateral incisions were used, if present, to avoid

Fig. 2

AP radiograph of a capitellocondylar elbow prosthesis with no signs of loosening or incongruity.

Fig. 3

Frontal projections of the capitellocondylar elbow prosthesis, showing normal position (left) and lateral translocation (right) of the ulnar component. In the normal position, incongruity is evident, and the ulnar component seems to be malrotated in relation to the ulna.

skin necrosis. The lateral collateral ligament was detached from its humeral origin, while the medial collateral ligament was left intact. We used a capitellocondylar prosthesis (Johnson & Johnson Orthopaedics, Raynham, Massachusetts) of standard or large size (Fig. 1) with a 5° valgus stem on the humeral component and a standard or thin stem on the metal-backed ulnar component. Apart from the standard instruments, we designed and used a saw jig to prepare the humerus. The use of ulnar components of three different thicknesses enabled us to balance the prosthetic joint against the intact medial collateral ligament (Ewald 1994). Both medullary canals were plugged and a vacuum-mixed gentamicin-containing polymethylmethacrylate cement was introduced with pressurisation (Palacos; Schering Corp, USA). The lateral collateral ligament was resutured at the correct tension.

The first five elbows were each held for five days in a plaster splint at 70° of flexion, but the others were held for 12 days in the same position. After removal of the splint, a hinged brace was fitted and used for another four weeks. Active exercises started then, but supination was allowed only after six weeks.

Statistics. We used the Wilcoxon signed-rank test and the chi-squared test to compare preoperative with postoperative examinations, and considered that *p* values of less than 0.05 were significant.

COMPLICATIONS AND REOPERATIONS

There were two major and 17 minor complications (Table I), only one of which was late. Ten revision operations were required in eight elbows (Table I). Soft-tissue surgery was performed in seven and the prosthesis was removed in one of these elbows.

Major complications. A female patient with rheumatoid vasculitis being treated with steroids and cytostatic drugs developed infection 12 months after the elbow replacement. A knee replacement and several metacarpophalangeal prostheses became infected probably from a small ulcer on one leg. One leg was amputated and the MTP joint prostheses were removed. The elbow replacement was also removed with conversion to a resection arthroplasty.

The second patient, an 80-year-old woman, sustained traumatic wound rupture and dislocation of the elbow prosthesis in a fall soon after operation. The wound was immediately resutured and the arm immobilised, but the elbow remained unstable. The lateral collateral ligament was twice reconstructed using external fixation on the second occasion. One year later, the patient was painfree with good elbow function and stability and a range of motion from 25° to 145°.

Minor complications. There were no wound-healing complications in the 45 elbows immobilised for 12 days, but wound healing was delayed in two of the five elbows mobilised earlier. Neither became infected and both healed after secondary suture.

In one elbow lateral translocation of the ulnar component was seen on radiography at six weeks after surgery. The translocation could be reduced but not held (Fig. 3) and there was minor lateral instability. Postoperative treatment with a hinged brace was continued for another six weeks. At one year the elbow was stable and painfree with a range of motion from 25° to 145°, although radiological lateral translocation remained.

Ulnar-nerve palsy or paresis was recorded in 14 elbows, of which four had postoperative nerve decompression. This palsy was transient in 11 and permanent in three.

Table I. Postoperative complications and reoperation in 50 elbow arthroplasties

Major complications	
Deep infection, haematogenous	1
Dislocation, traumatic	1
Minor complications	
Delayed wound healing	2
Lateral translocation	1
Ulnar-nerve palsy	
Transient	11
Permanent	3
Reoperations	
Removal of prosthesis	1
Reconstruction of lateral collateral ligament*	2
Secondary wound suture*	3
Ulnar-nerve decompression	4

* three reoperations were performed in the same patient

Fig. 4

VAS scores for pain on motion before and at a median three years after total elbow replacement (n = 50).

Fig. 5

VAS scores for pain at rest before and at a median three years after total elbow replacement (n = 50).

Table II. Median range of motion (degrees; range) before and three years after 50 elbow replacements

	Preop	Postop
Extension	-40 (-15 to -85)	-30 (-5 to -80)
Flexion	135 (80 to 150)	145 (120 to 155)
Supination	70 (0 to 90)	70 (25 to 90)
Pronation	60 (15 to 90)	70 (30 to 90)

RESULTS

The median VAS score for pain on motion was reduced from 7 to 0 (Fig. 4) and for pain at rest from 2 to 0 (Fig. 5), and the ranges of flexion, extension and pronation had improved (Table II). The median total range of flexion-extension had improved from 95° to 115°, having improved in 43 elbows, deteriorated in four and remained the same in three.

At preoperative examination 25 elbows were stable or only slightly unstable (<10°) while 25 elbows were unstable (≥10°): all but one were stable or only slightly unstable at follow-up. Thirty-one elbows had signs of synovitis while none had such signs at follow-up. No differences were found between the results from the follow-up at 4 months or at 1, 2, 3, 4 and 5 years regarding pain score, range of motion and the presence of instability and synovitis.

Thirteen patients had some signs of ulnar neuropathy before operation, four with sensory deficits and three with sensory and motor deficits. The other six had paraesthesia in the little finger but no definite deficits. Eleven of the 13 had ulnar-nerve decompression at the time of elbow replacement. At four months postoperatively, the preoperative neuropathy had persisted in ten, but by one year in only five and by two years in only three. Postoperative

ulnar-nerve symptoms or signs were recorded in 14 patients with no preoperative signs of ulnar neuropathy. Thirteen had sensory deficits and one had sensory and motor deficits. At four months, the deficit was still present in seven, but by two years in only three, all of whom had improved and had only minor complaints.

The HAQ index of performance of activities of daily living decreased from a median of 1.7 (0.6 to 2.8) preoperatively to 1.6 (0.1 to 2.8) at four months and at one year postoperatively. At later follow-up it tended to increase and no longer differed from the preoperative value.

Radiography. Before operation 15 elbows were classified as stage 3 of Larsen et al (1977), 26 as stage 4 and 9 as stage 5. Follow-up radiographs showed suspected loosening of one humeral component with a non-progressive, incomplete, radiolucency of 2 mm at the cement-bone interface, medial to the distal part of the stem, in combination with a fracture of the proximal tip of the cement (Fig. 6). In another four elbows, a radiolucency of 1 to 2 mm was seen at the cement-bone interface adjacent to the proximal part of the ulnar component. There was incongruity between the prosthetic components on radiographs of two elbows, one after traumatic dislocation, and one with lateral translocation (see Fig. 3).

DISCUSSION

The incidence of postoperative complications after total elbow replacement is difficult to estimate: most series are small and retrospective with varying follow-up. Complication rates reported in small series vary from 3% (Pritchard 1984) to 87% (Kasten and Skinner 1993). In our series of 50 non-constrained total elbow replacements, our total short-term complication rate (19 of 50) is comparable with

Fig. 6a

Fig. 6b

Radiographs before (a) and five years after (b) capitellocondylar total elbow replacement. Preoperatively, there is extensive bone loss and postoperatively there is distal radiolucency around the humeral component and a proximal cement fracture.

those previously reported for both non-constrained and semiconstrained series (Gschwend et al 1988; Ewald et al 1993), but we had only two major complications. Our most frequent complication was transient ulnar-nerve palsy, which may easily be overlooked unless prospective studies are made.

Postoperative dislocation has been a problem in non-constrained total elbow replacement with an average rate of 5% (Rosenberg and Turner 1984; Pöll and Rozing 1991; Ruth and Wilde 1992; Lyall et al 1994). We had only one case of traumatic dislocation in our series and instability was not a problem. Lateral translocation, seen in one of our elbows, may be caused by malrotation of the ulnar component (Fig. 3), but seemed to have little immediate clinical relevance (Ewald et al 1993) although excess polyethylene wear may follow, since the components are not completely congruent in the translocated position. The stability of a capitellocondylar prosthesis depends on the integrity of the collateral ligaments (Itoi et al 1992), and such stability can be obtained by implantation through a lateral approach. The use of ulnar components of different heights, an intact medial collateral ligament and a resutured lateral collateral ligament allow for proper soft-tissue balancing, which can prevent dislocation and instability.

Deep infection may occur early or late in the postoperative course: late infection is usually haematogenous, but defective wound healing is the major cause of early infection (Roper et al 1986; Wolfe et al 1990; Ruth and Wilde 1992). Previous surgery increases the risk of wound-healing problems (Hodgson, Parkinson and Noble 1991) and of infection (Morrey and Bryan 1983; Wolfe et al 1990). Postoperative immobilisation has been reported to prevent wound-healing complications in small series of total elbow replacements (Maloney and Schurman 1989; Brady and Quinlan 1993), and we also found no complications of healing in 45 elbows immobilised for 12 days postoperatively. Our total incidence of deep infection (1 of 50) was lower than the reported average of 4% to 5% (Morrey and Bryan 1983; Wolfe et al 1990).

Postoperative ulnar-nerve palsy is the most frequent

complication, but there is a wide variation in reported severity and incidence. Ewald et al (1993) reported a decreased incidence of ulnar-nerve palsy after implantation through a lateral approach (18 of 120) compared with a posterior approach (25 of 82), but Hodgson et al (1991) reported a very high incidence after the lateral approach (16 of 23), and our rate was also high (14 of 50). Most of the ulnar-nerve palsies were transient in all three studies, with a low incidence of permanent symptoms and signs.

It has been suggested that ulnar-nerve palsy may be prevented by frequent relocation of the laterally-approached elbow during surgery, and by a release of the fibrous arch and the fascia overlying the ulnar nerve at the medial epicondyle (Ewald et al 1993). We did not relocate elbows regularly, and decompression was performed only for patients with preoperative rheumatoid ulnar neuropathy or with a history of previous exposure and possible scarring of the nerve. We can therefore draw no conclusions on the preventive effects of frequent relocation or ulnar-nerve decompression. Ljung et al (1995) studied ulnar-nerve function during non-constrained total elbow replacement by the lateral approach. They showed that dislocation of the laterally-approached elbow carried a risk of ulnar-nerve injury, which did not seem to be prevented by decompression of the ulnar nerve, and confirmed the value of frequent relocation during surgery.

The outcome of total elbow replacement is generally satisfactory in terms of pain relief, joint stability and range of motion. A useful elbow should have a pain score of from 0 to 3 on a 10-point visual analogue scale, instability of less than 10° and a range of flexion-extension of 100° or more. In our series 43 of 50 elbows fulfilled these criteria of satisfactory function.

Function, measured by the HAQ index, had improved slightly at four months and at one year after capitellocondylar total elbow replacement, but there was no difference at later reviews, perhaps because of progress of the disease in other joints. Jonsson and Larsson (1990) found that function of both the hand and the arm, specifically evaluated by Sollerman's hand-function test and locomotion score, had

improved at six months after total elbow replacement for rheumatoid arthritis. This improvement was probably barely measurable by the HAQ index in the face of the slowly deteriorating overall function of our patients. The general functional improvement after a successful elbow replacement may last, but the HAQ index is not sensitive enough to evaluate the effect on function of a single joint.

We had only one suspected radiological loosening. Radiographs showed radiolucency around the humeral component in our first patient who was followed for five years and remained asymptomatic. Preoperative bone loss had been extensive, and the bone stock was, in retrospect, insufficient for proper seating of the humeral component (Fig. 6). Radiolucency adjacent to the proximal part of the ulnar component in four elbows was not considered to be a sign of loosening (Dennis et al 1990; Ewald et al 1993). Three previous reports on the capitellocondylar elbow (Weiland et al 1989; Ruth and Wilde 1992; Ewald et al 1993) indicated that longer-term revision rates for aseptic loosening were low (0 of 40 at 86 months; 1 of 51 at 78 months; 3 of 202 at 69 months). These levels are comparable with those for the hip and the knee.

Kraay et al (1994) reported 90% five-year survival with the Osteonics linked semiconstrained elbow prosthesis in 86 rheumatoid elbows, which should be compared with the

4% revision of 202 capitellocondylar non-constrained replacements followed for an average of six years, reported by Ewald et al (1993). The use of a semiconstrained prosthesis avoids early dislocation, but late loosening and mechanical failure of the sloppy hinge may produce an increasing revision rate with longer follow-up (Madsen, Søjbjerg and Sneppen 1994). With a non-constrained prosthesis, late loosening does not appear to be a problem (Ewald et al 1993), but there is greater risk of early dislocation. Our study indicates that the use of the lateral approach may help to avoid instability problems after non-constrained elbow replacement.

Our review showed that major short-term complications were few, instability was uncommon, and the outcome, in terms of pain relief, range of motion and joint stability, was satisfactory after capitellocondylar total elbow replacement for rheumatoid arthritis through a lateral approach provided that there was reasonably well-preserved bone stock.

This study was supported by Stiftelsen Konsul Thure Carlssons Minne, Alfred Österlunds Stiftelse, Stiftelsen för bistånd åt vanföra i Skåne, MFR (project 17X-09509), Lunds sjukvårdsdistrikt and Thelma Zoëgas fond för medicinsk forskning.

Although none of the authors have received or will receive benefits for personal or professional use from a commercial party related directly or indirectly to the subject of this article, benefits have been or will be received but are directed solely to a research fund, foundation, educational institution, or other non-profit institution with which one or more of the authors is associated.

REFERENCES

- Brady O, Quinlan W. The Guildford elbow. *J Hand Surg [Br]* 1993; 18:389-93.
- Dennis DA, Clayton ML, Ferlic DC, Stringer EA, Bramlett KW. Capitello-condylar total elbow arthroplasty for rheumatoid arthritis. *J Arthroplasty* 1990;Suppl:S83-8.
- Ekdahl C, Eberhardt K, Andersson SI, Svensson B. Assessing disability in patients with rheumatoid arthritis: use of a Swedish version of the Stanford health assessment questionnaire. *J Rheumatol* 1988; 17:263-71.
- Ewald FC. Capitellocondylar total elbow arthroplasty. In: Morrey BF, ed. *Master techniques in orthopaedic surgery: the elbow*. Raven Press Ltd, 1994;12:209-30.
- Ewald FC, Jacobs MA. Total elbow arthroplasty. *Clin Orthop* 1984; 182:137-42.
- Ewald FC, Simmons ED, Sullivan JA, et al. Capitellocondylar total elbow replacement in rheumatoid arthritis: long-term results. *J Bone Joint Surg [Am]* 1993;75-A:498-507.
- Gschwend N, Loehr J, Ivosevic-Radovanovic D, Scheier H, Munzinger U. Semiconstrained elbow prostheses with special reference to the GSB III prosthesis. *Clin Orthop* 1988;232:104-11.
- Hodgson SP, Parkinson RW, Noble J. Capitellocondylar total elbow replacement for rheumatoid arthritis. *J R Coll Surg Edinb* 1991; 36:133-5.
- Itoi E, King GJW, Morrey BF, An KN. Stabilizers of capitellocondylar total elbow arthroplasty. *J Shoulder Elbow Surg* 1992;1:271-9.
- Jonsson B, Larsson SE. Elbow arthroplasty in rheumatoid arthritis: function after 1-2 years in 20 cases. *Acta Orthop Scand* 1990; 61:344-7.
- Kasten MD, Skinner HB. Total elbow arthroplasty: an 18-year experience. *Clin Orthop* 1993;290:177-88.
- Kraay MJ, Figgie MP, Inglis AE, Wolfe SW, Ranawat CS. Primary semiconstrained total elbow arthroplasty: survival analysis of 113 consecutive cases. *J Bone Joint Surg [Br]* 1994;76-B:636-40.
- Larsen A, Dale K, Eek M. Radiographic evaluation of rheumatoid arthritis and related conditions by standard reference films. *Acta Radiol [Diagn] (Stockh)* 1977;18:481-91.
- Ljung P, Ahlmann S, Knutson K, Rosén I, Rydholm U. Intraoperative monitoring of ulnar nerve function during replacement of the rheumatoid elbow via the lateral approach. *Acta Orthop Scand* 1995;66:132-6.
- Lyall HA, Cohen B, Clatworthy M, Constant CR. Results of the Souter-Strathclyde total elbow arthroplasty in patients with rheumatoid arthritis: a preliminary report. *J Arthroplasty* 1994;9:279-84.
- Madsen F, Søjbjerg JO, Sneppen O. Late complications with the Pritchard Mark II elbow prosthesis. *J Shoulder Elbow Surg* 1994;3:17-23.
- Maloney WJ, Schurman DJ. Cast immobilisation after total elbow arthroplasty: a safe cost-effective method of initial postoperative care. *Clin Orthop* 1989;245:117-22.
- Morrey BF, Bryan RS. Infection after total elbow arthroplasty. *J Bone Joint Surg [Am]* 1983;65-A:330-8.
- Pritchard RW. Anatomic surface elbow replacement. *Contemp Orthop* 1984;9:13-21.
- Pöll RG, Rozing PM. Use of the Souter-Strathclyde total elbow prosthesis in patients who have rheumatoid arthritis. *J Bone Joint Surg [Am]* 1991;73-A:1227-33.
- Roper BA, Tuke M, O'Riordan SM, Bulstrode CJ. A new unconstrained elbow: a prospective review of 60 replacements. *J Bone Joint Surg [Br]* 1986;68-B:566-9.
- Rosenberg GM, Turner RH. Nonconstrained total elbow arthroplasty. *Clin Orthop* 1984;187:154-62.
- Ruth JT, Wilde AH. Capitellocondylar total elbow arthroplasty: a long-term follow-up study. *J Bone Joint Surg [Am]* 1992;74-A:95-100.
- Weiland AJ, Weiss A-PC, Wills RP, Moore JR. Capitellocondylar total elbow replacement. *J Bone Joint Surg [Am]* 1989;71-A:217-22.
- Wolfe SW, Figgie MP, Inglis AE, Bohn WW, Ranawat CS. Management of infection about total elbow prostheses. *J Bone Joint Surg [Am]* 1990;72-A:198-212.