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Total elbow arthroplasty with the Kudo prosthesis

Accepted: 12 June 2003 / Published online: 17 July 2003
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Abstract Between 1990 and 1997 we undertook 57 Kudo type-4 total elbow replacements in 45 patients with rheumatoid arthritis. A total of 34 patients (44 elbows) were evaluated at an average of 7 (4.4–11.2) years using the Mayo Clinic Performance Index. At review 29 elbows were excellent or good and four were fair or poor. The main complications were intraoperative fractures and ulnar neuropathy. No luxations were seen. Loosening of the ulnar component and breakage of the humeral component were most frequent indications for revision. Preoperative radiographic joint destruction was not correlated with revision rate.

Résumé Entre 1990 et 1997 nous avons réalisés 57 prothèses totales du coude Kudo type-4 chez 45 malades atteints de polyarthrite rhumatoïde. Un total de 34 malades (44 coudes) a été évalué à une moyenne de 7 ans (4.4–11.2) en utilisant l'index de performance de la Mayo Clinique. À la révision 29 coudes étaient excellents ou bons et quatre étaient médiocres ou mauvais. Les principales complications étaient les fractures opératoires et les neuropathies ulnaires. Il n'y a eu aucune luxation. Le descellement du composant ulnaire et la rupture du composant huméral étaient les indications les plus fréquentes de révision. La destruction radiographique pré-opératoire de l'articulation n'avait pas de correspondance avec le taux de révision.

Introduction

Various types of total elbow prostheses have been developed during the last decades, resulting in unconstrained and semiconstrained types. Some authors believe that with progressive joint destruction and lack of ligamentous stability, a more constrained type of elbow prosthesis is indicated [2, 3, 5, 15]. However, considering the constrained prostheses' high loosening rate, a semiconstrained prosthesis can still be indicated, even in elbows with severe destruction.

In this study we evaluated the clinical and radiological results of the Kudo type-4 unconstrained total elbow prosthesis in Larsen grades III, IV and V elbow joints and compared our findings with the results of other studies [9].

Materials and methods

From 1990 to 1997, 57 elbows in 45 patients with rheumatoid arthritis (RA) underwent a primary, noncemented total elbow arthroplasty using the Kudo type-4 prosthesis. Eleven patients (13 elbows) were lost to follow-up: six had died, one could not be traced, and four were interviewed by telephone because they were unable to visit our clinic due to poor physical condition.

Thirty-four patients (seven men and 27 women with 44 elbows) (19 dominant arms and ten operated bilaterally) were available for follow-up. The average age at the time of operation was 53 (23–76) years. Forty-four elbows were available for radiographic assessment. Preoperatively two investigators (DE, MH) independently graded all elbows radiographically according to Larsen [9].

The operations were performed by two orthopaedic surgeons using the posterior triceps splitting approach. Prophylactic intravenous antibiotics were given routinely. The ulnar nerve was routinely identified but not mobilized, except for three elbows where the nerve was transposed. Postoperatively the elbow was immobilized in a posterior splint at 90° of flexion for 5 days. Thereafter the elbow was mobilized under supervision of a specialized physiotherapist, avoiding active extension for six weeks. Two elbows were immobilized because of intraoperative fracture or instability.

After an average follow-up of 7.7 (4.4–11.2) years, 34 patients (44 elbows) were examined by two of the authors (DE, RR) who were not the surgeons. The Elbow Function Assessment Scale (EFA) and the Mayo Clinic Performance Index (MCPI) for the el-

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bow were used to assess pain, motion, stability and daily function [1, 10]. In addition the patients were asked to classify the result of their operation as excellent, good, fair or poor.

Anteroposterior and lateral radiographs of the operated elbow were obtained in a standardized way at follow-up. The radiographs were analyzed for implant subsidence, radiolucency, periprosthetic fractures, (sub)luxation and periarticular ossifications.

Results

Thirteen patients classified the function of their prosthesis as excellent, 30 as good, five as fair and one as poor. At the latest follow-up the average pain score (scale 0–10, 0 means no pain) at rest was 0.8 (range 0–8) and at activity 2.3 (range 0–9). The patients interviewed by telephone were included in these results of subjective function and pain score. Average flexion at reexamination was 136° (115–155°), extension 31° (12–90°), pronation 63° (20–90°) and supination 57° (0–90°). The average MCPI and EFA for elbows without revision were respectively 86.5 and 82.3 and for revised elbows 77.7 and 79.7. Results are listed in Table 1.

There were four intraoperative fractures; no subluxations were seen. Three patients had preoperative ulnar neuropathy. Neurological complications occurred in ten cases after operation—nine ulnar neuropathies and one radial neuropathy. In additional operations the ulnar nerve was released in two elbows and transposed in two. The ulnar neuropathy resolved in five cases and persisted in four; radial neuropathy had resolved. However, at follow-up, six other patients had symptoms of ulnar neuropathy.

Postoperatively four elbows had a limited range of motion. An operative release was done in three elbows and one was manipulated under anesthesia. One patient had a superficial infection, which was treated successful-

ly with 2 weeks of intravenous antibiotics. Eleven elbows underwent a revision after an average of 4.4 (1.8–8.0) years—six for ulnar loosening, four for breakage of the humeral component and one for a broken ulnar component. Two further elbows showed loosening of the ulnar component and breakage of the humeral component respectively. Both are scheduled for revision. We found no correlation between the preoperative radiographic joint destruction and the revision rate (Table 2).

Discussion

Due to the high incidence (70%) of proximal subsidence of the humeral component, the use of Kudo type-1 and type-2 prostheses was no longer recommended in 1985. In 1983 the type-3 prosthesis was developed. This prosthesis had an added humeral intramedullary stem to secure fixation [6]. With the Kudo type-4 prosthesis the complications were fatigue breakage of the humeral stem, metallosis and a high rate of polyethylene wear [7]. Results after an intermediate follow-up of Kudo type-5 prosthesis in patients with Morrey-Adams grade 3 (91%) and grade 4 (9%) showed fair to excellent clinical scores, no revisions and no radiolucency [8].

Our most frequent indications for revision were breakage of the humeral component ($n=5$) and ulnar loosening ($n=7$). Fatigue breakage of the Kudo type-4 humeral stem has been documented before and seems to be overcome by the development of Kudo type-5 prosthesis [8, 13]. The high rate of ulnar loosening in our series is surprising. Generally the literature reports a high rate of humeral loosening whereas ulnar loosening is reported less often [6, 13]. A possible explanation may be the fact that we used uncemented prostheses, whereas in other series both components were cemented.

Our study confirms the high complication rate reported previously in other series [11, 14, 16]. Neuropathy of the ulnar nerve is an important complication following total elbow arthroplasty. Studies show an incidence varying from 2 to 65% [12]. Our rate of persistent ulnar neuropathy was 9%. In the six patients who developed ulnar neuropathy several years after operation, a relation with RA seems likely. One study supports this idea, showing a high incidence (40%) of preoperative ulnar or peripheral neuropathy in the patients with RA [12]. Although postoperative valgus instability of the elbow may also be the cause, there was no relation between valgus instability and ulnar neuropathy in our group.

The infection rate after total elbow arthroplasty varies from 1.5 to 9% [4, 5]. Because of its subcutaneous position and poor soft-tissue cover, the incidence is higher than in other arthroplasty [5]. In our study one patient (2.2%) had a superficial infection, which recovered after 2 weeks.

Kudo unconstrained type-4 total elbow arthroplasty generally results in acceptable scores and function without dislocation or instability, even in elbow joints with severe destruction. Our study confirms the high rates of breakage of the humeral component. The rate of persistent ulnar

Table 1 Results at follow-up in numbers of elbows. *MCPI* Mayo Clinic Performance Index, *EFA* Elbow Function Assessment Scale

Score	MCPI	EFA
90–100	23	15
75–89	13	18
60–74	4	7
<60	4	4
Total	44	44

Table 2 Radiographic assessment and correlation with revision rate

Larsen	Elbows without revision	Elbows with revision	Total
Grade I	0	0	0
Grade II	0	0	0
Grade III	9	4	13
Grade IV	11	3	14
Grade V	11	6	17
Total	31	13	44

neuropathy and revisions (30%) is relatively high. Fatigue breakage of the humeral stem seems to be overcome by the introduction of the Kudo type-5 prosthesis. To prevent ulnar loosening we advise the use of an extended ulnar stem and fixation of the ulnar component with cement.

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