

Total elbow arthroplasty in rheumatoid arthritis

20 GSBIII prostheses followed 2–5 years

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From 1993 to 1996, we implanted 20 primary GSB III prostheses in 17 patients with rheumatoid arthritis. The Mayo Clinic performance index for the elbow was used for the evaluation. The average follow-up was 3 (2–5) years. At the follow-up examination, 12 elbows had an excellent result and 8 a good result. The medi-

an performance index increased from 30 (15–53) points to 95 (80–100) points. The subjective assessment was excellent for 11 elbows, good for 8 and poor for 1. 2 elbows had radiographic loosening with a progressive radiolucent line and a change in the orientation of the prosthesis.

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Before the 1970s, when total elbow arthroplasty was developed, synovectomy of the elbow combined with or without radial head resection, resection arthroplasty with or without interposition of soft tissues and, rarely, arthrodesis were the surgical choices. Today, resection arthroplasty and arthrodesis are no longer recommended (Brumfield et al. 1990, Pöll and Rozing 1991). Synovectomy with radial head resection is still performed in elbows without marked articular destruction, although this procedure does not prevent destruction. In cases with advanced articular destruction, total elbow arthroplasty is recommended. We evaluated the outcome of 20 primary GSB III arthroplasties.

Patients and methods

From 1993 to 1996, the same surgeon implanted 20 consecutive GSB III prostheses in 17 patients with rheumatoid arthritis (13 women). The mean age at the time of operation was 62 (48–79) years. 7 patients were in Steinbrocker (1949) class 2 and 10 in class 3. All patients were right-handed. 3 patients (1 woman) had a bilateral operation, 9 patients underwent surgery on the right side and 5 on the left side. The mean duration between the onset of rheumatoid arthritis and the prosthesis implan-

tation was 17 (7–23) years. All patients had had medical treatment and 9 elbows had had an elbow synoviorthesis. Of the 3 patients with bilateral prostheses, 1 had had a bilateral ulnar transposition and 1 a bilateral wrist synovectomy. In 9 patients, an operative procedure had been performed on the arthroplasty side (Benjamin osteotomy 1; wrist arthrodesis 2; wrist synovectomy 3; MCP arthroplasty 1) and on the opposite side (total shoulder arthroplasty 1; wrist synovectomy 4; wrist arthrodesis 1). 5 patients had had no upper limb surgery before the elbow arthroplasty.

4 elbows were radiographic stage 2, 8 stage 3, 6 stage 4, and 2 stage 5 according to Larsen et al. (1977). Pain was the primary indication for the operation in 17 elbows and limited motion was the primary reason in 3.

The operation was performed on the elbows using a pneumatic tourniquet and the transtricipital approach (Gschwend et al. 1996). Prophylactic intravenous antibiotics were given routinely. The ulnar nerve was released and protected, but not transposed anteriorly. 1 or 2 screws (3.5 mm) were put in 2 elbows because of condyle bone loss (Figure 1). Palacos with gentamicin was used on both the ulnar and humeral sides, without plugging the medullary canal and without the intramedullary injecting system. Postoperatively, the elbow was immobilized in a posterior splint at 90° of flexion.



Figure 1. A GSB III prosthesis with screws because of lateral condyle bone loss.

Mean duration of hospitalization was 7 (4–11) days. Rehabilitation was provided to all patients in a specialized center for an average of 38 (30–60) days. Elbow motion began, on average, on day 9 (7–21). A splint cast at 90° of flexion was kept on for an average of 30 (21–45) days. No patient was given manipulation under anesthesia to improve motion.

At follow-up after 36 (21–61) months, all the patients were examined by the same surgeon, who was not the operator. No patients were lost from follow-up. The Mayo Clinic performance index for the elbow was used to evaluate pain: 45 points; motion: 20 points; stability: 10 points and daily function: 25 points. Results are defined as excellent: 90–100 points; good: 75–89 points; fair: 60–74 points; and poor: less than 60 points (Morrey et al. 1981). We gave 2.5 points for each item of daily function when the patient could perform the activity, but with difficulty. Subjective assessment of patient improvement was made, using 5 ratings: excellent, good, poor, no improvement and worsening.

Anteroposterior and lateral radiographs were taken on the last follow-up examination. The bone-cement interface for both the humeral and the ulnar components was divided into two zones:

proximal and distal, to locate any radiolucent line that measured more than 1 mm. Radiographic loosening was defined as being present when the whole bone-cement was surrounded by an enlarging radiolucent line with a change in the orientation of the prosthesis (Pöll and Rozing 1991, Morrey and Adams 1992, Ewald et al. 1993, Gschwend et al. 1996).

Results

No patient developed an infection. 4 patients had ulnar paresthesia after operation. In 3 of them, the symptoms had resolved at 1 month in 1 elbow and at 5 months in the 2 others. The fourth patient had persistent ulnar paresthesias, without motor deficiency, 2 years after operation.

An additional operation was performed for uncoupling in 1 elbow 3 weeks after operation, without any complications.

On reexamination, 12 elbows had an excellent result and 8 a good one. The median performance index increased from 30 (15–53) points to 95 (80–100) points. The subjective assessment of improvement was excellent for 11 elbows, good for 8 and poor for 1.

Preoperative pain was severe in 16 elbows, moderate in 3 and mild in 1. Postoperative pain was mild in 7 elbows and none in 13. The median pain score increased from 0 (0–30) points to 45 (30–45) points.

The mean extension lag decreased from 38° to 30° and flexion increased from 116° to 139°. The median mobility score increased from 15 to 20 points. Pronation increased from 53° to 68° and supination from 45° to 71°.

Preoperatively, 9 elbows were stable, 6 moderately unstable and 5 grossly unstable, and postoperatively 20 elbows were stable. The median stability score increased from 5 (0–10) points to 10 (5–10) points. The median function score increased from 5 (0–15) points to 25 (10–25) points.

A radiolucent line that was more than 1 mm wide developed at the proximal and distal aspects of the humeral component and at the proximal aspect of the ulnar component in 2 elbows. These 2 elbows had radiographic loosening, with a progressive radiolucent line and a change in the ori-



Figure 2. Radiographic loosening.

entation of the prosthesis (Figure 2). 1 elbow was graded stage 3 according to Larsen and limited motion was the reason for operation, and the second one had an operative fracture of the two condyles. In a third elbow, a non-progressive radiolucent line was seen at the proximal aspect of the humeral component. There was no radiographic loosening in the 2 elbows in which screws were put because of bone loss.

Discussion

The results of total elbow arthroplasty in the 1970s were disappointing, because of the high rate of loosening with the rigid-hinged designs (Dee 1973). Nonconstrained and semiconstrained implants were thus developed in the mid-1970s. Although the risk of loosening is lower with nonconstrained designs than with semiconstrained ones, because the ligaments and joint capsule absorb forces at the elbow, instability or dislocation are nevertheless major complications of these nonconstrained implants (Trancik et al. 1987, Ljung et al. 1989, Dennis et al. 1990, Kudo and Iwano 1990). The use of a nonconstrained prosthesis requires intact ligaments and bone stock to avoid instability. Several authors have thus developed a semiconstrained prosthesis with polyethylene-metal sloppy-hinged design to decrease the high rate of loosening with the constrained metal-metal hinge prosthesis (Inglis and Pellici 1980, Morrey et al. 1981, Figgie et al. 1987, Goldberg et al. 1988, Kraay et al. 1994).

An analysis of the literature is difficult because there are many types of total elbow arthroplasties, patients having rheumatoid arthritis or traumatic arthritis may be included and sometimes the results with the same arthroplasty are confusing (Brumfield et al. 1990, Pöll and Rozing 1991, Kasten and Skinner 1993, Lyall et al. 1994, Sjöden et al. 1995). However, in addition to the decreasing rate of complications in the past years, the subjective and functional results, especially in patients with rheumatoid arthritis, are satisfactory mainly because of pain relief. The improvement

in the performance index in our series was due principally to pain relief and better daily function.

Radiographic loosening as defined by most authors is a radiolucent line which is complete and progressive around the prosthesis and/or a change in the orientation of the prosthesis (Pöll and Rozing 1991, Morrey and Adams 1992, Ewald et al. 1993, Gschwend et al. 1996).

An incomplete or a non-progressive radiolucent line is not radiographic sign of loosening. Morrey and Adams (1992) reported a radiolucent line at the ulnar component in 1 elbow and at the humeral component in 3 of 58 elbows, but no patient had radiographic evidence that suggested loosening of the implant with an average follow-up of 3.8 years. Ewald et al. (1993) observed a radiolucency adjacent to 8 humeral components and 19 ulnar components of 202 capitellocondylar arthroplasties with an average follow-up of 69 months. The radiolucent line was non-progressive in 12 of 19 ulnar components and 5 of the 8 humeral components, and a revision was necessary in 3 elbows (1.5%) because of aseptic loosening. Gschwend et al. (1996) found 4 of 118 elbows operated on between 1978 and 1992 which had progressive radiolucencies or scalloping suggesting loosening of the prosthesis. The rate of aseptic loosening with the semiconstrained designs reported by Morrey and Adams (1992), Kraay et al. (1994) and Gschwend et al. (1996) is less than with some unconstrained designs (Ljung et al. 1989, Kudo and Iwano 1990, Sjöden et al. 1995). In our series, we found 2 elbows with radiographic loosening. In 1 case, a fracture of the two condyles occurred dur-

ing surgery and a revision was performed. Fracture of the condyles compromises the implant fixation, according to Kraay et al. (1994) and Gschwend et al. (1996). On the other hand, intraoperative fracture of the humerus, which occurred in 4 of 58 elbows (6%), had no complications (Morrey and Adams 1992). A painless non-union developed in 2 elbows and the fragment was excised in the other 2. In our second patient with radiographic loosening, the preoperative range of motion was limited (lag of extension: 70° and flexion: 90°), but we cannot exclude an error in the cement technique. Cement technique is a critical part of the operative procedure, and all factors (severe osteopenia, bone defect, fracture, narrow medullary cavity) that compromise it will affect the implant fixation and increase the risk of loosening. The insertion of the cement must be done by using an intramedullary injection system for both the humeral and the ulnar components, as well as by plugging the medullary canal.

Infection is a serious complication that requires an additional operation. A rate of infection of 6% was reported by Morrey and Adams (1992) and 2.8% by Gschwend et al. (1996). Many factors such as skin incision, prophylactic intravenous antibiotics, cement with antibiotics, and elbow splinting after operation reduce the rate of infection.

Ulnar paresthesia is a common early complication that occurs not only with non-constrained designs but also with semiconstrained ones. This complication is usually transient. The reported rate of ulnar nerve lesions ranges between 1.7% (Gschwend et al. 1996) and 15% (Morrey and Adams 1992).

Instability is the major complication in of the semiconstrained prosthesis that is in keeping with extensive soft-tissue release. The rate of uncoupling was 0% in the study by Morrey and Adams (1992) and 3.5% in the study by Gwschwend et al. (1996).

We found that semiconstrained arthroplasties are useful in patients with rheumatoid arthritis; they show satisfactory clinical and functional outcome, despite some complications. The semiconstrained designs can be implanted even in cases of severe damage with inadequate ligaments and bone loss, a frequent finding in patients with rheu-

matoid arthritis. Nevertheless, radiographic loosening is a concern and a longer follow-up period is needed for us to be able to assess this procedure more adequately.

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